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Foreword

This first volume of the Third International Mathematics and Science Study (TIMSS) 1999 Video Study Technical Report focuses on every aspect of the planning, implementation, processing, analysis, and reporting of the mathematics components of the TIMSS 1999 Video Study. The report is intended to serve as a record of the actions and documentation of outcomes, to be used in interpreting the results and as a reference for future studies.

The TIMSS 1999 Video Study is a complex and ambitious study conducted under the aegis of the International Association for the Evaluation of Educational Achievement (IEA) and managed by the U.S. Department of Education's National Center for Education Statistics in cooperation with its study partner, the National Science Foundation. Over a period of four years, the study researchers collected, transcribed, translated, coded, and analyzed hundreds of hours of videotapes of eighth-grade mathematics lessons in the seven participating countries. The design of the study built on the foundations established by the first TIMSS 1995 Video Study, but was improved and carried out through a collaborative process that involved individuals around the globe.

Each of the chapters of this report, and the appendices, focuses on critical steps taken in the planning and implementation of the study, from its initial design to how the data was analyzed. One of the more complex tasks of the study was the development of a coding system that addressed critical questions and was applicable to each country's unique education system. The resulting coding system for the mathematics videos is discussed in detail in this report with the aim of making the system available for review, improvement, and possible application to future studies.

This report follows the first release of data focusing on the eighth-grade mathematics lessons made available to the public in March 2003. Additional reports are planned that will focus on the results of analyses of the eighth-grade science videos collected as part of the study, and a comparison of eighth-grade mathematics teaching in the United States based on the videos collected for the 1995 and 1999 studies. A second volume of the technical report that focuses on the science videos will be released soon after the first science report is released, expected in early 2004.

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Chapter 1. Introduction

1.1 Introduction

The Third International Mathematics and Science Study (TIMSS) 1999 Video Study examined classroom teaching practices through in-depth analysis of videotapes of eighth-grade mathematics and science lessons. An update and expansion of the 1995 TIMSS Video Study, the TIMSS 1999 Video Study investigated nationally representative samples of classroom lessons from relatively high achieving countries. The Video Studies were designed to supplement the information obtained through the TIMSS 1995 and 1999 mathematics and science assessments.

The TIMSS 1999 Video Study was funded primarily by the National Center for Education Statistics (NCES) in the Institute of Education Sciences (IES) of the U.S. Department of Education, and the National Science Foundation. It was conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA), based in Amsterdam, the Netherlands. Support for the project also was provided by each participating country through the services of a collaborator who guided the sampling and recruiting of participating teachers. In addition, Australia and Switzerland contributed direct support for data collection and processing of their respective sample of lessons.

This report presents the technical aspects of collecting videotapes of mathematics lessons for the TIMSS 1999 Video Study. A parallel technical report on the science lessons will be released separately.

1.2 Goals

The broad goal of the mathematics portion of the TIMSS 1999 Video Study was to describe and investigate teaching practices in eighth-grade mathematics in a variety of countries including several countries with varying cultural traditions and with high mathematics achievement, as assessed through TIMSS 1995. The participating countries were Australia, the Czech Republic, Hong Kong SAR[1], the Netherlands, Switzerland, and the United States. Japan, which participated in the science portion of the TIMSS 1999 Video Study, did not participate in the 1999 data collection for the mathematics portion. However, the Japanese data collected in the TIMSS 1995 Video Study were reanalyzed and were included in many of the results presented in *Teaching Mathematics in Seven Countries: Results from the TIMSS 1999 Video Study* (Hiebert et al. 2003).

[1] For convenience, in this report Hong Kong SAR is referred to as a country. Hong Kong is a Special Administrative Region (SAR) of the People's Republic of China.

In addition to the broad goal of describing mathematics teaching in seven countries, the TIMSS 1999 Video Study had the following research objectives:

- To develop objective, observational measures of classroom instruction to serve as appropriate quantitative indicators of teaching practices in each country.
- To compare teaching practices among countries and identify lesson features that are similar or different across countries.
- To describe patterns of teaching practices within each country.

1.3 Design of the Study

The TIMSS 1999 Video Study was designed to describe eighth-grade mathematics and science teaching in each participating country. The method employed was the video survey (Stigler, Gallimore, and Hiebert 2000). Video surveys allow researchers to integrate the qualitative and quantitative study of classroom teaching across cultures, increasing their chances of capturing not only universal quantitative indicators but culturally-particular qualitative categories as well. Video surveys combine videotaping with national probability sampling. Qualitative analyses of video can be validated against a national sample of videos. Quantitative analyses are rendered more interpretable by being efficiently linked to specific video examples of the categories coded.

Some of the challenges of studying teaching using video include creating standardized camera procedures, minimizing observer effects, and maintaining acceptable levels of coding reliability. As this report will describe, a detailed data collection protocol was developed and tested (see chapter 2) and several questionnaire items assessed teachers' perceived degree of bias due to the videocamera (see chapter 5).

Other challenges of video studies have to do with sampling strategies. To provide national-level pictures of teaching, the study videotaped each teacher once, teaching a single classroom lesson. It should be clear that taping only one lesson per teacher shapes the kinds of conclusions that can be drawn about instruction. Teaching involves more than constructing and implementing lessons. It also involves weaving together multiple lessons into units that stretch out over days and weeks. Inferences about the full range of teaching practices and dynamics that might appear in a unit cannot necessarily be made, even at the aggregate level, based on examining a single lesson per teacher. Consequently, the interpretive frame of the TIMSS 1999 Video Sudy is properly restricted to national-level descriptions and comparisons.

Another sampling issue concerns the way in which content is sampled. Eighth-grade mathematics courses are composed of different topics, and teaching might look different for different topics. Decisions about how to sample depend, again, on the goal of the study. To get a nationally-representative picture of eighth-grade mathematics teaching, the best procedure is to randomly select lessons across the school year. Different countries use different curricula and move through different sets of topics. The only reasonable way to deal with this variation is to sample steadily across the school year and to randomly select lessons at each point.

It might appear desirable to control for content by sampling the same topics in the curriculum in each country, but this turns out to be virtually impossible. Different curricula and different teachers across countries define topics so uniquely that the resulting samples become less rather than more comparable. If the researchers' goal is to compare the teaching of particular topics, and if the topics are selected and defined so there is a shared understanding of the material to be taught, then controlling for topic is a reasonable approach. But such a study would have a different goal than the one reported here.

The fact that images of teachers and students appear on the tapes makes it more difficult than usual to protect the confidentiality of study participants. This continues to be a serious issue when the data set is used for secondary analyses. The question is what procedures to establish to allow continued access to video data by researchers interested in secondary analysis (Arafeh and McLaughlin 2002). One option is to disguise the participants by blurring their faces on the video. This can be accomplished with modern-day digital video editing tools, but it is expensive at present to do so for an entire data set. A more practical approach, and the one employed for this study, is to define special access procedures that will protect the confidentiality of participants while still making the videos available as part of a restricted-use data set.

1.4 Overview of the Technical Report

This report provides a full description of the methods used to conduct the TIMSS 1999 Video Study. Chapter 2 discusses the field test process, including the development of videotaping procedures. In chapter 3 there is a full description of the sampling approach implemented in each country. Chapter 4 details how the data were collected, processed, and managed. Chapter 5 describes the questionnaires collected from both teachers and students in the videotaped lessons, including how they were developed and coded. Chapters 6 and 7 provide details about the codes applied to the video data by a team of international coders as well as several specialist groups. Lastly, in chapter 8, information is provided regarding the weights and variance estimates used in the data analyses. There are also numerous appendices to this report, including the questionnaires and manuals used for data collection, transcription, and coding.

Chapter 2. Field Test Study

2.1 Overview

Prior to the initiation of the TIMSS 1999 Video Study, a field test study was funded by NCES and conducted by LessonLab during May through August 1998. This chapter provides a brief overview of the field test study and focuses on the preliminary analysis of results relevant to the mathematics portion of the study.

In May 1998 when the field test study commenced, final decisions regarding the participating countries in the TIMSS 1999 Video Study had not yet been made. Some of the countries that collaborated in the field test study were therefore different from those in the final sample. The countries that participated in the field test study were: Australia, the Czech Republic, Japan, Luxembourg, the Netherlands, Switzerland, and the United States.

The goals of the field test were:

- To modify the methods and procedures of data collection and processing; and,
- To collect samples of videotapes for use in the development and refinement of data coding.

Although the methods and procedures of data collection developed in the TIMSS 1995 Video Study were useful in investigating mathematics classrooms in Germany, Japan, and the United States, a need for modifications for the TIMSS 1999 Video Study was identified for two main reasons. First, it was unknown whether the same data collection methods would work in science classrooms. Second, there was a desire to better document student work processes during lessons. Due to time constraints, field test data collection commenced as modified videotaping procedures were being developed. Several different cameras and filming procedures were tested in the field study before final equipment decisions were made and a data collection instruction manual was written.

In addition, modified teacher and student questionnaires were not yet ready during the field test study period. Therefore, the TIMSS 1995 Video Study teacher questionnaire was used, with some minor adjustments so that it would apply to science as well as mathematics teachers.

Below is a list of tasks that were carried out in the field test study:

- Selected video equipment;
- Developed/modified data collection methods and procedures;
- Developed/modified data processing methods and procedures;
- Videotaped mathematics and science classrooms from potential participating countries; and
- Reviewed the field test data to generate ideas for the development of a coding scheme.

The following sections of this chapter describe how these tasks were carried out and what was learned from them. Note that analyses of the field test videotapes were based on a relatively small sample from each country (see section 2.5). Therefore, the purpose of the analyses was to refine data collection, processing, and coding methods for the main data collection period. As such, conclusions reached through the field test, particularly as related to the typicality of events, were intended as preliminary hypotheses that could be further investigated in the full sample of videotapes.

2.2 Selecting Video Equipment

In the TIMSS 1995 Video Study, one videographer filmed all the mathematics lessons in each country using a single SONY Hi-8 camcorder. Although the Hi-8 camcorder produced high quality videos, for the TIMSS 1999 Video Study digital camcorders were used to achieve even higher quality videos.

In the 1995 Video Study, using one camera to film the lesson gave little freedom for the videographer to film activities not involving the teacher, such as student-student interaction. As a result, almost no information was available regarding students' work processes when they were completing assignments at their seats. This limitation was perceived as a problem in the 1995 Video Study, and therefore, a decision was made to use two cameras to film each lesson in the 1999 Video Study; one camera would be operated by the videographer and the other would be used as a stationary camera to capture the whole-class view at all times.

For the field test data collection, the SONY DX200 professional digital camcorder was selected to be the main camera (i.e., operated by the videographer) and the Canon Optura mini DV camcorder to be the second camera (i.e., used as a stationary camera).

In the field study, each teacher wore a wireless microphone, and both cameras were equipped with zoom microphones. For the wireless microphone, the Lectrosonic omni-directional lavaliere microphone, transmitter, and receiver were selected, which produced better sound quality and were more durable than the microphone used in the TIMSS 1995 Video Study. Two different zoom microphones were used. For the main camera, the Sennheiser K6P was selected, which is a high quality professional mic. For the stationary camera, the Canon ZM100 zoom mic was selected.

One downside of the Optura camcorder was that it required an external audio mixer to combine the audio from the teachers' wireless microphone with the zoom microphone mounted on the main camera. The Studio Pro XLR mixer was selected, which was a lightweight mixer that could be placed between the camera and the tripod.

Different tripods were used for each camera. For the main camera, the Mathews THM20 fluid head tripod was selected, and for the stationary camera, the Promaster 6400 photography tripod was selected.

The SONY DX200 produced high quality videos. However, based on videographers' experiences in the field study, using two Canon Optura mini DV camcorders for data collection in the main study was agreed to be more feasible. Not only were the SONY camcorders larger and heavier than the Optura camcorders, they required a heavier tripod and larger videotapes.

Videographers needed to travel around the country via airplane, trains, or car, in a variety of weather conditions. Then, once in the schools, a single videographer had to transport all the equipment to the classroom in order to be ready for the class, often under less than ideal conditions. Therefore, the SONY camcorders were deemed less suitable for the main study data collection in comparison to the Optura camcorders.

2.3 Developing Data Collection Procedures

Two video cameras were used in the TIMSS 1999 Video Study; one of the cameras was manually operated and the other was stationary. The primary role of the operated camera was to document the teacher, while the second camera was intended to provide supplementary footage, mainly documenting the students.

Regarding the positioning of the second, stationary camera, two options were considered:
1. place it in the front corner to capture the entire classroom; or
2. focus it on a few students.

The advantages of the first option were that it would be easy to know where to position the stationary camera, and it would provide a general view of what happened in the classroom. Additionally, since the stationary camera would maintain a wide shot of the entire lesson, the videographer would be free to occasionally take the operated camera off the teacher and document students' work processes. In other words, most likely the teacher would remain in view of the stationary camera, so his/her activities would still be recorded. One disadvantage of this option was that it would not provide long-term, close-up information about students' work processes.

The second option would provide detailed information regarding students' work processes, but only of a few students. For this option, an important question was "Who decides which students to focus on, and on what basis does that person decide?"

After evaluating advantages and disadvantages of these two options during the field test, the first option was selected for the 1999 Video Study.

Additionally, based on the field test data collection experience, the videotaping procedures developed in the 1995 Video Study were modified for the 1999 Video Study in three important ways: 1) including documentation of student work processes along with documentation of the teacher and the students, 2) positioning cameras to incorporate the second camera placement, and 3) pointing the teacher camera to film from the perspective of an ideal student and to keep track of the teacher. These modifications, along with other details regarding the data collection procedures implemented in the 1999 Video Study are presented in chapter 4, section 4.3.

2.4 Developing Data Processing Procedures

2.4.1 Digitizing and Storing Data on a Multimedia Database

In the TIMSS 1995 Video Study a system was developed to computerize the data and store them on multimedia database software (vPrism). This system was modified for the TIMSS 1999 Video Study to allow for more sophisticated editing and analyses of data.

The basic procedures that remained the same as the 1995 Study were: (1) video data would be digitized and compressed as MPEG-1 files; (2) supplementary materials would be scanned and converted to PDF files; (3) both MPEG video files and PDF document files would be stored on CD-ROM and on a computer server; (4) transcribers/translators would transcribe the lessons into English; (5) transcripts would be imported into vPrism and linked to the video files. One important new feature of the software was that each data unit (i.e., each lesson) in the database would have two video files—one from the teacher camera and one from the student camera. The development of this feature started as a field test study task.

2.4.2 Transcribing/Translating Lessons

In the TIMSS 1995 Video Study, U.S. lessons were transcribed in English, and German and Japanese lessons were translated and transcribed into English by bilingual staff. A protocol was developed to maintain the consistency of each transcription.

For the TIMSS 1999 Video Study, all lessons were also transcribed/translated into English. The original protocol was revised on the following points:

- Punctuation marks should be based on conventional English grammar rules; and,
- Each turn should not exceed three lines of text, as defined by the software.

Details are described in the TIMSS 1999 Video Study Transcription/Translation Manual in appendix A.

Because there would be over 1,000 mathematics and science lessons to transcribe/translate, LessonLab decided to explore the possibility of subcontracting these operations to professional transcribers/translators. This process was tested in the field study.

A U.S.-based company was subcontracted to transcribe and/or translate some of the field test data. After review, it was determined that the quality of their work was not satisfactory. Therefore other companies or individuals were sought to transcribe and/or translate the 1999 Video Study data.

In some countries, the initial transcriptions/translations were completed by individuals or companies in that country. With the aid of the National Research Coordinators, several freelance translators in the Czech Republic were recruited to do the first-pass translation/transcription. Each of these individuals specialized in one of four topics: mathematics, chemistry, biology, and physics. In the Netherlands, a company (Standby) was hired to do the first-pass translation/transcription. A member of the field test team met these translators in their countries, provided a brief orientation of the project, and went over the transcription protocol.

For the Australian and U.S. data, first-pass transcription was conducted by a company called Report Works. Most Swiss lessons were transcribed in their native language (i.e., French, German, or Italian) in Switzerland, and translations of a subset of lessons into English were completed by LessonLab.

These companies and individuals were deemed to produce high quality transcriptions/ translations, and were used for the remainder of the 1999 Video Study. (Hong Kong SAR lessons were translated/transcribed entirely by LessonLab.) All transcriptions/translations were reviewed by LessonLab, and time coding was completed at LessonLab. Additional details about the entire transcription/translation process can be found in chapter 4.

2.5 Collecting the Field Test Data

Three U.S.-based videographers were hired to videotape field test lessons in the seven countries. One of these videographers had collected the U.S. data for the TIMSS 1995 Video Study. Training took place at the University of California at Los Angeles and was based on the data collection procedures from the 1995 Video Study, with the modifications described above.

Table 2.1 shows the date of videotaping, country, location of schools, types of school, the subject and topic of lessons for the field test data. The number in parentheses indicates the number of lessons videotaped, by school type, subject, and topic.

Table 2.1. Field test tapings by country: 1998

Date (1998)	Country	School type	Subject (lessons)	Topic
May 18–22	Czech Republic	Basic (2) Integrated (1) Gymnasium (1)	Mathematics (5) Science (4)	Algebra (3) Geometry (2) Biology (2) Chemistry (1) Physics (1)
May 25–29	Switzerland	Lower track (1) Middle (1) Higher (1)	Mathematics (5) Science (4)	Algebra (2) Geometry (3) Biology (3) Physics (1)
June 2–4	Netherlands	Lower track (1) Middle track (1)	Mathematics (4) Science (4)	Algebra (4) Biology (1) Physics (3)
June 8–10	Luxembourg	Technical (1) Gymnasium (1)	Mathematics (4) Science (3)	Algebra (1) Geometry (3) Biology (2) Physics (1)
June 23–26	Australia	Government school (4)	Mathematics (4) Science (4)	Algebra (3) Geometry (1) Biology (2) Chemistry (1) Physics (1)
June 29-July 3	Japan	Private (1) Public (2)	Science (5)	Biology (5)
May 25-June 3	United States	Public (4)	Science (4)	Astronomy (1) Biology (1) Earth science (1) Physics (1)

NOTE: The number in parentheses indicates the number of lessons videotaped, by school type, subject, and topic.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

2.5.1 Collecting Videotapes

As described in sections 2.2 and 2.3, a single videographer filmed each lesson using two video cameras. The main camera was operated using procedures similar to those in the TIMSS 1995 Video Study, except that the camera was hand-held more often in order to capture students' work processes. A stationary camera maintained a wide angle shot on as many students as possible.

One of the challenges encountered during the field study was the difficulty in handling a large amount of camera equipment. The SONY DX200 was replaced with the Canon Optura for the main data collection primarily for this reason.

2.5.2 Collecting Additional Materials

In the 1995 Video Study, videographers were responsible for collecting all supplementary materials used or discussed in the lesson. These included:

- copies of pages of books, textbooks, or workbooks;
- copies of any written materials that were handed out to the students;
- copies of overheads that were projected;
- copies of worksheets or homework assignments that were discussed or given at the end of the lesson; and,
- copies of specific students' work that was discussed.

For the 1999 Video Study, the videotaped teacher was asked to gather all of these materials and send them back to their National Research Coordinator or to LessonLab, along with the completed teacher and student questionnaires. More information about these materials, including the questionnaire response rates, can be found in chapter 4.

2.5.3 Collecting Questionnaires

Modified teacher questionnaires were not ready when the field test data collection started. Therefore, the questionnaire developed in the 1995 Video Study was provided to the field test teachers. Because this questionnaire was only intended for mathematics teachers, some minor adjustments (e.g., topics covered in the videotaped lesson) were made so that it would apply to science teachers as well. The English version of the questionnaire was used for the teachers in Australia, the Netherlands[2], and the United States, and the German version was used in Luxembourg and Switzerland. The Japanese and Czech coordinators arranged the translation of the questionnaires into their languages and validated the quality of translation.

The teachers who participated in the field test study were provided with a copy of the questionnaire immediately after their lessons were filmed. They were instructed to return the completed questionnaire to the appropriate National Research Coordinator, who then sent it to LessonLab. Questionnaires were completed and returned by all teachers. They were used only to help the field test analysis team better understand the lessons.

The development of questionnaires for the TIMSS 1999 Video Study, including both the teacher and student questionnaires, is detailed in chapter 5.

2.6 Reviewing the Field Test Data

Field test data collection was completed in early July of 1998. Most of the videos were processed by the end of July, and were ready to be viewed. The plan was to spend August and September viewing the videos and generating ideas about coding development. The following sections describe how the field test data were reviewed and what was learned.

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[2] In the main study, teachers in the Netherlands were provided with a version of the questionnaire in Dutch.

2.6.1 Field Test Analysis Team

By the end of June 1998, participation in the TIMSS 1999 Video Study was only certain for four of the field test countries: the Czech Republic, Japan, the Netherlands and the United States. Country representatives for the Czech Republic, the Netherlands, and the United States were recruited by the end of July. These individuals would later serve as country associates for the code development and analysis of the 1999 Video Study. The country associate for Japan was scheduled to be recruited in the summer of 1999 when the science data coding began, since Japan was only participating in the science portion of the study. Dr. Ineko Tsuchida, a researcher experienced in classroom research participated in the field test study data analysis including Japanese mathematics data collected as part of the TIMSS 1995 Video Study. The Czech associate was Svetlana Trubacova, a physics teacher from Slovakia. The Dutch associate was Karen Givvin, a second generation Dutch American with a Ph.D. in education from UCLA. The U.S. associate was Jennifer Jacobs, a Ph.D. student in developmental psychology at UCLA. Dr. Kass Hogan, a U.S. researcher experienced in science classroom research, was also invited to help analyze the field test videos.

Participation of Australia, Luxembourg, and Switzerland was still being negotiated, but it was decided that they would each send a representative to Los Angeles for several weeks to participate in preliminary video analyses. The Australian representative was Nick Scott, who has conducted research in mathematics education at the University of Melbourne. The Luxembourg representative was Dr. Jean-Paul Reeff, a psychologist and the international project manager at the Luxembourg Ministry of Education. The Swiss representative was Dr. Christine Pauli, a researcher of classroom instruction at the University of Zurich.

2.6.2 Reviewing Videos Individually

In order to elicit cultural beliefs and expectations about classroom instruction, the field test analysis team members were asked to first individually carry out the six tasks described below:

<u>Task 1</u>: View the videos from your own country and write down a brief description of each lesson. Do not yet share your observations with the other country representatives.

<u>Task 2</u>: View the lessons a second time and complete a five-column table for each lesson. The columns are: time, what the teacher is doing, what the students are doing, the mathematics or science content, and any additional comments.

<u>Task 3</u>: Describe some similarities and differences across the lessons.

<u>Task 4</u>: Select one mathematics and one science lesson that you believe is most typical of how these subjects are taught in your country. If you could interview the teacher of these lessons, how do you think he/she would answer the following questions: what does the teacher believe about the subject, what things should the students

be learning from the course, how do students best learn, and what is the teacher's role.

Task 5: View all the lessons from the other countries that have been selected as most typical. Write a brief description of each lesson and describe the most important similarities and differences between those lessons and the ones from your own country.

Task 6: Prepare a presentation of 15–30 minutes on what you have found.

The presentations were given on August 20 and 21, 1998 at the TIMSS Video Data Center meeting room in UCLA. Each representative spent about 30 minutes discussing the tasks and briefly describing the education system and instructional practices in their country. Each presentation was followed by a 15–30 minute discussion. All the presentations were videotaped and burned onto CD-ROM as a record.

2.6.3 Outcomes of the Tasks

Tables 2.2 through 2.8 describe the summary of outcomes that were generated by each of the country representatives. In particular, these tables present the country representatives' initial responses to the field test mathematics lessons from their own country.

Table 2.2. Australian country representative's initial responses to the Australian field test mathematics videos: 1998

Category	Response
Similarities across the three Australian mathematics lessons	▪ A brief introduction to put the lesson in the context of previous work. ▪ A period of direct instruction in the form of a demonstration of procedures. ▪ Students practicing the demonstrated procedures, and the teacher "working the room" attending to individual students or small groups. ▪ Students' self-correction of their work to monitor their own progress. ▪ Catering for individual differences by assigning differential amount of seatwork assignments.
Description of the lesson selected as most typical of Australian mathematics teaching	A traditional text-driven lesson on combining like terms. The lesson starts with some review of previous work (about 12 minutes) followed by a small teacher-led theoretical introduction then by student skill development. During seatwork the teacher visited each group of students. The justification given to the students for the work was that it would "all be on the test."
Inferred teachers' beliefs about mathematics and mathematics teaching	▪ Mathematics is a way of thinking and describing many phenomena in the world. ▪ There is a natural sequence that dictates what mathematics content should be taught and when it should be taught. ▪ Mathematics is best learnt through the practice of skills and procedures on a large number of examples. ▪ There is a set of facts that needs to be memorized to make practicing techniques for problem solving easier. ▪ Studying for tests is a helpful approach to consolidating understanding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 2.3. The Czech Republic country representative's initial responses to the Czech field test mathematics videos: 1998

Category	Response
Similarities across the three Czech mathematics lessons	▪ Lessons follow a traditional structure that consists of an extended review and an introduction to new topics. ▪ During the review, the teachers employ a variety of approaches but tend to "review with students" by soliciting a large amount of oral or written contribution from the students. ▪ During the introduction of new topics, the teachers explain the target topic but "use students' knowledge" by asking a number of questions.
Description of the lesson selected as most typical of Czech mathematics teaching	A geometry lesson in which the teacher explains at the beginning of the lesson what the topic is. Then the teacher "slowly and clearly explained every single step she was doing so students could understand everything and had enough time to make their own notes." The teacher also encourages students to discover new things, and the mathematical language used by the teacher and students is of a very high level.
Inferred teachers' beliefs about mathematics and mathematics teaching	▪ Students need to understand mathematics so they can use it in their everyday life. ▪ Students need to pay attention during class so they will understand the subject. They then need to practice. ▪ The best way to practice is to solve many different problems and to discuss their solutions. ▪ The teacher's role is basically to explain everything and to show how to use knowledge in solving many different problems. ▪ Explain everything in as much detail as possible and show many examples, (this) will increase the chance that students will learn.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 2.4. Japanese country representative's initial responses to the Japanese field test mathematics videos: 1998

Category	Response
Similarities across the three Japanese mathematics lessons	▪ Problem solving orientation, that is, the students had a set of problems to investigate or solve. ▪ The students were learning to apply a fundamental mathematical concept or formula into more complex situations or to prove the relationships among the characteristics of a geometric shape. ▪ Students' problem solving was limited only to the extent that they were expected to apply the mathematical notion or formula in different but related situations (i.e., not designed to promote hypothesis building).
Description of the lesson selected as most typical of Japanese mathematics teaching	An introductory lesson on geometry. The teacher spends a large amount of time exposing the students to the notion of a geometric shape. Then the teacher demonstrates how to prove that the vertically opposite angles created by two straight lines are equal.
Inferred teachers' beliefs about mathematics and mathematics teaching	▪ It is important to draw a connection between classroom mathematics and students' daily life. ▪ The students will learn mathematics by relating it to their daily life or the immediate surroundings. ▪ A certain level of teacher directive is important in the introduction of mathematics. ▪ Students need to attentively listen to teacher's explanation to grasp mathematical concepts or principles in order to accomplish the main goals in the lesson. ▪ The proper role of teachers is to be a model for students. ▪ It is important to use good questions in instruction especially to build a relationship with the students and to stimulate students' thinking.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 2.5. Luxembourg country representative's initial responses to the Luxembourg field test mathematics videos: 1998

Category	Response
Similarities across the three Luxembourg mathematics lessons	▪ Classroom arrangements are well suited for teacher-led instruction. ▪ Lesson goals are not made explicit. ▪ The teachers ask questions frequently to students, but the questions normally deal with small portions of knowledge, and answers are either obvious or the students can only guess. ▪ When students give wrong answers, the teacher simply proceeds to the next student or gives the answer himself. ▪ The teachers switch to the native language (Luxembourgish) in critical situations.
Description of the lesson selected as most typical of Luxembourg mathematics teaching	The lesson topic is on rays and segments. The teacher introduces the concept of rays through a series of examples. Teacher-led instruction: the teacher tries to systematically ask questions and tries to motivate students to produce partial solutions on the blackboard and on special teacher-prepared worksheets. The whole classroom situation is rather chaotic.
Inferred teachers' beliefs about mathematics and mathematics teaching	▪ Mathematics is a set of concepts and rules defining the relations between these concepts. ▪ Students should learn precise definitions of mathematical objects. ▪ Students learn best while carefully looking at the teacher's demonstrations at the blackboard, solving minor problems themselves in the classrooms and at home. ▪ The teacher's role is to carefully choose suitable examples that best illustrate the topics to be dealt with, to decompose the problem in a sequence of small steps, to prepare exercising sheets relating to the steps, and to guide students through the solution of a problem in the classroom.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 2.6. The Netherlands country representative's initial responses to the Netherlands field test mathematics videos: 1998

Category	Response
Similarities across the three Dutch mathematics lessons	▪ Working on small set of prepared problems. ▪ The teachers indicate what information is important and/or gives hints for those problems assigned where students may experience difficulty. ▪ Students work on assignments in pairs and ask the teacher questions when necessary. ▪ The teachers are highly active throughout lessons answering students' questions. They do so with what appears to be great patience and even pleasure.
Description of the lesson selected as most typical of Dutch mathematics teaching	The lesson is on linear equations. The teacher writes assignments on the board, provides an overview of the problems, then sends off the students to work in pairs on the assignments. The teacher returns to his desk at the front of the room, and students approach him there with questions. The teacher models problem solving using different strategies, identifying what works and what does not.
Inferred teachers' beliefs about mathematics and mathematics teaching	▪ Mathematics is a set of skills that can be used to understand everyday life experiences that involve numbers. Students will leave the class having learned how to think of these experiences in mathematical terms. ▪ Students best learn mathematics by first receiving a small amount of teacher instruction, and then solving problems alone or with their peers. If they have questions, they should feel comfortable asking the teacher for whatever degree of assistance they feel they need to understand the solution. ▪ Teachers need to know what students do and do not understand. Part of a teacher's role is to help students through the areas the teacher knows will be difficult.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 2.7. Swiss country representative's initial responses to the Swiss field test mathematics videos: 1998

Category	Response
Similarities across the three Swiss mathematics lessons	▪ The lessons follow a 3-step temporal structure: an introduction phase, in which the teacher establishes the students' attention and sets a positive climate, a main phase that starts with a goal or problem statement, and a closing phase that includes next lesson previews and homework assignments. ▪ Frequent use of teacher-directed classroom dialogue to co-construct a conceptual structure with the students. ▪ While assisting students individually during seatwork, the teachers tend not to tell the students what is right or wrong but try to scaffold instead. ▪ The emphasis is on anchoring conceptual knowledge through problem solving, often using practical, everyday problems. ▪ The teachers speak the official language (German) when talking publicly to the whole class and switch to the native language (Swiss German) when assisting students privately.
Description of the lesson selected as most typical of Swiss mathematics teaching	Two lessons were selected: an introduction lesson in which the teacher mainly guides the students through teacher-directed classroom discourse, and an application lesson in which a large portion of the lesson time is spent by the students working on problems independently of the teacher.
Inferred teachers' beliefs about mathematics and mathematics teaching	▪ One important goal of mathematics education would be to design learning situations that allow students to have increased confidence in their capacity to do mathematics. ▪ The teacher should provide each individual student with the appropriate support, help, or assistance, in correspondence to his/her needs. ▪ Students should master mathematical procedures, but not in a mindless way. Instead, they should understand, or at least be aware of, what they are doing when they operate with numbers and relations. ▪ It is important that … after the introduction of the procedures and concepts, there should be a phase of working through the conceptual structure, and that the students have many opportunities for practice. At the end, the students should be able to execute the procedure by themselves and to use it to solve applied problems.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 2.8. The U.S. country representative's initial responses to the United States field test mathematics videos: 1998

Category	Response
Similarities across the three U.S. mathematics lessons	▪ Most lesson time is spent working on problems as a whole class. ▪ The teacher guides the students through problems, providing some of the information needed to solve the problems (i.e., problems are broken down into pieces, and given students provide answers to the pieces of the problem). ▪ Lessons are focused on particular concepts the teacher wants students to learn.
Description of the lesson selected as most typical of U.S. mathematics teaching	A geometry lesson applying what students already know about "transformation" to coordinate graphs. The teacher uses problems to explain the conceptual points he wants to make. Throughout the lesson the teacher maintains a very animated personality, and continually asks for and incorporates the students' input. At the end of the lesson, the students work on a few of the same type of problems individually, and then share their answers.
Inferred teachers' beliefs about mathematics and mathematics teaching	▪ Mathematics is a set of concepts, as well as a vocabulary needed to talk about those concepts. ▪ Mathematics follows a set of rules and is logical, but not necessarily intuitive. Therefore, an expert is needed to explain the concepts and define the terms. ▪ Students learn by watching the teacher's demonstration of important concepts, and then by practicing on their own. ▪ Students need to be paying attention and following along as the teacher explains, but they also need some time for practicing on their own. ▪ The teacher should be an expert, and present the concepts and vocabulary clearly and in a meaningful sequence.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

2.6.4 Reviewing Videos as a Group

After reviewing and sharing individual observations, the field test analysis team worked together to create "meta-plans," that is, a list of their thoughts regarding each lesson. This idea was suggested by the Luxembourg representative, Dr. Reeff, and involved the following four steps:

Step 1: Lessons were discussed one at a time. Each person individually generated ideas about that lesson and wrote them down on notecards.

Step 2: The whole team shared and discussed the ideas.

Step 3: The whole team categorized and consolidated the ideas.

Step 4: Each person selected a) the five ideas he/she believed best characterized the lesson and b) the five ideas that were most different from lessons in the member's own country.

Meta-plans were created for all but two of the mathematics and science lessons denoted as "most typical" by the country representatives.

All of the meta-plans were created in the same manner. First, each country representative wrote down thoughts about the designated lesson on notecards—one thought per card. To the extent possible, these thoughts were to be objective descriptions or ideas about the lesson.

Next, each card was read, discussed, and categorized into one of the nine categories. These categories were loosely defined as lesson flow, content, lesson structure, teacher behavior, student behavior, climate, technical issues, comments, and missing events (see table 2.9). If two or more of the cards contained the same ideas, they were placed together.

Table 2.9. Meta-plan categories created to describe the field test lessons: 1998

Category	Definition
Lesson flow	Specific events that occurred in the lesson, listed in chronological order
Content	The mathematics or science content covered
Lesson structure	The general structure of the lesson
Teacher behavior	Noticeable behaviors by the teacher
Student behavior	Noticeable behaviors by the students
Climate	The lesson climate or atmosphere
Technical issues	Issues regarding the video quality
Comments	Personal opinions or judgments
Missing events	Events that were expected to but did not occur in the lesson

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Each country representative chose the five descriptions that best characterized the lesson, and marked these with a "C." They also chose the five descriptions that were most different from teaching in their own country, and marked these with a "D" (see table 2.10).

Table 2.10. Definitions of “characteristic” and “different” used in the meta-plans: 1998

Term	Definition
Characteristic (C)	A description that characterizes the lesson very well. For example, a very interesting feature of the lesson, or a feature that someone would very likely mention when giving a brief description of the lesson.
Different (D)	A description that is different from the teaching typically found in “your” country. Something that rarely occurs in lessons from “your” country.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Lastly, there was an extended discussion about each “typical” field test lesson that focused on the following three topics:

a) Descriptions that many representatives chose as characteristic of the lesson.

These descriptions represented a consensus among the country representatives regarding a particular lesson’s most critical features, and as such were considered likely candidates for further code development. Additionally, ideas designated by many team members as “characteristic” of a lesson but not “different” from lessons in other countries were likely to apply to several countries.

b) Descriptions that representatives chose as different from the teaching in their country.

These descriptions represented features that one or more team members regarded as different from the teaching typically found in their country. Such differences were important tools for discussion, as they were considered candidates for further code development to capture important distinctions across countries.

c) Descriptions that many representatives chose as both characteristic and different.

These descriptions represented consensus among the representatives regarding a particular lesson’s most critical features, and as such were candidates for further code development. However, since one or more representatives chose these ideas as “different,” they were likely to be unique to one (or possibly a few) countries.

The process in which the country representatives engaged, as described above, was a “bottom-up” process. That is, it revolved around extensive watching and discussion of individual lessons. The next step was to take a more “top down” and theoretical approach. The field study analysis team decided to once again employ the meta-plan technique to generate and share ideas regarding general coding strategies. Using the meta-plans from all of the individual lessons as guides, the team brainstormed several possible coding strategies for many of the categories, as well as for other categories. Country representatives then embarked on an extensive theoretical/literature review on topics in these categories.

2.7 Summary

2.7.1 What Was Modified Based on the Field Test

Table 2.11 describes the data collection and processing methods that were modified from the 1995 Video Study based on the field test experiences.

Table 2.11. Modifications to the data collection and processing methods made in the TIMSS 1999 Video Study: 1999

Item	TIMSS 1995 Video Study	TIMSS 1999 Video Study
Number of cameras used to film each lesson	One video camera was operated by the videographer: ▪ One SONY EVW300 three-chip professional Hi-8 camcorder ▪ One Bogen fluid head tripod ▪ One Hi-8 tapes	One video camera was operated by the videographer, another camera was used as a stationary camera: ▪ Two Canon Optura mini DV camcorders ▪ Mathews THM20 fluid head tripod, Promaster6400 photography tripod ▪ Two mini DV tapes
Camera positioning	Camera was placed at the side of the classroom one third of the way back from the front.	Main camera: Placed one third to one half of the way back from the front. Stationary camera: Placed high on the tripod along a sidewall near the front of the room.
Camera pointing	Principle 1: Document the perspective of an ideal student Principle 2: Document the teacher regardless of what the ideal student is doing.	Principle 1: Document the teacher. Principle 2: Document the students. Principle 3: Document the task.
Collection of additional materials used in the lesson	Videographers collected all materials.	The videotaped teacher sent copies of all the materials to LessonLab.
Data storage	One video file was linked to each lesson in the multimedia database software, vPrism.	Two video files were linked to each lesson in vPrism.

Table 2.11. Modifications to the data collection and processing methods made in the TIMSS 1999 Video Study: 1999—Continued

Item	TIMSS 1995 Video Study	TIMSS 1999 Video Study
Translation/transcription of data	Both first- and second-pass translation/transcription and timecoding were conducted at UCLA.	First-pass translation/ transcription was subcontracted to professional translators/transcribers for Australian, Czech, Dutch, and U.S. lessons. All second-pass transcription and timecoding were conducted at LessonLab.
Transcription protocol	▪ Turns at talk were marked when the speaker changed or when there was a gap in the talk. No limit for the length of a turn was set. ▪ Commas, exclamation points, semi-colons, and colons were not used. ▪ Names of classroom participants were transcribed without changes. ▪ The speaker code for a student was "S" at all times.	▪ Each turn should not exceed three lines of text. ▪ Punctuation marks were used based on conventional English grammar rules. ▪ Names of classroom participants were all changed to different names starting with the same letter. ▪ "SN" indicated a new student speaker, and "S" indicated the speaker was the same student as in the previous student turn.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

2.7.2 What Was Learned from the Analyses of the Field Test Data

2.7.2.1 Agreement in Describing the Lessons

One of the main goals in examining the field test data was to closely examine the biases of the cultural insiders. For this reason, the tasks performed by the field study team required them to individually watch the lessons and write about their impressions before engaging in any group discussions.

In preparation for the meta-planning sessions, the representatives from the seven countries summarized their ideas about each lesson. Again, the intention was that each representative would bring a unique perspective, and that there might be disagreements in how the representatives interpreted the lessons.

Sharing the individually generated lesson descriptions revealed a high level of agreement among the representatives (in a non-statistical sense). In almost all cases when a new idea was raised, other team members noted that they agreed with it or had themselves recorded a similar idea. The only disagreements among the representatives regarded the topic of "lesson climate." From the field test discussions, it appeared that views regarding climate were the most strongly affected by personal experience and/or cultural perspective.

2.7.2.2 Agreement on the Most Important Characteristics of the Lessons

In addition to the team's general consensus on how to describe the field test lessons, there was also a good deal of agreement as to which descriptions were most "characteristic" of a given lesson. Even though each lesson could be described in many ways, the representatives largely agreed on which descriptions were the most critical for understanding (and ultimately coding) the lessons. Interestingly, for all lessons there was a high degree of agreement between the cultural insider (the representative from a given country) and the cultural outsiders (representatives from the other countries) in choosing which descriptions were most characteristic.

Tables 2.12 through 2.16 list descriptions that a majority of the team members considered to be very characteristic of the "typical" field test mathematics lessons from five countries. (Due to time constraints, the typical mathematics lessons from Australia and the United States were not included in this final analysis.) The preliminary theories that were developed regarding the typical components of these country's mathematics lessons would later be explored in the full dataset.

Table 2.12. Characteristics of the "typical" Czech field test mathematics lessons: 1998

Category	Characteristic
Content	An introduction and elaboration of concepts
Structure	Whole-class works together
Teacher behavior	Asks questions with different degrees of freedom
Student behavior	The student at the board has to talk through the solution

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 2.13. Characteristics of the "typical" Japanese field test mathematics lessons: 1998

Category	Characteristic
Lesson flow	Long illustration of new topic
Content	Logical thinking
	Wide spectrum of information connected and brought to the level of students
Teacher behavior	Meta comments
	Allows students a long time to think about questions

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 2.14. Characteristics of the "typical" Luxembourg field test mathematics lessons: 1998

Category	Characteristic
Lesson flow	Teacher-led instruction; one student solves a problem at the board
Lesson structure	Teacher centered
Teacher behavior	Asks questions, mostly of low cognitive level
Other	Students seem to have poor recall and understanding

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 2.15. Characteristics of the "typical" Netherlands field test mathematics lessons: 1998

Category	Characteristic
Lesson flow	Students work independently, teacher assists (tutoring)
Lesson structure	Students assist each other
Teacher behavior	Gives varied forms of assistance (e.g., direct telling, scaffolding[1])
	Almost no public explanation

[1]See Bruner (1966) for an explanation of scaffolding.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 2.16. Characteristics of the “typical” Swiss field test mathematics lessons: 1998

Category	Characteristic
Lesson flow	Class starts with an opening problem that takes a long time
	Teacher demonstrates solutions
	Teacher assists students individually during seatwork
Content	Practice lesson
Lesson structure	Students work individually and in pairs
Student behavior	Students seem to be on task most of the time

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

2.7.2.3 Many Similar Coding Issues for Both Mathematics and Science Lessons

After developing meta-plans for all of the “typical” science lessons and most of the “typical” mathematics lessons, the field test analysis team noticed that many of the issues raised could be applied in a general sense to all of the data. That is, there seemed to be a number of general coding categories that could be appropriate for both the mathematics and science lessons. At a more specific level, these codes would have to be developed separately. However, watching and discussing both mathematics and science lessons led the team to consider many coding categories as applicable for both topics. Table 2.17 describes the list of the coding categories that resulted from these preliminary analyses of the field test data.

Table 2.17. Potential coding categories derived from analyses of the field test data: 1998

Category	Issue
Content	▪ Link between theory and "real life" ▪ Utility of knowledge ▪ Complexity of content (relatedness between topics, ideas) ▪ Content brought on level of students
Teacher content knowledge	▪ Whether teachers make mistakes in their explanations
Structure	▪ Elements of scientific method: inclusion and sequence ▪ Lesson closure (summary, recap, review, preview of the next lesson) ▪ Amount of individual vs. group work ▪ Ways or qualities of reviewing
Teacher behavior	▪ Structuring comments (lesson and topic)
Student behavior	▪ Time on task, student engagement ▪ Students' applied activities
Discourse/interaction	▪ Teacher's role during whole class discussion ▪ Teacher's assistance during individual work time ▪ Students' opportunities to communicate reasoning ▪ Amount of student-initiated inquiry during whole-class work and seatwork ▪ Explicit link between lessons, topics, and ideas
Climate	▪ How students' errors were treated ▪ Teacher's emphasis on performance, speed, mastery, and understanding
Classroom management	▪ Discipline talk ▪ Ability to make smooth transitions
Lesson characteristics	▪ Teacher controlled vs. student controlled learning and problem solving ▪ Coherence of lesson
Cognitive level	▪ Facilitation of transfer ▪ Work expected of students to think, do, and memorize ▪ Ways or qualities of practice ▪ Reflection on learning strategies ▪ Content knowledge (what to learn) ▪ Representations of phenomena/objects

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

2.7.3 Overall Summary

The field test for the TIMSS 1999 Video Study helped to generate improvements in data collection, processing, and analyses. Some of the most important modifications involved creating videotaping procedures for two cameras, updating the software to include two video tracks, generating transcription/translation protocols to incorporate five languages, and generating hypotheses and coding ideas to describe teaching in a wide range of countries.

The field test analysis team consisted of representatives for each of the countries participating in the field test study. These representatives spent several months in 1998 studying the data from all of the countries. As one task, they selected a “typical lesson” from their own country, and then viewed the “typical lessons” from all of the other countries. Structured group discussions about these lessons led to preliminary theories about the characteristics of instruction within each country as well as important differences in teaching across countries. These theories then paved the way for more intensive code development work to begin, as described in chapter 6.

Chapter 3. Sampling

3.1 Introduction

The TIMSS 1999 Video Study was designed to provide comparable information about nationally-representative samples of mathematics and science lessons in participating countries. To make the comparisons valid, it was necessary to devise a sampling design for each country that called for uniformity in sampling procedures but also allowed participating countries to account for differences in educational systems, as well as implementation limitations. In general, the sampling plan for the TIMSS 1999 Video Study followed the standards and procedures agreed to and implemented for the TIMSS 1999 Achievement Study. Most of the participating countries drew separate samples for the TIMSS 1999 Video Study than they did for the TIMSS 1999 Achievement Study, however. For this and other reasons, the TIMSS 1999 assessment data cannot be directly linked to the video database.

3.2 Selecting Countries to Participate in the Study

The TIMSS 1999 Video Study aimed to expand on the TIMSS 1995 Video Study by examining instruction in more countries, and in particular in more high-achieving countries. The selection of countries for inclusion in the TIMSS 1999 Video Study was based primarily on the results from the TIMSS 1995 mathematics assessment administered to eighth-grade students (NCES, 1996) with the aim of including countries that outperformed the United States. Since it was not operationally or financially possible to include all nations that outperformed the United States in mathematics in TIMSS 1995, the sponsors of the study invited four nations from Europe and Asia—the Czech Republic, Hong Kong SAR, Japan, and the Netherlands—to participate, along with the United States. In addition, Switzerland and Australia joined the study partly at their own expense. Japan agreed to participate in the science portion of the study only; the Japanese mathematics video data collected as part of the TIMSS 1995 Video Study were re-analyzed using the TIMSS 1999 Video Study coding system.

Table 3.1 lists the countries analyzed as part of the TIMSS 1999 Video Study along with their scores on the TIMSS 1995 and 1999 mathematics assessments. With the exception of Australia, the TIMSS 1999 assessment was administered after the 1999 Video Study sample. Thus, these assessment results were not used to select countries for the 1999 Video Study.

On the TIMSS 1995 mathematics assessment, eighth graders as a group in Japan and Hong Kong SAR were among the highest achieving students, and their results were not significantly different from one another. On average, students in the Czech Republic scored statistically below their peers in Japan but similar to those in Hong Kong SAR. Average scores in Switzerland and the Netherlands were similar to one another. The mathematics average for Australia was similar to that in the Netherlands. Students in the United States scored, on average, significantly lower than the other six countries.

Eighth graders in these countries continued to score significantly higher than their peers in the United States on the TIMSS 1999 mathematics assessment, except for students in the Czech

Republic whose scores were not significantly different than the scores for students in the United States in 1999. Switzerland did not participate in the TIMSS 1999 assessment.

Table 3.1. Average score on the TIMSS 1995 and TIMSS 1999 mathematics assessments, by country: 1995 and 1999

Country	TIMSS 1995 mathematics score		TIMSS 1999 mathematics score	
	Average	Standard error	Average	Standard error
Australia ◊	519	3.8	525	4.8
Czech Republic	546	4.5	520	4.2
Hong Kong SAR	569	6.1	582	4.3
Japan	581	1.6	579	1.7
Netherlands ◊	529	6.1	540	7.1
Switzerland	534	2.7	—	—
United States	492	4.7	502	4.0

◊ Nation did not meet international sampling and/or other guidelines in 1995. See Beaton et al. (1996) for details.
—Not available
NOTE: Rescaled TIMSS 1995 mathematics scores are reported here. Switzerland did not participate in the TIMSS 1999 assessment.
SOURCE: Gonzales, P., Calsyn, C., Jocelyn, L., Mak, K., Kastberg, D., Arafeh, S., Williams, T., and Tsen, W. (2000). *Pursuing Excellence: Comparisons of International Eighth-Grade Mathematics and Science Achievement from a U.S. Perspective, 1995 and 1999* (NCES 2001– 028). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

3.3 International Sampling Specifications

In general, the sampling plan for the TIMSS 1999 Video Study followed the standards and procedures agreed to and implemented for the TIMSS 1999 Achievement Study. The sampling plan proposed for the TIMSS 1999 Video Study internationally was a two-stage stratified cluster design. The first stage consisted of a stratified sample of schools, and the second stage consisted of a sample of mathematics and science lessons from the 8th-grade in the sampled schools. This relatively simple and cost-effective design was intended to produce national samples that would meet the analytical requirements necessary to allow estimates for classrooms and schools.

At a minimum, the sample design for each country had to provide a sampling precision at the lesson (or classroom) level equivalent to a simple random sample of 100 mathematics and 100 science 8th-grade lessons for Australia, the Czech Republic, the Netherlands, and the United States; 100 science 8th-grade lessons for Japan; 100 mathematics 8th-grade lessons for Hong Kong SAR; and 143 mathematics 8th-grade lessons for Switzerland[3]. There was no minimum sample size established for the study. Rather, each country sample was carefully scrutinized to determine acceptability.

[3] Switzerland wished to analyze its data by language group, resulting in a nationally-representative sample that is also statistically reliable for the French-, Italian-, and German-language areas.

In addition, an attempt was made to collect data across the school year, and thus be representative of the teaching that eighth-grade students received over an academic year. In order to achieve this, an average of 12–15 lessons were videotaped per month in each country. In Hong Kong SAR, an above average number of lessons were collected over a one-month period. To ensure that the data collected would be evenly distributed over the school year, nine lessons from this one-month period were randomly selected and omitted from the Hong Kong SAR sample. These lessons were replaced by others that were taught by the same teachers and videotaped at a later date.

3.3.1 The School Sampling Stage

Under the international sample design, the first sampling stage was the sampling of schools. The school sampling frame in principle included all schools in the country that had eligible students in 8th grade, the target grade. The school sample was required to be a Probability Proportionate to Size (PPS) sample. A PPS sample assigns probabilities of selection to each school proportional to the number of eligible students in the 8th-grade in schools countrywide. Westat[4] strongly recommended systematic sampling, with implicit and explicit stratification, to each of the participating countries. Systematic sampling was recommended because of its good properties with regard to lower sampling variance (when the implicit stratification structure is chosen well), and its relative simplicity, allowing for use by individual countries. Whether or not systematic sampling was used, the sample was required to be a scientific probability sample, selected using the techniques and principles of this method.

Under the proposed systematic sampling approach, all schools within the explicit stratum should be ordered by a set of school characteristics that become the implicit strata. The explicit strata were generally expected to be regions of the country or other similar subgroups for which an exact sample size was desired for each subgroup. The implicit strata were expected to be other school characteristics for which exact sample sizes within subgroups were not deemed necessary, but for which a small variability in sample size across subgroups was desired.

Once the final ordering of schools was determined, a sample was to be drawn for each explicit stratum by computing an aggregate measure of size where the measures of size are proportional to the school selection probabilities for each school on the ordered list. The first school's aggregate measure of size is equal to its measure of size, the second school's aggregate measure of size is equal to the summation of the first and second schools' measures of size, and so on, with the final school's aggregate measure of size equaling the total summation of all measures of size in the explicit stratum. A sampling interval was computed that is equal to the total measure of size for the explicit stratum divided by the sample size for the stratum.

A random number was chosen for the explicit stratum between 0 and the sampling interval. The school with the smallest aggregate measure of size greater than the random number would be selected. A stream of numbers was then generated by adding positive integer multiples of the sampling interval to the random number, until the total measure of size was exceeded. For each number in this stream, a school was to be selected by taking the school with the smallest aggregate measure of size greater than that number.

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[4] Westat was contracted to guide the sampling and weighting procedures for the TIMSS 1999 Video Study.

If originally selected schools declined to participate, in some countries replacement schools were selected using the same procedure described above. In general, the original and replacement schools had very similar probabilities of selection into the initial sample. More information on the number of replacement schools used in each country is presented in sections 3.4 and 3.5 of this chapter. Additional details on the selection probabilities and weights assigned to the replacement schools in each country can be found in chapter 8.

3.3.2 The Classroom and Lesson Sampling Stage

The next stage following school selection was classroom selection within schools, and finally lesson selection. One mathematics and/or one science 8th-grade class per school was to be sampled, depending on the subject(s) to be studied in each country.[5] The classes were to be randomly selected from a list of eligible classes in each participating school. The classroom sampling design was to be an equal probability design with no subsampling of students in the classroom.

For schools in which both mathematics and science classes were to be videotaped, the mathematics classroom was selected first with each available mathematics classroom having an equal probability of being selected. However, science classes that were scheduled at the same time as the selected mathematics class were omitted, and the science classroom was then randomly selected from the remaining available classrooms.

One lesson from each selected mathematics and science classroom was then videotaped. The videotaping date was determined by the scheduler in each country, and was based on scheduling and operational convenience.

3.4 Selecting Samples Within Each Country

Within the guidelines specified above, each country developed its own sampling strategy. For example, in two countries the video sample was a subsample of the TIMSS 1995 or TIMSS 1999 Achievement Study schools.[6] Also, although most countries used replacement schools, some did not. All of the TIMSS 1999 Video Study countries were required to include at least 100 schools in their initial selection of schools; however some countries chose to include more for various reasons. Furthermore, although all countries had to obtain a systematic Probability Proportionate to Size (PPS) sample, they were allowed to define strata appropriate for their country.

In most countries, the school sample was selected by the national research coordinators. In the United States, Westat (a contracted research corporation) selected the school sample. In countries that used the same sample of schools as for the TIMSS 1999 Achievement Study, school samples were selected and checked by Statistics Canada. In all cases, countries provided

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[5] Australia, the Czech Republic, Japan, the Netherlands, and the United States also collected video data on eighth-grade science lessons.

[6] For the German-language area of Switzerland, the video sample was a subsample of the TIMSS 1995 achievement school sample. For Hong Kong SAR most, but not all, of the video sample was a subsample of the TIMSS 1999 achievement school sample.

the relevant sampling variables to Westat, so that they could appropriately weight the school samples.

The national research coordinators were responsible for selecting the classroom sample in their country. LessonLab was responsible for selecting the classroom sample in the United States. Westat received information about the number of classes in each country, so that the classroom stages of sampling could be weighted correctly. Additional information on the weighted participation rates in each country is provided in chapter 8.

In all countries, the national research coordinator was responsible for securing and verifying that any consent required by law was obtained from teachers, students, and/or parents. In addition, the national research coordinator in each country determined the type of compensation that would be provided to participating teachers. In each country, teachers were provided locally appropriate monetary compensation, a book voucher, and/or a videotape of their lesson in return for participation.

The details of the sample selection in each country are provided below. For most countries, a table is provided describing the breakdown of the types of schools by source of funding and any other variables deemed pertinent by the national research coordinator. For more detailed information on the educational systems within each of the participating countries, see Robitaille (1997).

3.4.1 Australia Sample

Australian schools were sampled systematically from 13 explicit strata, which were defined by state/territory and metro/non-metro status. Within each stratum, the schools were sorted by sector (government, Catholic, and independent) and enrollment. A systematic Probability Proportionate to Size (PPS) sample of 100 schools was selected from the ordered list. The measure of size (MOS) was the estimated number of mathematics and science classes in the school. Sixty-one of the 100 originally sampled schools agreed to participate and 26 replacement schools were used, yielding a final sample size of 87 schools. Mathematics lessons were filmed in all of the selected classrooms.

Table 3.2 shows the breakdown of the type of schools in the Australian sample, based on source of funding.

Table 3.2. Number and percentage distribution of the Australian school sample, by source of funding: 1999

School sector type	Number	Percent
Total	87	100.0
Government	54	62.1
Catholic	16	18.4
Independent◊	17	19.5

◊Independent schools included Christian Community schools, non-Catholic religious schools, and others.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

3.4.2 The Czech Republic Sample

Schools in the Czech Republic were sampled systematically from two explicit strata: basic schools and gymnasia schools. Within each stratum, the schools were sorted and a systematic PPS sample was selected from the ordered list. Consistent with the distribution in the population, 90 schools were selected from the basic school stratum and 10 schools were selected from the gymnasia school stratum. The measure of size (MOS) was the number of students enrolled in the eighth grade. Eighty-nine out of 100 originally sampled schools agreed to participate and 11 replacement schools were used, yielding a final sample size of 100 schools. Mathematics lessons were filmed in all of the selected classrooms.

Table 3.3 shows the breakdown of the type of schools in the Czech Republic sample, based on source of funding as well as ability track.

Table 3.3. Number and percentage distribution of the Czech Republic school sample, by source of funding and ability track: 1999

School sector type	Number	Percent
Total	100	100.0
Funding		
State	98	98.0
Religious	1	1.0
Private	1	1.0
Ability track[1]		
Basic	90	90.0
Gymnasia	10	10.0

[1]In the Czech Republic there is a two-tiered school system at the lower secondary level (grades 6-9). At the time of data collection, basic schools (the lower tier) were attended by approximately 90 percent of lower secondary students. Student attending gymnasia schools (the upper tier) were required to pass an entrance examination to gain entrance to the school.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

3.4.3 Hong Kong SAR Sample

The videotaped schools in Hong Kong SAR represent a subset of schools that participated in the TIMSS 1999 Achievement Study. The TIMSS 1999 Achievement schools represent a systematic PPS sample with strata defined by source of funding of the schools (3 levels: government, aided, and private) and gender of students (2 types: co-educational and single-sex). Using an alphabetically-sorted list of the 180 schools in the Achievement Study sample, schools were chosen at a randomly selected interval. The school MOS was the reported 8th-grade enrollment. Sixty-three out of 100 originally sampled schools agreed to participate and 37 replacement schools were used, yielding a final sample size of 100 schools. Mathematics lessons were filmed in all of the selected classrooms.

During one month of data collection, the number of lessons taped in Hong Kong SAR far exceeded the monthly average. To ensure that the data collected would be evenly distributed over the school year, nine lessons from this one-month period were randomly selected and omitted from the sample. These lessons were replaced by others that were taught by the same teachers and videotaped at a later date. That is, the data collection period in Hong Kong SAR was extended by two months to incorporate the collection of these videotapes.

Table 3.4 shows the breakdown of the type of schools in the Hong Kong SAR sample, based on source of funding and management.

Table 3.4. Number and percentage distribution of the Hong Kong SAR school sample, by source of funding and management: 1999

School sector type	Number	Percent
Total	100	100.0
Government	8	8.0
Aided	85	85.0
Private	7	7.0

NOTE: Government schools are government funded and managed. Aided schools are government funded but managed by School Sponsoring Bodies.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

3.4.4 Japan Sample

The Japanese sample of mathematics lessons was collected in the TIMSS 1995 Video Study (see Stigler et al., 1999). The videotaped schools represent a subset of the 158 schools that participated in the TIMSS 1995 Achievement Study. Schools were sampled systematically from strata defined by size of community and size of school. Within each stratum, the schools were sorted and a systematic PPS sample was selected from the ordered list. One third of the schools in the TIMSS 1995 Achievement Study sample were randomly selected within each stratum for the 1995 Video Study.

Forty-eight out of 50 originally sampled schools agreed to participate and 2 replacement schools were used, yielding a final sample size of 50 schools. The sample size was reduced to 50 because collaborators at the Japanese National Institute for Educational Research (NIER) determined that 100 classrooms would create too great a burden for their country. This smaller sample size was deemed sufficient due to the homogeneity of the classrooms.

It is important to note that the Japanese sample size is considerably smaller than the sample sizes of all the countries participating in the TIMSS 1999 Video Study. In addition, videotaping was conducted largely over a condensed period of the school year and the Japanese sample is skewed toward geometry (Stigler et al., 1999). In the international report on the mathematics results (NCES 2003-013), it is noted that the Japanese sample contained lessons with high percentages of two-dimensional geometry problems relative to the other countries, which may be due to the topic sample (Hiebert et al., 2003). Therefore, where appropriate, analyses were run based only on lessons that contained two-dimensional geometry problems.

Videotaping was usually done in a different class from the one in which testing for the TIMSS 1995 Achievement Study was conducted. When there was a choice, the principal of each school chose the classroom to be filmed.

3.4.5 The Netherlands Sample

Schools in the Netherlands were sampled systematically from seven implicit strata based on ability tracking at the school level. A systematic PPS sample of 175 schools was drawn from a list sorted on the stratum and number of 8th-grade students (the Measure of Size). The sample was selected at the same time as the TIMSS 1999 Achievement Study sample. The same sampling interval was used for both samples, but the random number for the 1999 Video Study sample was the random number for the 1998–1999 Achievement Study sample plus 0.5. This was done to reduce the overlap between the two samples. However, significant overlap occurred in spite of this procedure. Sixty-nine of the 175 originally sampled schools had already been selected to participate in the TIMSS 1999 Achievement Study or were "first replacements" (the school following the sampled school on the sorted list for that study). Therefore, they were not considered eligible schools for the 1999 Video Study. An additional four schools were dropped randomly, and two other schools were ineligible, leaving 100 schools for the video sample. This constituted the number of schools considered to be in the original sample for the study.

Forty-nine originally sampled schools agreed to participate and 36 replacement schools were used, yielding a final sample size of 85 schools. Of the 36 replacement schools, in 27 cases the replacement was the initially designated first replacement school. The other 9 replacements were chosen from unused substitutes for other schools, including one case of a school that had previously been dropped. Mathematics lessons were filmed in 78 of the selected classrooms. (Science lessons only were filmed in 7 schools.)

Table 3.5 shows the breakdown of the type of schools in the Netherlands sample, based on source of funding as well as ability track.

Table 3.5. Number and percentage distribution of the Netherlands school sample, by source of funding and ability track: 1999

School sector type	Number	Percent
Total	78	100.0
Funding◊		
Public	25	32.1
Roman Catholic	24	30.8
Protestant-Christian	22	28.2
Non-denominational private	7	9.0
Not identified	3	3.8
Ability track		
(i)vbo	5	6.4
mavo	5	6.4
vbo/mavo	8	10.3
mavo/havo/vbo	20	25.6
havo/vwo	11	14.1
(i)vbo/avo/vwo	17	21.8
large (i)vbo/avo/vwo	12	15.4

◊Funding information is from teacher questionnaire responses. In the questionnaire, teachers identified schools with as many categories as applied. The total percent of all categories is therefore greater than 100 percent, and the sample size is greater than 78 schools.
NOTE: (i)vbo = (individual) junior vocational education; mavo = junior general education; havo = senior general education; vwo = pre-university education; avo = mavo and/or havo. Large (i)vbo/avo/vwo schools are those that serve all ability tracks and include a large number of students in the eighth grade. Because these schools had a different selection probability from those that were smaller, they were placed in a separate stratum.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

3.4.6 Switzerland Sample

Switzerland employed different sampling procedures for each of its three linguistic areas: German, French, and Italian.[7] Overall, the sampling of these three areas was proportionate to the student population: German (74.4 percent), French (21.8 percent), and Italian (3.8 percent). This distribution is based on estimates for the 9th-grade population of Switzerland from OECD (2001).

Switzerland analyzed its data by language group, resulting in a nationally-representative sample that is also statistically reliable for the French-, Italian-, and German-language regions.

[7] The country of Switzerland is divided into 26 cantons (the equivalent of provinces or states). Data for the German-language area were collected from 14 cantons, data for the French-language area was collected from 6 cantons, and data for the Italian-language area was collected from 1 canton. The language of instruction in the lessons from each canton corresponds to the language predominantly spoken in that canton.

Table 3.6 shows the breakdown of the type of schools in the Swiss sample based on source of funding, and Table 3.7 shows the breakdown based on ability track.

Table 3.6. Number and percentage distribution of the Swiss school sample, by language area and source of funding: 1999

School sector type	Number	Percent
Total	140	100.0
German-language area		
Public	72	51.4
Private religious	2	1.4
French-language area		
Public	39	27.9
Italian-language area		
Public	27	19.3

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 3.7. Number and percentage distribution of the Swiss school sample, by language area and ability track: 1999

Ability track	Number	Percent
German- language area	74	100.0
Basic requirements	26	35.1
Extended requirements	38	51.4
Highest requirements	10	13.5
French- language area	39	100.0
Basic requirements	5	12.8
Extended requirements	20	51.3
Highest requirements	14	35.9
Italian- language area◊	27	100.0
Basic requirements	9	33.3
Extended requirements	18	66.7

◊For the Swiss-Italian schools, ability tracking is within schools. That is, each school contains two tracks for mathematics classes.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

3.4.6.1 German-Language Area of Switzerland

Schools in the German- language area of Switzerland represent a subset of 133 schools that participated in (or were selected for) the TIMSS 1995 Achievement Study. Schools were sampled systematically from implicit strata. Schools were sorted on school type, stratum, canton, and number of 8th-grade students (the MOS), and a systematic PPS sample was selected from the ordered list. Fifty-one out of 75 originally sampled schools agreed to participate and 23 replacement schools were used, yielding a final sample size of 74 schools. Mathematics lessons were filmed in all of the selected classrooms.

3.4.6.2 French-Language Area of Switzerland

Classes in the French-language area of Switzerland were sampled systematically from class lists assembled by canton. Because these were selected from each canton by equal probability, the MOS value for each class is 1.

The sample allocation for each canton was based on the population proportion of that canton. Thirty-seven out of 41 originally sampled schools agreed to participate. Although 40 schools were initially sampled, one class in the sample was actually two classes. Because this was a random selection, and because the class division that affected this class is common-place in the population, it was decided to keep the "extra" class as a valid sample selection and increase the target sample size from 40 to 41 classes. The original 40 plus the "extra" class are considered the full complement of original selections for participation rate purposes.

Two replacement schools were used, yielding a final sample size of 39 schools. Mathematics lessons were filmed in all of the selected classrooms.

3.4.6.3 Italian-Language Area of Switzerland

In the Italian-language area of Switzerland all eligible schools in the population (i.e., all schools in the district of Ticino) were selected for the video study. Twenty-seven out of 35 of the schools in the population agreed to participate. Mathematics lessons were filmed in all of the selected classrooms.

3.4.7 United States Sample

3.4.7.1 United States Sample Selection Process

To select schools in the United States, first a sample of 52 geographic Primary Sample Units (PSUs) was selected from a frame of PSUs that represented the entire country. PSUs were defined to be counties or groups of counties. Ten of the PSUs, the ten largest Metropolitan Statistical Areas (MSAs), were included with certainty. Among the next largest 12 MSAs, a systematic random sample of 6 was selected. The remaining sample of PSUs consisted of a stratified sample of 36 other areas—18 MSAs, and 18 groups of counties from outside metropolitan areas. These 36 PSUs were stratified by geographic region, metropolitan/non-metro, and characteristics such as proportion of adults with college degrees and size of minority populations (the exact stratification characteristics varied by region and metro/non-metro status). The 36 PSUs were selected with probability proportional to population size as reported in the 1990 U.S. Population Census.

The PSU sample design is very similar to that used for the TIMSS 1995 Video Study, and is identical to that which was used for sampling schools for the TIMSS 1999 Achievement Study. In the TIMSS 1999 United States sample, different schools were used for the achievement and video study and, except for the 16 large metro areas, the PSUs for the two study samples were different.

A systematic PPS sample of 110 schools was chosen from the 13,261 schools that taught grade 8 in the selected PSUs. The schools were selected from a list sorted by region, urban/rural status (and, in the case of the 16 largest PSUs, central city/suburban status), type of school (public/private), and school size. Approximately two schools were selected from each PSU, but larger metropolitan PSUs may have had more than two schools selected, while from other PSUs a single school was selected.

The primary purpose for including the PSU stage of selection was to ensure that the sample for the TIMSS 1999 Video study was in different schools, and to a large extent in different school districts, from the TIMSS 1999 Achievement Study sample, the IEA Civics Education Study sample, and the National Assessment of Educational Progress Long-Term Trend and 2000 Field Test samples. All of these studies were taking place in national samples of grade 8 schools across the nation during the 1998–1999 school year.

Replacement schools were not used in the United States sample. Instead, an extra 10 schools were selected along with the 100 schools to increase the likelihood that 100 schools would participate in the study. It was likely that some selected schools would not be eligible. As it turned out, one school had ceased operations and another only had one student in the eighth-grade.

Eighty-nine out of the 108 eligible, originally sampled schools agreed to participate. Mathematics lessons were filmed in 83 of the selected classrooms. (Science lessons only were filmed in 6 schools.)

Table 3.8 shows the breakdown of the type of schools in the U.S. sample, based on source of funding.

Table 3.8. Number and percentage distribution of the United States sample, by source of funding: 1999

School sector type	Number	Percent
Total	83	100.0
Public	75	90.4
Private	8	9.6

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

3.4.7.2 United States Special Circumstances

A classroom in the United States was required to have at least three students to be eligible for selection into the lesson sample. Classrooms with fewer than three students could not be combined with an adjacent classroom. Two sampled schools were identified as ineligible after data collection efforts began. One school was closed permanently and another had only one student in the grade 8 mathematics and science classes.

When the available classes included a combination mathematics and science lesson which was team taught, one mathematics class was randomly selected from all classes teaching math, then a science class was selected following the procedures described above. In one case, the team-taught class was randomly selected and videotaped. This class fulfilled the requirement for one mathematics and one science lesson.

3.4.7.3 United States Refusals to Participate

The project director, other TIMSS 1999 Video Study senior staff members, and/or NCES contacted districts or schools that seemed disinclined to participate. They explained in detail the TIMSS 1999 Video Study, provided background information, answered questions, and discussed any concerns districts or schools had (see appendix B for copies of the information provided to U.S. superintendents, principals, and teachers). For some schools, the promise of a presentation about the video study by the project director was offered to encourage participation. In other cases, just providing reassurance of school and teacher confidentiality was enough to secure cooperation in the study.

Some districts and schools that had originally refused were later re-contacted and then accepted. In some cases, this was because a new superintendent or principal had come on board who had a more favorable opinion of the study. In other cases, this was simply because things were less hectic and they had more time to consider participating. In two cases, it was necessary to offer schools more money for compensation of lost time before they would agree to participate. Teachers in the United States were generally given $300 as compensation for their participation in the study, and a videotaped copy of their lesson.

Participation in the TIMSS 1999 Video Study in the United States required obtaining consent at three levels: district superintendent, school principal, and teachers. Of the sample of eligible respondents, 11 superintendents refused to allow the sampled school in their district to participate in the video study, 8 principals refused to allow their school to participate in the study. Furthermore, 14 mathematics teachers and 9 science teachers refused to participate. The tables below summarize the number of schools and teachers that accepted or refused.

Table 3.9. Participation status of United States schools, by type of school: 1999

Participation status	Total schools	Public schools	Private schools	Department of Defense schools
Number in original sample	110	96	13	1
Number accepted	89	81	8	0
Number refused	19	14	4	1
Number ineligible	2	1	1	0
U.S. school response rate – unweighted percentage	81	84	62	0

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 3.10. Participation status of United States teachers, by field of teacher: 1999

Participation status	Total mathematics teachers	Total science teachers	Total teachers
Number of original sample of teachers contacted	97	97	194
Number accepted	83	88	171
Number refused	14	9	23
U.S. teacher response rate – unweighted percentage	86	91	88

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

U.S. district superintendents' reasons for refusing to participate included the following:

- Superintendent did not want to be part of a video study;
- Committee of superintendents declined; they were not allowing any more research projects for the school this year;
- Superintendent said teachers had too many student assessments and tests to be able to accommodate an additional study; and
- No explanation provided.

U.S. principals' reasons for refusing to participate included the following:

- A private, religious school did not allow visitors on the campus;
- Principal said no teachers were interested;
- Principal said teachers were too busy ("this is not a good year to do something new"); and
- Principal said two teachers were new and were not comfortable being videotaped.

U.S. teachers' reasons for refusing to participate included the following:

- Teacher was not interested or not willing to participate;
- Teacher was too busy;
- Teacher was not comfortable being videotaped;
- Concern about consent forms; and

- No explanation provided.

3.4.7.4 United States Teacher Consent/Waivers

All participating teachers (and parents of the students in the class) were required to sign a consent form (see appendix C for a sample of the United States consent form). This consent/waiver released the usage of their lesson video for research purposes. In most instances, the school principal was relied upon to provide teachers with an introductory packet that described the study and invited them to participate. The consent/waiver form was contained in the packet, and was supposed to be signed and returned to LessonLab prior to the videotaping. Although most teachers confirmed their participation through the principal, very rarely did they return their consent/waiver in a timely fashion.

Often the videographer would attempt to collect the teacher's waiver on the day of the taping. In many of these instances, the teacher reassured the videographer that the waiver had already been signed and returned. However, after the fall of 1999, it was discovered that 28 lessons had been videotaped without the teachers' signed consent/waivers on file. After senior staff contacted these teachers and addressed any issues, all 28 teachers agreed to sign and return their waivers. All videotapes collected in the United States have the requisite consent/waivers on file.

3.5 Summary

All of the TIMSS 1999 Video Study countries were required to include at least 100 schools in their initial selection of schools. In this chapter, information was provided regarding the participation rates in each country, as well as their sampling strategies. Also presented were details regarding the nature of the participating schools within each country, including the types of schools in the sample by funding source and/or ability track.

Chapter 4. Data Collection and Processing

4.1 Data Collection

4.1.1 Nature of Data Collected

The primary focus of the data collection for this study was the videotaping of a full mathematics and/or science lesson in each sampled classroom. What counted as a lesson was determined by what was standard in each participating country.

Additional data were also collected to help understand the videotaped lesson more fully. This additional data included:

- A teacher questionnaire;
- A student questionnaire;
- Photocopies of text pages, worksheets, overhead transparencies, and other materials used in the lesson; and,
- A log sheet that videographers completed after each taping session.

4.1.2 Data Collection Schedule

The National Research Coordinators in each country were responsible for scheduling the videotaping and ensuring that taping was evenly distributed throughout the school year. LessonLab scheduled the videotaping of classrooms in the United States. As an added check, the receipt control system at LessonLab tracked the proportion of lessons that arrived from each country on a monthly basis, to ensure there was not a disproportionate number of tapes collected during any given month.

Most of the data collection took place in 1999. In some countries filming began in late-1998, and in other countries filming began in 1999. Data collected ended in either late-1999 or mid-2000 in order to sample lessons across the academic year in each country. Table 4.1 lists the start and end dates for data collection in the six participating countries.

Table 4.1. Data collection periods, by country: 1998–2000

Country	Data collection start date	Date collection end date
Australia	5/24/99	12/3/99
Czech Republic	11/26/98	10/20/99
Hong Kong SAR	3/11/99	12/13/99
Japan◊	11/94	3/95
Netherlands	12/8/98	3/22/00
Switzerland	5/1/99	7/31/00
United States	1/26/99	5/18/00

◊Japan did not participate in the mathematics portion of the TIMSS 1999 Video Study. Japanese data were collected as part of the TIMSS 1995 Video Study during the 1994-1995 school year. Information on Japanese data collection dates is from Stigler et al. (1999).
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

4.1.3 Number of Mathematics Lessons Filmed

Detailed sampling procedures are described in chapter 3. Table 4.2 provides the final sample size of mathematics lessons that were included in the study.

Table 4.2. Number of mathematics lessons included in the study, by country: 1999

Country	Number of mathematics lessons
Australia	87
Czech Republic	100
Hong Kong SAR	100
Japan[1]	50
Netherlands	78
Switzerland[2]	140
United States	83

[1]Japanese mathematics data collected in 1995.
[2]Seventy-four lessons were included from the German-language area of Switzerland, 39 lessons were included from the French-language area of Switzerland, and 27 lessons were included from the Italian-language area of Switzerland.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

In some countries, additional mathematics lessons were filmed but not included as part of the final sample for various reasons.

- In Hong Kong SAR, 9 additional lessons were filmed but not used in the study because they were not evenly distributed throughout the school year (see chapter 3, sections 3.3 and 3.4.3)

- In Switzerland, two lessons were filmed but then disqualified. In one case a seventh-grade class was inadvertently selected and filmed. Once the error was discovered, an eighth-grade class from the same school was selected and filmed. In another case a teacher decided to revoke her permission to participate in the study.
- In the United States, one lesson was filmed but not used in the study because it was not from a sampled teacher. Another lesson was excluded from the database because the sound and visual quality were too poor to be coded. The class was re-filmed at a later date.

4.1.4 Number of Questionnaires Collected

Each videotaped teacher was given a questionnaire to complete after the videotaped lesson, as was each student in the class. Response rates on the teacher questionnaire were between 96 and 100 percent, and response rates on the student questionnaire were between 83 and 97 percent, as shown in table 4.3. More complete information about the development and nature of the questionnaires is available in chapter 5.

Table 4.3. Teacher and student questionnaire response rates, by country: 1999

Country	Teacher questionnaire response rate (unweighted)		Student questionnaire response rate (unweighted)	
	Percentage	Sample size	Percentage◊	Sample size
Australia	100	87	83	1,942
Czech Republic	100	100	90	2,133
Hong Kong SAR	100	100	97	3,560
Netherlands	96	75	93	1,733
Switzerland	99	138	94	2,485
United States	100	83	89	1,623

◊Percentage represents the number of student questionnaires received out of the total number of students reported by the teacher to be enrolled in each class. Questionnaires were collected only from the students who were in attendance at the filming. Student questionnaires were received from all videotaped lessons except for 1 lesson in Australia, 4 lessons in the Netherlands, 3 lessons in Switzerland, and 3 lessons in the United States. All data are unweighted.

NOTE: Japan did not participate in the mathematics portion of the TIMSS 1999 Video Study.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

4.2 Data Receipt and Processing

4.2.1 Data Receipt

Data receipt was a collaborative effort between the data tracker, national research coordinators, and videographers. The following section describes the procedures that were put into place to ensure that all data was properly collected and accounted for.

All instruments (including teacher questionnaires, student responses, and instructions) were custom-produced for each participating country. Instruments were not produced or distributed until their translated versions met the approval of all parties. In Hong Kong SAR, for example, it was later agreed that both English and Cantonese questionnaires would be provided to teachers and students.

All videotapes, completed questionnaires, and ancillary materials were sent to LessonLab in Los Angeles for processing. Once final approval was granted and the data collection instruments were produced, the data tracker and national research coordinators agreed upon the best distribution and collection procedures to ensure that all data would arrive safely at LessonLab. These procedures took into consideration each country's geographical parameters, postal methods, and customs regulations.

Data collection procedures then were carefully reviewed with each videographer before entering the field. As part of the data collection process, all videographers were required to complete log sheets and assess each taping session; a copy is included as part of the TIMSS 1999 Video Study Data Collection Manual in appendix D. These log sheets provided the following information:

- The camera operator's name;
- The lesson's field identification number;
- Date and time that the lesson was taped;
- Whether any problems were encountered during videotaping; and,
- Any other comments by the videographer that might be useful for understanding the videotape.

Once the videotapes were received at LessonLab, the staff digitizer reviewed the videographer's log sheet and noted any technical problems they might have encountered. Such technical problems included:

- a classroom's air conditioner or poor acoustics interfered with the microphone's audio reception;
- the camera stopped operating due to battery failure;
- a brief time lapse while the videographer inserted an additional tape for a double-length lesson; and,
- a student accidentally unplugged the adapter cord causing the camera to stop.

In almost all cases, these difficulties were minor, and digital adjustments could be made to ensure their use in the study. Also, having two tapes of each lesson (from the teacher and student camera) helped to minimize the impact of these problems.

As data were collected from the field, the data tracker confirmed receipt of all data with each country's collaborator. Follow-ups were often needed with participating teachers in order to retrieve missing materials.

4.2.2 Data Processing

A sophisticated database management and tracking system was specially created for this study. This receipt control system was used to document the receipt and processing of video, teacher and student questionnaires, and other materials collected from the lessons. All processing of the data was entered into the system, and could be tracked daily. The major components of the system included:

- Document receipt and management component—for entering and maintaining receipt and process status of each videotape, questionnaire, and additional materials (e.g., videotape transcription/translation, digitizing, and coding status; questionnaire scanning and coding status; additional material scanning status);
- Process control component—for tracking the dates and status of data by a variety of classifications;
- Sample management component—for maintaining identification and links to teachers, schools, and countries;
- Management reporting component—which provides pre-specified reports;
- Database management component—which allows for importation, backing up, and archiving of all field data; and,
- Query processing component—for ad hoc queries.

Each lesson was identified by subject (mathematics or science), country, and classroom. This information was included in a bar code label that was applied to all the relevant materials for that lesson, including the two videotapes, the teacher questionnaire, each student questionnaire, and any other additional materials. Thus, the lesson, the teacher, and the students were linked by this unique identification number (LESSONID).

The LESSONID was then recorded in the receipt control tracking system. It contained information on the lesson subject, country, and teacher as shown in table 4.4 below.

Table 4.4. Information included in each LESSONID: 1999

Column	Identification	Code
1	Subject	M = Mathematics S = Science
2–3	Country	AU = Australia CZ = Czech Republic HK = Hong Kong SAR JP = Japan NL = Netherlands SW = Switzerland US = United States
4–6	Lesson	Number of lesson, range = 001–100

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

4.3 Videotaping Procedures in Classrooms

What is seen on video is dependent not only on what transpires in the classroom, but also on the way the camera is used to film the classroom. To achieve comparability across countries and classrooms, all camera operators must make similar filming decisions. Decisions on how to standardize filming also have an effect on what can be coded from the tapes. The TIMSS 1999 Video Study developed and used an explicit protocol for the collection of lesson videos and the operation of two cameras. Part of this protocol was developed during the field test study, details of which can be found in chapter 2, section 2.3.

4.3.1 Using Two Cameras

In the TIMSS 1995 Video Study, one camera was used to videotape lessons. However, in the TIMSS 1999 Video Study two cameras were used in order to obtain more detailed information on student behavior. One camera (the "teacher camera") focused primarily on the teacher, and was operated manually by a videographer. The videographer also used this camera to capture close-ups of the chalkboard or overhead screen, objects shown or used in the lesson, students' notebooks or worksheets during periods of private work, and teacher/student interactions during private work.

A second camera (the "student camera") was placed high on a tripod near the front of the room, positioned with a wide angle to include as many students as possible. The main goal of this camera was to capture students' interactions with the teacher and/or each other during the lesson. The student camera facilitated coding of the mathematics instruction, for example by reducing the number of inferences coders had to make about what students were doing in response to teacher talk and action, or to what student behaviors the teacher was referring.

The following statements guided camera operation and are excerpted from the TIMSS 1999 Video Study Data Collection Manual (see appendix D):

Two Camera Strategy

We are using two cameras in this study. The first camera will be operated by the videographer. It will be placed on a tripod, but will also be removed from the tripod whenever it is necessary to document the lesson. It will generally be placed between one third and one half of the way back from the front of the class, and will more often than not focus on the teacher and his or her zone of interaction. We will refer to this camera as the "teacher camera."

The second camera will be stationary. It typically will be placed up high on a tripod along a side wall near the front of the room, set to the widest shot possible, and used to capture as many students in the classroom as possible. We will refer to this as the "student camera."

The physical arrangement of classrooms and the activities that take place within them vary greatly. The videographer must decide where to place the cameras so that the documentation requirements outlined above can be met to the greatest possible extent. It is helpful, if possible, to talk with the teacher before the class begins to find out generally what is going to happen, and where the action will take place. The camera should be placed so that it can easily tape the main chalkboard or audiovisual device, the teacher, and some of the students in a single master shot. The position should also allow for easy panning to other areas of the classroom.

4.3.2 Videotaping Equipment

As described in chapter 2 section 2.2, Canon Optura mini DV camcorders were used for data collection based on their feasibility, as determined by the field test study. Two different tripods were used: the Mathews THM20 fluid head tripod was use for the teacher camera, and the Promaster 6400 photography tripod was used for the student camera.

Sound quality is another critical factor to take into account when studying classroom processes. Three microphones were used when filming each lesson: a wireless microphone attached to the teacher, a "shotgun" microphone set on top of the teacher camera, and a built-in microphone on the student camera. The wireless microphone included a Lectrosonic omni-directional lavaliere microphone, transmitter, and receiver. For the teacher camera, the Sennheiser K6P, a high quality professional microphone, was used. For the student camera, the Canon ZM100 zoom microphone was used.

Videographers carefully monitored the sound levels throughout the lesson, and made adjustments as necessary.

4.3.3 Basic Principles Guiding the Cameras

Camera operators were trained to film each classroom as if they were an observer watching the lesson. With regard to the teacher camera, they were instructed to carefully document the teachers' activities and behaviors during the lesson. For example, they were asked to capture what the teacher was doing and saying, and what information was being presented to the class.

Most of the time, the videographer decided where to focus the camera by taking the perspective of a model student in the class. In other words, if the teacher was lecturing, the camera focused on the teacher; if the teacher pointed to something on the chalkboard, the camera focused on the relevant portion of the chalkboard.

The teacher camera also filmed what students did and said during whole class instruction. Videographers focused mainly on the activities and behaviors of the students who were interacting with the teacher, but occasionally panned the classroom to see what other students were doing as well. During private work, the videographer was instructed to follow the teacher and document the activities and behaviors of the students who were interacting with the teacher. When possible, the videographer zoomed in on students' work to see how students were doing the assigned tasks.

The teacher camera was usually placed along a side wall in the classroom, about one third to half way from the front of the room. During whole class interaction, the camera was typically mounted on a tripod, but during private work it was often hand-held in order for the videographer to follow the teacher.

Videographers were trained to use a "master shot" most of the time, defined as the shot that gives the most encompassing view of the whole scene. This shot is thought to be the least subject to bias by both the videographer and the viewer, because it gives the most information about the context within which the action occurs. Also commonly used were "medium shots" and "close-ups" to capture information written on the chalkboard, overhead projector, or in students' notebooks.

The following three principles that guided the data collection procedures are excerpted from the TIMSS 1999 Video Study Data Collection Manual (see appendix D):

> Document the Teacher
>
> During lessons teachers engage in a variety of activities. For example, they explain concepts and procedures, pose problems, assign tasks, ask questions, write information on the chalkboard, walk around the classroom and assist individual students, etc. Because the main goal of this project is to study teaching in different countries, it is necessary that we thoroughly and carefully document the teacher's activities and behaviors during the lesson. Therefore, what the teacher is doing, what he/she is saying, and what information he/she is presenting to the class must be captured.
>
> Document the Students
>
> In order to understand what goes on in the classroom, it is important to know what the students are doing as well as what the teacher is doing. The main focus should be placed on the activities and behaviors of the students when they are interacting with the teacher, but what they do when they are not working with the teacher should also be documented from time to time. Although it is not possible to document everything that every student does or says, the goal here is to sample student behavior so that what is portrayed in the videotape is representative of what actually happened in the lesson.

Document the Tasks

During mathematics and science lessons, teachers assign various tasks to students. Normally the teacher presents the task to students clearly enough so that students understand what they are supposed to do, and it is usually not hard to see in the video what the assigned task is. Sometimes, however, students may actually engage in something that is not what the teacher intended. Also, if the class is broken into small groups, each group may be working on a different task.

In all cases, what we want to see in the video is the task that students are actually engaged in doing, whether or not it is what the teacher intended. To see clearly what students are doing it is often necessary to zoom in close enough to capture what at least a few of the students are working on.

4.3.4 What to Do in Common Situations

The 638 eighth-grade mathematics lessons in the sample had a wide variety of classroom arrangements and instructional situations, and a great deal of thought was given to handling these in a systematic way. Table 4.5 is an excerpt from the TIMSS 1999 Video Study Data Collection Manual (see appendix D) detailing relatively common teaching situations and how they should be filmed.

Table 4.5. Descriptions of common teaching situations and how they should be filmed: 1999

Descriptions of possible situations	What to do
• Teacher talks publicly • One student at the board works on a problem and talks publicly • Rest of the class works individually at their seats	• Focus on the teacher and the student at the board • Find a chance to document what other students are doing
• Teacher walks around assisting students privately and talks to the whole class from time to time • One student at the board works on a problem • Rest of the class works individually	• Document how the teacher instructs individual students • Document the student at the board and the information on the board when there is a chance
• Teacher stays at his/her desk assisting students privately • Rest of the class works on their own	• Document how the teacher instructs individual students (move close to them) • Document what other students are doing
• Students are in groups, and each group works on the same task • Teacher walks around assisting each group	• Document how the teacher assists each group (follow the teacher) • Document some groups when the teacher is not with them
• Students are in groups, and each group works on different tasks • Teacher walks around assisting each group	• Document how the teacher assists each group (follow the teacher) • Document the work of each group

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

4.3.5 Training Videographers

Videotaping procedures were field tested and modified prior to their implementation in the TIMSS 1999 Video Study. At least two videographers in each country were employed, and all completed a several day training session conducted by members of the TIMSS 1999 Video Study team. The training sessions involved learning about the goals of the study, getting familiar with the selected video equipment, going over the data collection manual (see appendix D) and practicing filming lessons in both mock and actual classrooms. In addition, videographers received regular feedback about their filming techniques, beginning with a review of their practice lessons.

To ensure that videographers were using the standardized procedures they had been taught, their first two mathematics and science lessons filmed were evaluated on six dimensions by specially trained country associates:[8] camera positioning, documenting the entire lesson, audio, documenting information, framing shots, and camera movements. These critiques were videotaped, sent to the videographers, and discussed as needed. Subsequent lessons by each videographer were also examined and evaluated on these same six dimensions, as discussed in the next section.

4.3.6 Monitoring Quality

Several procedures were used to monitor the quality of the videotapes. Prior to filming, videographers checked over their equipment, recharged their batteries, etc. Then, during filming videographers continually monitored the sound and video quality from each of the two cameras. After filming was completed, videographers checked the sound and visual quality of tape. Additionally, a specially trained technician checked the sound and visual quality before processing the tape. Very few tapes had major problems. Only one lesson had serious enough problems with the video and audio problems that it could not be used (see section 4.1.3 above). Other tapes with minor technical problems, such as low sound levels, could be adjusted digitally.

As a further quality control measure, lessons numbered 001 and then every tenth numbered lesson from each country (i.e., 001, 010, 020) was critiqued along the six dimensions listed above by specially trained country associates. Whenever problems were noted, they were discussed with the videographers. In all cases, the problems were minor (e.g., get closer shots of the blackboard, remember to film your digital watch when first starting the cameras so that footage from the teacher and student cameras can be easily synchronized) and only required the videographers to make minor adjustments in future videotaping sessions. Regular correspondence between the videographers and the mathematics code development team was maintained throughout the data collection period.

[8] Country associates were international representatives from each country, who comprised the code development team. For more details on the country associates, see chapter 6 and appendix H.

4.4 Constructing the Multimedia Database

4.4.1 Digitizing, Compressing, and Storing

Once data were collected they were sent for processing to LessonLab. The videotapes were sent to LessonLab directly by the videographers, immediately after they were filmed. The teacher and students' questionnaires were first sent from each teacher to the National Research Coordinator in their country, who then forwarded them to LessonLab. Teachers in the United States sent their questionnaires directly to LessonLab.

The two videotapes from each lesson (i.e., from the teacher and student cameras) were compressed into MPEG-1 format and stored on a video server. The questionnaires and supplementary materials (such as text pages, worksheets and tests) were scanned and stored digitally in PDF format. As a back-up measure, the video files and supplementary materials for each lesson were burned onto a single CD-ROM disk. Then, the videos and supplementary materials were entered into vPrism, a multimedia database software developed for the TIMSS 1995 Video Study and enhanced especially for the TIMSS 1999 Video Study.

English transcripts for each lesson were created and also entered into vPrism software, as described in the next section. One important feature of this software is that the transcripts can be linked by time code to the video. Viewers can watch either the teacher or student tape, and see a running English translation. They can also enter codes into the vPrism database, and directly access the supplementary materials. English transcripts were also created for each open-ended response in the teacher questionnaires and entered into Excel files for code development. Closed-ended responses on the teacher and student questionnaires were entered into separate Excel files.

4.4.2 Transcribing and Translating Lessons

Once the videotaped lessons were digitized, entered into the multimedia database, and made accessible through the network server, translators/transcribers (henceforth referred to as "transcribers") carefully reviewed each one and produced a full English transcript of all classroom interaction audible on the tape.

English transcripts linked to the video afforded code developers and coders the opportunity to view lessons from all of the countries during code development, coder training, and times when assistance was needed to make difficult coding decisions. Furthermore, the transcripts could be "exported," either in their entirety or in specified portions, so they could be used by specialists.

4.4.2.1 Hiring Transcribers and Translators

Transcribers were hired on the basis of their fluency in both English and in the language of the instruction being studied. For the TIMSS 1999 Video Study, the languages of instruction were Australian English, Cantonese, Czech, Dutch, Japanese, and American English. Most transcribers were educated in the country whose lessons they translated and transcribed. A mathematics or science background was also a strong determinant of hire.

4.4.2.2 Developing and Training Standardized Procedures

Each transcriber participated in a two-week training period, during which they learned the TIMSS 1999 Video Study transcription convention requirements, as well as the operation of the specialized vPrism transcription/timecoding software. For instance, transcribers were taught rules about how to indicate speakers, how to break speech into turns, how to use punctuation in a standardized manner, and how to translate technical terms in a consistent way. Details of these procedures may be found in the TIMSS 1999 Video Study Transcription and Translation Manual, included as appendix A.

Each videotaped lesson was processed and reviewed by two transcribers prior to its final processing and review by the transcription manager. Every audible utterance by the teacher and students was translated into English from the original language by the "first-pass" transcriber, who reviewed the lesson in its entirety up to three times before passing it on to the "second-pass" transcriber.

Upon receiving the preliminary "first-pass" transcript, the "second-pass" transcriber compared the transcript line-by-line with the videotaped lesson, making any necessary corrections or additions. Once the transcript was fully corrected, the second-pass transcriber separated the utterances into segments that were no more than three typed lines in length, as defined by the software. This was done in preparation for timecoding the utterances, which enables the transcript to be linked to the video and displayed as English subtitles. Finally, the second-pass transcriber "time-coded" the transcript, linking the videotape (in hours, minutes, seconds and frames) with the corresponding in-point (i.e., start point) of the transcribed utterance.

4.4.2.3 Quality Control Measures

Having been reviewed in its entirety up to six times (three by each transcriber), each lesson was then submitted to the transcription manager, who performed an overall review of the transcript by checking the grammar, spelling, punctuation, formatting, and the accuracy of timecode/utterance synchronization. As an additional quality control measure, completed transcripts were selected at random and checked line-by-line by the transcription manager, with the assistance of the transcriber. Any concerns about transcription procedure were discussed with the individual transcriber and at monthly transcription department meetings.

4.5 Summary

This chapter covered a number of issues related to the collection and processing of the TIMSS 1999 Video Study mathematics data. Videotapes, questionnaire responses, and other supplementary materials were processed at LessonLab using a sophisticated database management and tracking system. Both videographers and transcribers followed well-defined protocols in order for videotaping and transcription/translation procedures to be standardized across countries. Specific quality control measures were in place to carefully monitor both groups. Video data and corresponding English transcripts were entered into vPrism, a multimedia database software developed for the TIMSS 1995 Video Study and enhanced especially for the

TIMSS 1999 Video Study. Coders used this software to watch the teacher and student tapes, see running English translations, access supplementary materials, and enter codes into the database.

Chapter 5. Questionnaire Data

5.1 Development of the Teacher and Student Questionnaires

5.1.1 Teacher Questionnaire

5.1.1.1 Purpose of the Questionnaire

The purpose of the teacher questionnaire was to elicit information that would provide important background for the analysis and interpretation of the videotapes. The information collected from teacher responses was used in two ways.

1) Coders used the information from the questionnaire to make better judgments about what they saw on the videotapes. For instance, sometimes coders needed to know the teacher's goal for a lesson in order to make sense of the activities that constituted the lesson. As another example, when coders segmented the lessons into periods of review, new, and practicing/applying new material, it helped coders to refer to questionnaire items where the teacher identified what students had previously been taught and what they were expected to learn from this lesson.

2) Information from several questionnaire items also was used to assess the typicality of the lesson captured on videotape. Although teachers were instructed not to prepare in any special way for this lesson, what transpired on the day of the taping was potentially not typical compared to what normally happens in a given classroom. An atypical lesson may have resulted from nervousness on the part of the teacher, excitement on the part of the students, or some special event not connected to the TIMSS 1999 Video Study. Furthermore, questionnaire responses might identify a sampling bias. For example, if teachers reported that the lessons were "stand-alone" lessons rather than part of a curricular series, this information could indicate an atypical lesson.

5.1.1.2 Constructing the Mathematics Questionnaire

Constructing the teacher questionnaire was a multi-step process that took place over several months. Two parallel versions of the teacher questionnaire were developed at the same time for the mathematics and science teachers participating in the TIMSS 1999 Video Study. The following section describes this process in detail for the mathematics version.

Step 1: Review of the TIMSS 1995 Video Study Questionnaire

The TIMSS 1995 Video Study teacher questionnaire was reviewed by project staff. Items that were particularly useful were highlighted, and those that did not provide the anticipated information were examined more closely. In addition, project members involved with coding and reporting data in the 1995 Video Study identified those questions that had produced the most helpful information. They then discussed the limitations of other questions that were less successful. Two questions guided the item analysis: (1) Did this item measure an issue that was important to retain in the TIMSS 1999 Video Study questionnaire? (2) If yes, does the item need to be rewritten to achieve the intended purpose?

The TIMSS 1995 Video Study teacher questionnaire was modestly revised and used in the TIMSS 1999 Video Study field test (see chapter 2).

Step 2: Review of Teacher Questionnaires from Other Studies

The teacher questionnaires used in the TIMSS 1995 Achievement Study, as well as other recent education research projects, also were reviewed. Items that fit into the designated domains were considered for inclusion in the TIMSS 1999 Video Study questionnaire.

A set of decision-making guidelines emerged during this process. The guiding questions were:

1) Does the item help to better understand the context of the videotaped lesson?
2) Does the item help to make judgments about the relationship of the videotaped lesson to current thinking about mathematics or science teaching?
3) Could the question be answered simply by looking at the videotape?

Step 3: Drafting and Revising the Questionnaire

Information generated from the discussions mentioned above was used to draft new sample items for the TIMSS 1999 Video Study teacher questionnaire. The new items were reviewed and a first draft of the revised teacher questionnaire was created. An additional guideline was added: Don't change an item on the TIMSS 1999 Video Study teacher questionnaire unless a strong case can be made for the necessity of a change.

The questionnaire development team and additional project members (including the Project Director and the Chief Analyst) reviewed the draft. The questionnaire was electronically sent out for review to collaborators in each of the participating countries. They were asked to provide feedback to the development team by July 6, 1998.

Questionnaires from the teachers who participated in the TIMSS 1999 Video Study field study test were translated into English (when necessary) and reviewed.

Based on these reviews, the team revised the questionnaire and created the "final" version.

Step 4: Creating and Translating the Final Version

A panel, consisting of NCES personnel and mathematics and science education experts, reviewed all items on the questionnaires for consistency, clarity, and utility. Suggested revisions from the National Research Coordinators, education experts, and NCES were incorporated into the final versions of the teacher questionnaires.

A panel at the Office of Management and Budget (OMB) also reviewed and approved the questionnaire. The OMB review panel suggested randomly sorting the teacher attitude items in question 57 and reversing the direction of several items in this question. Revisions were made and reported to OMB (see section 5.1.3).

National adaptations of the questionnaire were made, according to the requests of each participating country (see section 5.1.4)

5.1.1.3 __Questionnaire Item Justification__

The final version of the questionnaire asked mathematics teachers to provide additional information about the videotaped lesson, their background and experience, attitudes, and professional development. A copy of the questionnaire provided to U.S. teachers is included as appendix E. The questionnaire included the seven domains listed below. In this section, a rationale is provided for each domain.

- The videotaped lesson;
- The larger unit or sequence of lessons;
- The typicality of the videotaped lesson;
- Ideas that guide teaching;
- Educational background, teaching background, and teaching load;
- School characteristics; and
- Attitudes about teaching.

The Videotaped Lesson

This section of the questionnaire was designed to gather contextual information about the lesson recorded on videotape. Some information necessary for understanding the lesson might not have been evident from simply watching the videotape. These background items were collected in this section of the questionnaire.

<u>Content of the Lesson</u>
Item 1: Knowing the teacher's definition of the content of the lesson facilitates interpretation of the tape. This information is especially helpful when the teacher has content goals in mind that might not be immediately obvious to the coder.

Items 2 and 3: These questions elicit the sources of influence on the content of the videotaped lesson. Item 2 asks if there is an external document or textbook that played a major role in the teacher's decision to teach this content. Access to the relevant document could provide insight into how the teacher interpreted these materials and how they influenced the teaching of the lesson. Item 3 requests the name of such documents.

Item 4: This question elicits important information about the sources of influence on the teacher's lesson. These sources may influence the teacher's ways of understanding and representing the content as well as providing him/her with ideas about pedagogical strategies. In addition, the question (especially in combination with other questions) provides glimpses into the teacher's tendency to collaborate with colleagues and the teacher's ways of thinking about students.

Item 5: This question serves two purposes. First, it provides an outline of the content of the lesson from the teacher's perspective. Secondly, it clarifies which content is new to students and which is review. This is important in making coding decisions about the nature of the lesson activities (e.g., whether an activity contains new information).

Intended Student Learning

Items 6 and 7: Knowing the teacher's intended goal facilitates interpretation of the tape (item 6). The goal of the lesson also may explain differences in observed instruction. Item 7 provides teachers opportunity to highlight portions of lessons they considered problematic and explain why. Coders might use this information to understand the lesson.

Item 8: This question about the teacher's perception of resource limitations gives teachers a chance to express which additional resources would have improved the lesson. In addition, the item enables cross-national comparisons of perceived resource needs.

Teacher Planning

Item 9: This question helps assess typicality of planning for taped lesson. Although the teachers are instructed to plan and teach the lesson just as they would normally do, some teachers may put in extra time planning this lesson.

Items 10 to 14: The ability levels of the students will not be known from the videotape. Thus, items 10 and 11 help us learn whether the teacher put students in groups according to ability or other reasons. These items give a rough indication of the mix of students working together in the small groups. Also, because schools in different jurisdictions may or may not use "tracking" which we cannot infer from the tapes, questions 13 and 14 will help us identify such practices. Teaching techniques may differ according to ability level of the students; these questions alerts coders to any special quality of this particular group of students and their abilities.

Items 15 to 18: These items will indicate what kinds of preparation students have had for the videotaped lesson. A classroom activity may serve a different purpose for students who are already familiar with materials used in the lesson than it would for students who are seeing the material for the first time.

Assessment
Items 19 and 20: Assessment tasks provide important windows into teacher thinking. In particular, assessment tasks reflect a great deal about the kind of learning that is valued by the teacher (factual, conceptual, procedural, etc.). The assessment also can help us evaluate the alignment among the teacher's goals, the teacher's instructional practices in the lesson, and the assessment.

The Larger Unit or Sequence of Lessons

The questions in this section asked the teacher to place the videotaped lesson in the context of a larger unit or sequence of lessons. These questions were important for three reasons: (1) standards documents in mathematics education describe good teaching as connected and as developing student conceptual understanding across time; (2) the data could be used to make judgments about the teacher's views about teaching; and (3) in combination with the videotaped lesson, the data could enable the construction of a more complex view of teaching. Thus, teacher responses to these questions provided data on teaching that supplemented data provided by the videotape alone (without incurring the enormous cost of videotaping additional lessons).

Items 21 through 25: Placing the videotaped lesson in the context of a sequence of lessons helps clarify the teacher's goals and purposes before and beyond the videotaped lesson. Is the content development in this lesson closely linked to other lessons? How does the teacher think about content and the development of ideas over time? How long are the sequences?

Item 26: This item helps assess the typicality of the video lesson and places the video lesson in a broader context, and provides insights into the teacher's thinking about effective mathematics teaching. Requesting teachers to describe the lesson in words commonly used in her/his nation provides information on cultural differences in types of lessons in each nation.

The Typicality of the Videotaped Lesson

This section of the questionnaire is designed to gather information about the typicality of the lesson that was videotaped. The study will generate descriptions of mathematics teaching that are deemed typical in each country. It is important to know whether the lessons that are videotaped are indeed typical.

Items 27 to 31: These questions address the important issue of whether the instruction recorded on the videotapes is judged as typical by the teacher. Typicality ratings are elicited for teaching methods and student participation. The teacher will also be asked to describe any aspects of the lesson that were not typical. Analysis will examine differences in judged typicality across countries. National portraits of what is marked as atypical will be used to moderate interpretation of findings.

Item 32: This item is designed to assess the effect that being videotaped had on the teacher.

Ideas that Guide Teaching

This section of the questionnaire was designed to provide insights into the teacher's knowledge and personal views of good mathematics teaching.

Item 33: This item that identifies teachers' broadest instructional goals for the school year provides a measure of teacher's knowledge and attitudes toward current thinking about mathematics, and her/his own teaching philosophies.

Items 34 to 37: These questions were designed to assess teachers' response to and awareness of current ideas about how to teach mathematics in the classroom. The teacher's self-rating is complemented by information about how they acquired this information and their list of familiar documents.

Items 38 and 39: This item asks teachers to describe a particular part of the lesson in relation to reform concepts that provides information on how teachers define these concepts.

Items 40 and 41: These questions serve as an indicator of the teacher's involvement in professional development activities that are consistent with peer collaboration and observation recommended in standards and reform documents.

Educational background, teaching background and teaching load

Items 42 to 51: These items inquire about the teacher's pre-service and subsequent preparation for teaching and for teaching specific subject matters.

Item 52: This item asks teachers to identify how much time is spent preparing to teach and doing other school-related work.

School Characteristics

Item 53 to 56: These questions ask for a basic description of the school including size, type, how students are admitted, number of teachers of mathematics or science, and grade levels. Teacher responses indicate whether or not the school has any special status that might contribute to the nature of the observed teaching. For example, students at a magnet school might receive a different kind of mathematics instruction or have access to more resources than a traditional school.

Attitudes about Teaching

This section provides information on the teacher's attitudes towards teaching mathematics. The items suggest ways in which the teacher thinks about her/his work, the students, and mathematics. It is important to examine the satisfaction of teachers since this factor might be associated with differences among teachers.

Items 57a, b, n to p: These items explore the teacher's attitudes towards teaching mathematics

Items 57k to n, q: These items probe the teacher's attitudes towards and interest in mathematics.

Items 57b, m, r to x: These items examine the teacher's attitudes towards students.

Items 57d to h: These items probe the teacher's attitudes towards professional development and growth.

Items 57c, f, i to k: These items explore the teacher's feelings of satisfaction with working conditions.

Items 57k, y, z, aa, bb: These items explore the teacher's feelings of being appreciated and respected.

Items 58 and 59: NCES added these items to assess knowledge of and participation in implementing the National Council of Teachers of Mathematics (NCTM) standards.

5.1.2 Student Questionnaire

The student questionnaire was designed to elicit basic demographic characteristics of the students (such as age and gender), the home environment, and educational expectations of students participating in the videotaped lesson. The United States student questionnaire consisted of 12 closed-ended questions. A copy of this questionnaire is included as appendix F. Contingent upon receiving NCES approval, each country could revise their student questionnaire to make the items nationally appropriate. Australia, Hong Kong SAR, and Switzerland included the full set of questions, the Czech Republic included 6 of the questions, and the Netherlands included 11 of the questions.

5.1.3 Approval of Questionnaires

The first versions of the TIMSS 1999 Video Study teacher and student questionnaires were designed to provide an opportunity for individual countries to make modifications to some questions or response options in order to include the appropriate wording or options most consistent with their own national education systems. These versions of the teacher and student questionnaires were approved by NCES and the OMB review panel on November 16, 1998. Each country revised the questionnaires as needed. These national adaptations of the questionnaires then were reviewed by the national research coordinators and the country associates, and requested revisions were sent to NCES for approval. Data collection in a country did not begin until approval of that country's teacher and student questionnaires was received. The following table presents the dates final versions of the questionnaires were approved for the participating countries.

Table 5.1. Dates of approval for national versions of questionnaires, by country: 1998–1999

Country	Date of Approval
Australia	4/12/99
Czech Republic	11/16/98
Hong Kong SAR	1/15/99
Netherlands	11/16/98
Switzerland	12/17/98
United States	11/16/98

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

5.1.4 National Modifications of the Questionnaires

Most items in the teacher and student questionnaires were common to the questionnaires of all participating countries. Table 5.2 indicates the number of open- and closed-ended questions in each country's teacher questionnaire.

Table 5.2. Number of items in the teacher questionnaire, by country: 1999

Country[◊]	Open-ended questions	Closed-ended questions
Australia	27	31
Czech Republic	25	32
Hong Kong SAR	26	32
Netherlands	23	32
Switzerland: German-speaking	25	29
Switzerland: French-speaking	25	32
Switzerland: Italian-speaking	23	31
United States	27	32

[◊]Japanese mathematics teacher questionnaire data were collected as part of the TIMSS 1995 Video Study. Those results can be found in Stigler et al (1999).
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

There are four general types of options for adapting the questionnaires to the purposes of each participating country. The first of these was a translation option in which countries were asked to translate terms and expressions into the local idiom if they thought it necessary. For the most part, these were minor wording changes to such things as the format for recording dates. Translations of the questionnaires were completed in each participating country.

The second type of option required that a country consider the nature of a concept defined internationally and then develop country-specific names for the items, or even country-specific indicators for a particular concept. The specification of the name of the national curriculum guide is an example of the first kind. Developing country-specific indicators for the multi-item measure of family wealth exemplifies the second kind of translation task in this option category.

Another option that allowed for the inclusion of questions in the national questionnaires was encouraged but not obligatory. The last option was for a country to include questions with particular national relevance.

Table 5.3. Modifications and additions to teacher and student questionnaire items, by country: 1999

Country	Translations or minor word changes	Modified with country-specific names	National options added	Questions not applicable nationally
Teacher questionnaire:				
Australia	8F, 8I	4L, 4M, 13, 14, 42, 51, 54, 55	57CC, 57DD	2B, 4N
Czech Republic	—	42, 54	—	44 to 47
Hong Kong SAR	—	4L, 4M, 42, 54	—	
Netherlands	—	54, 55	—	13, 14
Switzerland		42, 51, 54	—	2B, 4N, 13, 14, 44 to 47
United States	—	—	58, 59A-D	—
Student questionnaire:				
Australia	—	3 to 5, 8 to 11	13	—
Czech Republic	—	8, 9	—	3 to 6, 10, 11
Hong Kong SAR	—	4 to 6, 8 to 11	—	3
Netherlands	—	4 to 6, 8 to 11	—	3
Switzerland	—	3 to 6, 8 to 11	—	—
United States	—	—	—	—

— Not applicable
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

5.2 Coding of Open-Ended Items in the Teacher Questionnaire

5.2.1 Code Development

The teacher questionnaires consisted of both closed-ended (or forced-choice) and open-ended (or free-response) items. Open-ended questions were appropriate for this study because of its cross-cultural nature, which made it especially difficult to anticipate the possible range of teachers' responses. Teachers were expected to spend approximately 45–50 percent of the time for filling out the questionnaires responding to the open-ended questions.

The 32 open-ended items on the teacher questionnaire required development of quantitative codes to analyze the responses. Teachers' answers to these questions were translated into English by coders who were bilingual in English and one of the other relevant languages. Coding of the data then was carried out using the English translations by a team headed by the Chief Analyst of the TIMSS 1999 Video Study.

The open-ended questions were partitioned into two types: short-answer questions and extended-response questions. Short-answer items required teachers to provide a brief response to a question. For example, "What materials are you aware of that describe current ideas about the teaching and learning of mathematics?" Extended-response items required teachers to provide a more lengthy and detailed response to a question. For example, "What was the main thing you wanted students to learn from the videotaped lesson?"

Separate codes for each open-ended item were developed using a four-phase process. First, before examining teachers' responses, categories of anticipated responses were developed based on current research in mathematics teaching and learning and advice from subject matter specialists. This part of the process helped the code developers (1) form a common interpretation of the question, (2) identify categories that may not be provided in the teachers' responses, and (3) address culturally specific issues, such as the meanings of phrases used in the different countries.

Second, categories were further developed based on the responses from the first 10 mathematics teacher questionnaires received from each country. Teachers' actual responses were used in the code development process because they allowed codes to reflect the variety of comments possible as well as teachers' interpretations of the questions. The process of within country and then across country category development was selected so that the categories created would retain responses unique to a country.

Third, codes were created using the categories generated in the preceding two phases considering frequencies of responses, the cultural significance of a code, and the importance of a category in understanding teachers' beliefs and goals. Comparing categories in this way ensured that the codes for the free-response items reflected the different educational systems of the study as well as current understandings of teaching and learning.

Fourth, the codes were checked for reliability. Using these results, the codes were further revised and then applied to the remainder of the questionnaires.

5.2.2 Reliability

Codes developed for the free-response items are described in detail in the TIMSS 1999 Video Study Mathematics Teacher Questionnaire Coding Manual (see appendix G). Inter-rater reliability was established on all of the open-ended items that were coded. For each item, two coders independently coded 10 randomly selected lessons from each country. An 85 percent inter-rater reliability criterion was used. If an 85 percent level was not achieved initially, discrepancies were discussed and necessary modifications were made to the code definition. Reliability was then attempted on a different, randomly selected set of lessons. This procedure is similar to reliability procedures used in the TIMSS 1995 Achievement Study to code students' responses to the open-ended assessment tasks (Mullis et al. 1998: B-32).

Table 5.4 lists the reliability scores for each of the open-ended questionnaire items that were coded. In each case, reliability was calculated as the percentage of agreement between coders.

Table 5.4. Reliability estimates for eighth-grade mathematics teacher questionnaire open-ended response codes: 1999

Teacher questionnaire item	Item reliability (percent)
Name of the videotaped course	98
Other subject matter content of the videotaped lesson (TQ1u)	97
Other materials used when planning this lesson (TQ4o)	100
Ideas that were mainly review and new to students (TQ5)	86
Main thing students should learn from the videotaped lesson (TQ6)	89
Nature of the class size limitation (TQ8d)	100
Basis by which students were assigned to groups (TQ11)	98
What students were expected to do for homework (TQ16)	98
How students will be assessed (TQ20)	98
What was different from how you normally teach (TQ28)	94
How you hear about current ideas (TQ36)	92
Part of the lesson that exemplified current ideas (TQ39)	87
Teaching certification (TQ43)	88
Undergraduate major (TQ44)	89
Undergraduate minor (TQ45)	97
Graduate major (TQ46)	95
Graduate minor (TQ47)	100
How are students admitted to the school (TQ55)	98

NOTE: Inter-rater agreement was calculated as the number of agreements divided by the sum of the number of agreements and disagreements.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

5.3 Questionnaire Analyses

As presented in the international report on the mathematics results (Hiebert et al., 2003), teacher responses to the questionnaires were used in the following ways:

1. *Computation of national-level univariate statistics.* Distributions by country provided information on the basic characteristics of the sample.

2. *Help interpret observed classroom data.* Coders used qualitative analyses of selected questionnaire items to enhance interpretations of the videotape.

Most of the analyses of teacher responses to the questionnaire that are presented in *Mathematics Teaching in Seven Countries: Results from the TIMSS 1999 Video Study* (Hiebert et al. 2003) include comparisons of means or distributions across six countries for questionnaire data. In all cases, the lesson was the unit of analysis. Analyses were conducted in two stages. First, means or distributions were compared across all available countries using either one-way ANOVA or Pearson Chi-square procedures. Variables coded dichotomously were usually analyzed using ANOVA, with asymptotic approximations.

Next, for each analysis that was significant overall, pairwise comparisons were computed and significance determined by Bonferroni adjustment. The Bonferroni adjustment was made assuming all combinations of pairwise comparisons. For continuous variables, Student's t values were computed on each pairwise contrast. Student's t was computed as the difference between the two sample means divided by the standard error of the difference. Determination that a pairwise contrast was statistically significant with $p<.05$ was made consulting the Bonferroni t tables published by Bailey (1977). For categorical variables, the Bonferroni Chi-square tables published in Bailey (1977) were used.

A significance level criterion of .05 was used for all analyses. All differences discussed in *Mathematics Teaching in Seven Countries: Results from the TIMSS 1999 Video Study* (Hiebert et al. 2003) met at least this level of significance, unless otherwise stated. Terms such as "less," "more," "greater," "higher," or "lower," for example, are applied only to statistically significant comparisons.

All tests were two-tailed. Statistical tests were conducted using unrounded estimates and standard errors, which also were computed for each estimate.

The analyses reported in *Mathematics Teaching in Seven Countries: Results from the TIMSS 1999 Video Study* (Hiebert et al. 2003) were conducted using data weighted with survey weights, which were calculated specifically for the classrooms in the TIMSS 1999 Video Study (see chapter 8 for a more detailed description of weighting procedures).

5.4 Summary

To help understand and interpret the videotaped lessons, questionnaires were collected from teachers and students in each lesson. The teacher questionnaire was designed to elicit information about the professional background of the teacher, the nature of the mathematics course in which the lesson was filmed, the context and goal of the filmed lesson, and the teacher's perceptions of its typicality. The construction of this questionnaire was an elaborate process, and justifications for each item are reported in this chapter.

The student questionnaire was designed to elicit basic demographic characteristics of the students, their home environment, and their educational expectations. Both the teacher and student questionnaires were approved by a review panel, and then country appropriate versions were created under the direction of the national research coordinators in each country.

The teacher questionnaire contained a number of open-ended items, for which a coding scheme was developed and applied. Reliability statistics are presented.

Chapter 6. Coding Video Data I: The International Mathematics Team

This chapter describes the coding of the video data by the International Mathematics Coding Team. First, background is provided on the personnel involved, including the code development team, advisory groups, and the coders. Next, details on the code development process are provided, along with information about each code. Methods used to train coders, measure reliability, and ensure quality control are also described.

6.1 Coding Personnel

6.1.1 Code Development Team

An international team was assembled to develop codes to apply to the TIMSS 1999 Video Study mathematics data. The team consisted of country associates (bilingual representatives from each country) and was directed by a mathematics educator. The mathematics code development team worked closely with two advisory groups: a group of national research coordinators representing each of the countries in the study, and a steering committee consisting of five, North American, mathematics educators. Refer to appendix H for a list of the code development team members, the national research coordinators, and the steering committee members.

6.1.1.1 Mathematics Code Development Team

Each country participating in the project was represented by a country associate, who was fluent in the language and well versed in the cultural background of the country. The country associates served as representatives for their countries, providing reminders of the diversity of instruction and challenging the coding system to account for them. Furthermore, the representatives provided an "insider's" interpretation of events in the videotaped classrooms. Thus, the impressions of both cultural insiders and outsiders were considered when developing codes. Additionally, the country associates helped to hire and manage coders for their country, and could aid them in making coding decisions that might involve cultural or linguistic nuances.

The country associate team was headed by a mathematics coordinator who directed the code development effort, analyses, and reporting of data. The associate director of the 1999 Video Study also played an active role in the mathematics code development team by participating in conceptualizing and defining codes, and guiding analyses and reporting of the data.

As a group, the mathematics code development team was responsible for creating and overseeing the coding process. The team discussed coding ideas, created code definitions, wrote a coding manual, gathered examples and practice materials, designed a coder training program, trained coders and established reliability, organized quality control measures, consulted on difficult coding decisions, and managed the analyses and write-up of the data.

6.1.1.2 National Research Coordinators

A national research coordinator was designated for each of the participating countries. These coordinators were all from academic or research institutions in their own country, and were also involved in the TIMSS 1995 and/or TIMSS 1999 Achievement Studies. As national research coordinators of the 1999 Video Study they played several roles. On an operational level, they organized the data collection in their country (i.e., designing a sampling procedure tailored to their country, selecting schools, modifying the questionnaires for teachers and students in their country, contacting teachers, and scheduling videotaping). They served also as advisors throughout the study. Meetings including the mathematics code development team and national research coordinators were held at least once each year throughout the project to discuss the progress made to date and to gather input on pertinent tasks such as developing research questions, defining specific codes, and reviewing the data.

Several national research coordinators made independent visits to LessonLab during the life of the project, and contributed to the ongoing code development process. Additionally, the coordinators served as hosts to country associates when the latter visited their "home" country for meetings with educators and teachers.

The coordinators also occasionally convened groups of experts in their country, to perform tasks requested by the code development team. These experts were individuals identified as being particularly knowledgeable about mathematics and education in their country and as being interested in cross-cultural video research. For example, experts were asked to help in the development of hypothetical teaching models in each country (see chapter 2) and to review particular code definitions.

6.1.1.3 Steering Committee

A North American mathematics steering committee was convened, composed of a diverse group of individuals who represented a cross-section of interests within mathematics education. All members of the steering committee were based in the United States or Canada. The steering committee met with the mathematics code development team yearly; these meetings sometimes overlapped with the national research coordinator annual meetings. Steering committee members reviewed and commented on research priorities, identified research questions, provided input on code definitions, and reviewed tables and drafts of the final report.

6.1.2 Coders

6.1.2.1 International Coding Team

Most of the videotape coding was conducted by an international group of specially trained coders at LessonLab. Similar to membership on the mathematics code development team, members of the international video coding team represented all of the participating countries. They were fluently bilingual so they could watch the lessons in their original language, and not rely heavily on the English transcripts. In almost all cases, coders were born and raised in the country whose lessons they coded. Many had a particular interest in education, teaching, and/or mathematics.

In general, two videotape coders from each country were employed. Collaboration between coders, particularly those from the same country, was encouraged. Coders also interacted closely with the country associates throughout the coding period.

For all countries except Switzerland, hiring, training and coding took place at LessonLab. Swiss training and coding took place in Zurich, Switzerland. There was frequent communication between the Swiss coders and the LessonLab team, and in particular with the Swiss country associate who was based at LessonLab. Daily or weekly electronic and telephonic communication was used to ensure equivalence between the Swiss and LessonLab operations. For most training sessions, the Swiss country associate traveled to Zurich, explained the codes to the coders there, and led them through the initial reliability process. In addition, several members of the Swiss research team traveled to the United States and spent an extended period of time at LessonLab participating in the code development process.

6.1.2.2 Specialist Coders

Most of the codes presented in the report *Teaching Mathematics in Seven Countries: Results from the TIMSS 1999 Video Study* (Hiebert et al., 2003) were applied by members of the international video coding team. As noted above, these individuals were cultural insiders and fluent in the language of the lessons they coded. However, not all of them were experts in mathematics or teaching. Therefore, several specialist coding teams with different areas of expertise were employed to create and apply codes regarding the mathematical nature of the content, the pedagogy, and the discourse. Several of these specialist teams made use of coding and tables prepared by the international video coding team. The work of the specialist coding teams will be discussed in the next chapter.

6.2 Code Development Process

6.2.1 Developing a Coding Scheme

The mathematics code development team, with the aid of national research coordinators and the steering committee, developed a guiding set of research questions and a framework for constructing individual codes. Strategies for code development were sensitive to the twin goals conceived early in the project: to describe the nature of teaching within each country, and to compare teaching across all countries. Although code development strategies for achieving these goals were not conflicting, they required somewhat different approaches.

Both strategies outlined above were implemented by constructing individual codes that reliably captured important features and segments of lessons. To begin the process, the mathematics code development team consulted instruments and coding protocols used in previous studies of teaching, including the TIMSS 1995 Video Study, and textbooks and curriculum materials from each participating country. Codes that would answer research questions regarding the nature of teaching within each country and/or the differences and similarities in teaching across countries were defined, piloted, and refined. As this work revealed new insights into teaching within and across countries, the set of research questions was revised and new codes were suggested.

To capture the nature of teaching within each country, the mathematics code development team began with the conclusion of the TIMSS 1995 Video Study—that there are unique cultural patterns of teaching mathematics in each country. At the beginning of the TIMSS 1999 Video Study, cultural "insiders" (including the country associates, the national research coordinators, and mathematics educators) developed hypotheses about specific instructional patterns that might be found in eighth-grade mathematics classrooms in their country. These hypotheses took the form of “country models” (see section 6.2.2 below) and were continually revisited to ensure that each country's perspective on teaching was considered as individual codes were constructed.

6.2.2 Field Test and Constructing Tentative Country Models

In early 1998, at least four mathematics field test lessons were collected in each country. These videotapes of eighth-grade mathematics classrooms provided an initial opportunity to observe teaching in the different countries in the sample. An international group of representatives[9] met together for an entire summer, viewing and reflecting on these tapes. They followed a structured protocol throughout this period, with the intention of generating hypotheses that could later be tested by quantitative analyses of the full data set (see chapter 2 for more details on the field test study.)

These discussions yielded six dimensions that the representatives agreed framed classroom practice and were of interest across countries and lessons: purpose, classroom routine, actions of participants, content, classroom talk, and classroom climate. The dimensions were then used to create country models—holistic representations of a “typical” mathematics lesson in each country. The hypothesized country models were developed in collaboration with the national research coordinators, steering committee members, and other colleagues in each country, and refined over a period of several months.

The goal was to retain an “insider perspective,” and faithfully represent the critical features of teaching in each country in the coding system. The country models served two purposes toward this end. First, the models provided a basis on which to identify key, universal variables for quantitative coding. Second, they described a larger context that might be useful in interpreting the coding results.

[9] Most of these representatives continued in the role of code developer.

The hypothesized country models for Australia, the Czech Republic, Hong Kong SAR, the Netherlands, Switzerland, and the United States are presented in tables 6.2 through 6.7. Table 6.1 provides a key to the symbols used in these models. A country model was not created for Japan.

Table 6.1. Key to symbols and acronyms used in hypothesized country models

Symbol/Acronym	Meaning
T	Teacher
S	Student
Ss	Students
HW	Homework
BB	Blackboard
‖: :‖	Segment may repeat

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 6.1. Hypothesized country model for Australia

	Review	Introduction of New Material	Assignment of Task	Practice/Application & Re-instruction			Conclusion
				practice/ application	reassignment of task	practice/application	
Purpose	reinforce knowledge; check/correct/ review homework; re-instruct	acquisition of knowledge;	assignment of task	application of knowledge	assignment of task	application of knowledge	reinforce knowledge
Classroom Routine	review of relevant material previously worked on	presentation of new material	assignment of task	completion of task	assignment of task	completion of task	summary of new material; assignment of homework
Actions of Participants	T – [at front] ask Ss questions; elicit/embellish responses; demonstrate examples on BB	T – [at front] provides information asking some Ss questions and using examples on BB	T – [at front] describes text book/ worksheet task	T – [roams room] provides assistance to Ss as needed and observes Ss progress on set task	T – [at front] re-explains text book/ worksheet task	T – [roams room] provides assistance to Ss as needed and observes Ss progress on set task	T – [at front] provides information & asks Ss questions
	Ss – [in seats] respond to & ask T questions; listen to T explanations, watch demonstrations	Ss – [in seats] listen to T explanations and respond to T questions	Ss – [in seats] listen to T descriptions	Ss – [in seats] work individually or in pairs on task	Ss – [in seats] listen to T descriptions	Ss – [in seats] work individually or in pairs on task	Ss – [in seats] listen to T descriptions; respond to & ask T questions
Content	related to previous lesson	definitions/ examples building on ideas previously worked on	description of task; focus on text/worksheet problems	text/worksheet problems	description of task; focus on text/ worksheet problems	text/worksheet problems	text/worksheet problems; homework problems
Classroom Talk	T talks most; Ss one-word responses	Mix of T/S talk although discussion clearly T directed	T provides direct instructions	mix of T/S and S/S talk – including explanations & questions	T provides direct instructions	mix of T/S and S/S talk – including explanations & questions	mix of T & T/Ss talk – including explanations & questions
Climate	somewhat informal - relaxed yet focused						

NOTE: Refer to table 6.1 for a key to the symbols and acronyms used in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 6.2. Hypothesized country model for the Czech Republic

Purpose	Review			Constructing New Knowledge			Practice	
	Evaluating	**Securing old knowledge**	**Re-instruction**	**Activating old knowledge**	**Constructing new topics**	**Formulating the new information**	**Practice "working - through"**	**Using knowledge in different problems**
Classroom Routine	oral exam test homework	set of problems; homework	dialogue	Experiment, solving problems, demonstration, dialogue	dialogue		dialogue, solving problems	solving problems
Actions of Participants	T – giving grade	T – gives individual help	T – explaining procedure			T – writing notes at the board		
	Ss – solving problems at the board	Ss – at the board		Ss – answering questions, solving problems at the board			Ss – solving problem; more then one student solving one problem	
Content	content probably from unit			special problems prepared in special order, solutions are very visible, strong connection with new topics	step by step solving problem, solutions very visible	mathematical statements and definitions; something new that students don't know		stronger connection with real life
Classroom Talk	answering questions; fast pace		T talk most	T-S dialogue	T talks most of the time; slow pace	T talks most of the time		more mathematically open questions
Climate	few mistakes allowed Ss very quiet serious atmosphere	mistakes are not graded but not expected, Ss talk loudly					more mistakes allowed	

NOTE: Refer to table 6.1 for a key to the symbols and acronyms used in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 6.3. Hypothesized country model for Hong Kong SAR

	Review	Instruction	Consolidation		
Purpose	To review material and prepare for the present lesson	To introduce and explain new concepts and/or skills	To practice the skills learned		
Classroom Routine	T – goes over relevant material learned in the past, sometimes through asking Ss questions	T – introduces a new topic T – explains the new concepts/skills T – shows one or more worked examples	Seat-Work T – assigns seat-work Ss – work on seat-work T – helps individual Ss	Evaluation T – asks some Ss to work on the board T – discusses the work on the board with Ss	Homework T – assigns homework Ss – start doing homework
Actions of Participants	T – talks at the blackboard	T – explains at the blackboard T – works examples on the blackboard	T – talks at blackboard T – walks around the class	T – discusses Ss' work on the board	T – talks at blackboard
	Ss – listen in their seats Ss – answer questions from their seats	Ss – listen and/or copy notes at their seats	Ss – listen and then work in their seats	Ss – listen in their seats Some Ss work on the board	Ss – listen in their seats
Content	Usually low demand of the cognitive processes	Higher demand in the cognitive processes Definitions/proofs/examples Heavy reliance on textbook	Medium demand on the cognitive processes Select exercises Focus on procedures or skills		
Classroom Talk	T – talks most of the time Pace relatively fast Convergent questions by T Conversation evaluation	T – talks most of the time Pace relatively slow Mostly convergent questions and some divergent questions Less evaluative	Some informal S talk (with each other) Pace relatively slow		
Climate	Serious Relatively quiet Mistakes less acceptable	Serious Relatively quiet Mistakes more acceptable	Less serious Less quiet Mistakes more acceptable		

NOTE: Refer to table 6.1 for a key to the symbols and acronyms used in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 6.4. Hypothesized country model for the Netherlands

Purpose	Re-instruction		Instruction		Assignment of Task	Students Attempt Problems
Classroom Routine	**Going Over Old Assignment**		**Presenting New Material**		**Assignment of Task**	**Student Problem Solving** Continued work on old assignment and/or initial efforts on new assignment
Actions of the Participants	*Option 1* Completion of each problem as a class	*Option 2* T gives hints for selected problems	*Option 1* T verbalizes	*Option 2* Complete reliance on text	T – writes assignment on BB (or may give verbally)	If "Re-instruction" follows Option 2, Ss first work on the old assignment, then work on the new
	T – goes through assignment, problem by problem at the front of the class, with or w/o use of the BB; Emphasis is on procedures	T – provides partial assistance (e.g., hints) on selected problems at the front of the class; T – provides answers on paper (e.g., answer sheet, access to T manual); Emphasis is on procedures	T – verbalizes text presentation and/or points to selected features of the text presentation	None		T – available to answer S-initiated questions T – gives mostly procedural assistance T – generally provides answers freely; doesn't require much S input T – may give semi-public assistance (at front of room) or private assistance (at Ss desks)
	Ss – follow along at their desks, respond to T questions, ask clarifying questions	Ss – follow along at their desks; Very low S involvement	Ss – listen to T at their seats	Ss – read about new topic(s) from the text, at their desks	Ss – write assignment into their agendas	Ss – work in pairs at their desks and ask T for assistance when necessary, either at their desks or at the front of the room
Content	Small number of multi-part problems from the text; Assignment given yesterday and worked on as HW; Generally one solution method provided		Heavy reliance on text; new material presented within the context of a task/problem		Small number of multi-part problems from the text (~5) to be continued tonight as HW; Ss only need to find one solution method (<u>any</u> one solution is O.K.)	
	Problems are in a real world context (might be considered "application"), situations vary across tasks, T rarely solicits errors					
Classroom Talk	*Option 1* T asks Ss questions and rephrases Ss' responses	*Option 2* T briefly gives partial information on selected problems; Ss rarely ask questions. Less S talk than in *Option 1*	*Option 1* Direct instruction	*Option 2* None	Direct instruction; T verbalizes the assignment as written on the BB	S-S talk regarding assignment; 1-on-1 (or 2 to 3-on-1) private, S-T conversations initiated by S, but then dominated by T
	Low level of evaluation/low concern for assessment					
Climate		High level of S freedom and responsibility		High level of S freedom and responsibility		Moderate level of noise is accepted by T
	High error tolerance by the T, T-S relationship is relaxed					

NOTE: Refer to table 6.1 for a key to the symbols and acronyms used in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 6.5. Hypothesized country model for Switzerland: Classroom patterns of Swiss mathematics lessons *with* introduction of new knowledge

Purpose	**Opening**	**Construction of new cognitive structure**	**Working-through**	**Practice (automatization, rehearsal)**	**Practice (automatization, rehearsal)**
Classroom Routine	Collecting homework, informal talk	Interactive instruction[1] T – presents 'real action' T – models problem solving	Interactive instruction Problem solving	Ss write or read at their desks Interactive instruction	
Actions of Participants		T – asks questions and explains, demonstrates procedure, or states a problem…	....	....	
		Ss – answer questions, observe T, imitate, act, solve problems; work as a whole class	(See Notes)[3] Ss – work as a whole class	Ss – individual, group, or pair work	
Content		New concept is introduced in a step by step fashion, starting from Ss previous knowledge and/or their everyday experience Goal: Ss understand the concept (on their level of knowledge); Usefulness of concept (for further learning, and as a tool for everyday practice) emphasized; Visualization (*Anschauung*) is important; New information is reinforced (presented at board or textbook in a standardized fashion); Relationship between tasks: no set (often: Problem-like situation)	Sequence of carefully selected tasks related to new topic Relationship between tasks: Set 2[4]	Collection of tasks related to new topic Relationship between tasks: Set 1	.... Relationship between tasks: Set 1, 2, …
Classroom Talk		*Lehrgespraech*[2] (Interactive instruction; long wait-time, Ss expected to actively participate in construction process)	Interactive instruction	T-S-dialogue	
Climate					

Figure 6.5. Hypothesized country model for Switzerland: Classroom patterns of Swiss mathematics lessons *with* introduction of new knowledge—Continued

[1]The introduction phase may include some further actions that may be embedded in the interactive instruction, such as teacher presentation, or modeling or "real actions."
[2]Most frequently a new topic (concept) might be co-constructed by means of interactive instruction (*Lehrgespraech*). The means of guidance are primarily teacher questions and hints. The procedure is oriented toward the Socratic dialogue. The teacher questions serve two main purposes: (1) to guide and initiate students' thinking (e.g., propose a certain point of view, or perspective on a problem), and (2) to diagnose students' actual understanding. An important feature of quality of a *Lehrgespraech* is the need for sufficient wait-time after the teacher's questions.
[3]Reform 1: In reform-oriented classrooms another pattern of introduction lessons might be expected: (1) student independent problem solving in pairs, groups or individually (inventing procedures for solving new, open problems, discovering principles, regularities, and so on); (2) discussion of the different approaches and negotiating an accepted approach. This approach (influenced by scholars of mathematics didactics in Germany and the Netherlands) is presently recommended in teacher education and professional development. (It is unclear if this is observable at the eighth grade level.)
[4]Not all students always solve the same tasks (individualization of instruction).
NOTE: Refer to table 6.1 for a key to the symbols and acronyms used in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 6.6. Hypothesized country model for Switzerland: Classroom patterns of Swiss mathematics lessons *without* introduction of new knowledge

Purpose	**Opening**	**Working-through or practice** goal: understanding and/or proficiency	**Practice** goal: understanding and/or proficiency	**Re-Instruction, sharing**	**Practice** goal: understanding and/or proficiency	**Re-Instruction, sharing**	**Using knowledge in different situations/to solve diff. problems**
Classroom Routine	Collection of homework, informal talk	Interactive instruction	Ss solve tasks[3]	Share and check Ss' solutions (*Besprechung*) - interactive instruction - S presentation - discussion	Ss solve tasks	Share and check Ss' solutions (*Besprechung*) - interactive instruction - S presentation - discussion	problem solving interactive instruction
Actions of the Participants		Classwork[1]	Ss – individual, group, or pair work	Classwork	Ss – individual, group, or pair work	Classwork	Ss – individual, group, or pair work
Content		Topic: introduced in a previous lesson T may start with short review of topic, and solve some examples of tasks Relationships between tasks: no set, or Set 1 or Set 2[2]	Relationships between tasks: Set 1 or Set 2	Relationships between tasks: Set 1 or Set 2	Progression to more demanding tasks, finally: to demanding application problems (possibly not in the same lesson, but later)[4] Relationships between tasks: Set 1 or Set 2	Relationships between tasks: Set 1 or Set 2	Character of tasks: Given new situations but connection to mathematics concepts is not obvious Relationships between tasks: Set 2 or no set
Classroom Talk		Interactive instruction	T-S-dialogue, and/or S-S-conversation	Interactive instruction/Discussion	T-S-dialogue, and/or S-S-conversation	Interactive instruction/Discussion	T-S-dialogue, S-S-conversation, discussion…
Climate							

Figure 6.6. Hypothesized country model for Switzerland: Classroom patterns of Swiss mathematics lessons *without* introduction of new knowledge—Continued

[1]The sequence of activity units varies, and does not always start with a classwork phase.
Reform 2: In some reform classrooms there will be no or almost no classwork phase and each student may be proceeding through a weekly assigned collection of learning tasks (arranged in collaboration with the teacher; individualized instruction). As with Reform 1, it is not clear if and how many teachers are in fact practicing this reform model of instruction (which is recommended in teacher development) at the eighth-grade level.
[2]Not all students always solve the same tasks (individualization of instruction).
[3]As a general pattern an alternation between students solving tasks at their own and of sharing/checking/re-instruction based on students' work in a classwork sequence may be expected, but the duration of and total amount of the phases is not predictable. The first unit may provide some special kinds of tasks (warm up, or a motivating starting task). In most cases, the teacher will vary the social structure (e.g., classwork – individual work – classwork – pair work – and so on).
[4]There is a progression from easier to more demanding tasks over the entire learning phase; usually the progression leads to application problems (most often, applied story problems).
NOTE: Refer to table 6.1 for a key to the symbols and acronyms used in this table.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 6.7. Hypothesized country model for the United States

Purpose	**Review of Previously Learned Material** ***A***			**Acquisition of Knowledge** ***B***	**Practice & Re-instruction** ***C***	
	Assess/ evaluate	Assess/ Evaluate, re-instruct, secure knowledge	Secure knowledge, activate knowledge			
Classroom Routine	Quiz ***A1***	Checking homework ***A2***	Warm-up/ Brief review ***A3***	Presenting New Material ***B***	Solving Problems (Not for homework OR for homework) ***C1***	***C2***
Actions of the participants	T – tells or solicits answers T – at the front	T – tells or solicits answers T – may work through difficult problems T – at the front	T – tells or solicits answers T – may work through problems T – at the front	Information provided mostly by T T – tells students when, why, and how to use certain procedures T – asks short-answer questions T – may do an example problem T – at the front	T – Ss practice through example problems T – at the front	T – walks around the room T – provides assistance to Ss who raise their hands
	Ss – Students take quiz Ss – provide or check their answers Ss – at their seats	Ss – provide or check their answers Ss – at their seats Ss – may put their answers on the board	Ss – complete problem(s) Ss – provide or check their answers Ss – at their seats	Ss – listen & answer T's questions Ss – may work on an activity, as explicitly instructed by the T Ss – at their seats	Ss – help the teacher do the problems Ss – at their seats	Ss – work individually or in small groups at their seats Ss – may state their answers as a class
Content	Content related to previous lesson	Content related to previous lesson	Content may or may not be closely related to the new topic	Simple rules or definitions stated by T, focus is mostly on procedure (little reflection on concepts)	More problems very similar to what the T has just shown	More problems very similar to what the T has just shown
Classroom Talk	Known-answer questions, relatively quick pace, more S turns, T evaluates, recitation?[1]	Known-answer questions, relatively quick pace, more student turns, T evaluates	Known-answer questions, relatively quick pace, more student turns, T evaluates	Fewer student turns; Direct instruction and lectures are possible	Recitation, more S turns, direct instruction?	T-S dialogue, S-S dialogue (private talk)
Climate	T wants correct answers					Friendly atmosphere

Figure 6.7. Hypothesized country model for the United States—Continued

[1]Recitation = A series of short, known-answer questions posed by the teacher, to solicit correct answers from students. Consists mainly of Initiation-Response-Evaluation sequences.

NOTE: Refer to table 6.1 for a key to the symbols and acronyms used in this table.

An alternative U.S. classroom pattern occasionally exists that does not resemble this model. These are considered “reform” mathematics lessons. They typically consist of an open-ended problem posed by the teacher, a long period of seatwork during which the students work on the problem, and then a period of “sharing” when the students provide their answers and the teacher summarizes the key points.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

6.2.3 Deciding What to Code

Classroom lessons are filled with many activities and human interactions, more than can be described even when analyzing only a few lessons. The challenge is compounded when 638 mathematics lessons from seven countries are to be analyzed. Decisions must be made to focus the analysis and reduce the complexity. The mathematics code development team sharpened its focus by setting priorities among the six dimensions of classroom practice presented in the country models. Because this was a study of mathematics teaching, not generic teaching, the content dimension emerged as a dimension of special interest. Research on teaching and learning, results gleaned from the TIMSS 1995 Video Study, the field test lesson reviews, the nature of the country models, and the suggestions of the steering committee, all reinforced the initial focus on content.

The mathematics code development team quickly discovered that content in most eighth- grade mathematics lessons is carried through working on problems. Again, this consensus was reinforced through reading the research literature and discussions with the national research coordinators and other cultural insiders. Mathematics is taught in all participating countries largely through the use of problems (Hiebert et al. 2003).

Using the mathematical problem as a primary code provided a window into other questions of interest, such as what kind of mathematics was presented, who did most of the mathematical work, and what kind of work was done by students and by teachers. Segmenting lessons into mathematical problems paved the way to examine important aspects of the learning opportunities provided for the students.

6.2.4 Coverage and Occurrence Codes

An initial coding challenge was how to extract the mathematical problems from each lesson in order to examine them in greater detail. Problems usually were embedded in a variety of contextual elements and it was necessary to dissect the lesson in various ways in order to see how the problems were situated. The mathematics code development team ascertained that two kinds of codes would be useful in this process: coverage codes and occurrence codes.

Coverage codes parsed the entire lesson, or a specified part of the lesson, into non-overlapping segments. Every moment of the lesson, or specified part, was "covered" by one of the mutually exclusive and exhaustive categories. For example, a mathematics lesson could be segmented into periods of time when there was either: 1) no mathematical work, 2) mathematical organization or management, or 3) mathematical work. Then, the mathematical work time could be segmented into either working on problems or not working on problems.

Occurrence codes were used to identify the occurrence of a particular event, either within the lesson or within a specified part of the lesson. For example, a mathematics lesson might or might not have contained a goal statement. Similarly, a mathematical problem might or might not have been related to a real world context, or involved physical materials. Codes such as these were developed to describe how often events of interest occurred within lessons, problems, and other such segments.

6.2.5 Creating a Code Development Procedure

To ensure that each country associate provided input into the development of codes, a 6-step process was established (see table 6.2). This process both distributed the work across team members and encouraged their feedback and support.

Table 6.2. Six-step mathematics code development process

Step	Action
1	Full group of code developers held an initial discussion of particular research goals and questions, and generated ideas for relevant codes
2	Subgroup developed a preliminary proposal for a code, with alternatives
3	Full group discussed the alternatives, and made a decision about which option(s) to pursue
4	Subgroup developed a revised proposal, including definitions and examples
5	Full group tried out the code on sample lessons
6	Full group shared their results, revised the definition, and entered it into the coding manual

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

The first step in the process was for the entire mathematics code development team to review particular research questions and generate ideas for codes that might answer those questions. Alternatively, the team sometimes considered codes that had been used in other studies or were suggested by viewing the videotapes, and discussed whether they might address one or more research questions. These brain-storming sessions helped to determine the general nature of the codes and allowed everyone in the group to contribute ideas.

The second step in the code development process was to establish a subgroup that would meet and discuss more specific details regarding a code. The subgroup's task was to write a preliminary proposal for the code, which might include several alternative definitions with rationales and video examples. Then, the subgroup shared their ideas and proposal with the full group. Other team members often generated new ideas and raised questions to push the development of the code further along. Next, the subgroup re-worked their initial proposal, wrote revised definitions, and looked for examples. Typically, they would suggest a lesson or lesson segments on which the full group could try out the code.

The subgroup and full group meetings would alternate as long as necessary, until a coding definition was agreed upon by the entire mathematics code development team. That definition was then entered into the coding manual, along with illustrative examples (and occasionally counter-examples). A copy of the TIMSS 1999 Video Study Mathematics Coding Manual is included as appendix I. The manual served as a tool for training coders, as well as a shared reference throughout the coding process. During training, coders sometimes suggested improvements to the codes. Those agreed upon by the code development group were then incorporated in the manual. Once the definitions were finalized, a strict reliability procedure was implemented for each code, as discussed in section 6.5.

6.3 Applying the Coding Scheme

Applying codes requires paying close attention to specific details in a lesson. Often coders were asked to note when a certain activity began or ended, and then describe the activity as one of several possible types. In order to reduce information processing demands, enable high inter-coder reliability, and ensure continued high quality coding, the codes were separated into "passes," with only a subset of codes applied during each pass. A pass involved viewing the entire lesson (and re-viewing critical portions) and marking all relevant segments. Altogether, 45 codes were applied in seven coding passes.

Most of the codes in the first few passes were coverage codes, and segmented the entire lesson into meaningful chunks that later could be studied in more detail. In Pass 1, coders marked the beginning and end of the lesson, and then divided the lesson into periods of public and private interaction. Passes 2 and 3 involved dividing the lesson into periods of time when mathematical problems were and were not worked on. Additionally, coders had to note the beginning and ending time of each problem, and write down the problem statement and problem solution.

The fourth pass was comprised of occurrence codes for specific events that might occur during the lesson, such as outside interruptions, goal statements, and lesson summaries. In the fifth and sixth passes, numerous questions were asked about each mathematical problem that had been identified. For example, was the problem connected to the real world, how many solutions were presented publicly, and was the problem worked on or discussed by the class for more than 45 seconds.

Pass 6 also involved a series of questions about periods of time marked as private interaction, such as what kind of problems were students assigned to work on, and did they work individually or in groups. Another set of codes in Pass 6 explored whether particular resources were used during the lesson, such as computers and calculators. Finally, in Pass 7, coders divided each lesson into segments according to their purpose— addressing previously learned content, introducing new content, or practicing and applying new content.

In the sections that follow, the codes in each pass are described and defined. The code definitions provided in this chapter are simplified, partial definitions. Complete definitions of the codes, as applied to the video data, can be found in the TIMSS 1999 Video Study Mathematics Coding Manual, included as appendix I. Where appropriate, examples and rationales are provided.

6.3.1 Pass 1: Beginning and End of Lesson; Classroom Interaction

The first coding pass contained two codes: time of lesson (LES) and classroom interaction (CI). Time of lesson involved marking the beginning and ending of each lesson, defined as the first and last public talk by the teacher that appeared to require all students' attention. The talk did not have to be about mathematics, but it should have signaled the point when a good student would recognize the lesson as starting or finishing.

LES was used to establish the duration of each mathematics lesson, and it enabled the calculation of "percent of lesson" variables. Furthermore, all subsequent coding had to occur within the defined lesson boundaries.

Marking classroom interaction (CI) patterns required coders to consider each moment of lesson time and decide which of five mutually exclusive and exhaustive categories it best fit. The five categories were: 1) entirely public interaction, 2) public information provided by the teacher, but optional for student use, 3) public information provided by a student, but optional for student use, 4) public and private work both apparent; subgroups of students varied in classroom interaction pattern, and 5) entirely private interaction.

The CI code builds on the coding of "classwork," "seatwork," and "classwork/seatwork combination" in the TIMSS 1995 Video Study. Due to the more varied interaction patterns found in the TIMSS 1999 Video Study lessons, creating additional categories was deemed necessary. Another, more subtle, change in this code was the focus on how teachers and students interacted, rather than how they were organized. The revised name of the code and coding categories reflects this emphasis.

6.3.2 Pass 2: Content Activity Coding

Pass 2 contained a single coverage code, content activity (CC), with 13 mutually exclusive and exhaustive categories. This code described the content activities in the lesson using very general terms. For example, whether mathematics was being conducted, and if so whether the mathematics was presented through a problem or a non-problem segment.

The coding categories were: non-mathematical work, mathematical organization, independent problem, concurrent problem set-up, concurrent problem seatwork, concurrent problem classwork, concurrent problem mixed activity, answered only problem, interrupting a problem, non-problem segement, break, and technical difficulty.

The CC code contained one of the most important segmentations: marking the in- and out-points of mathematical problems. The definition of a mathematical problem was intentionally generous, so that most borderline cases would likely be included as problems. The main requirement of a problem was that a mathematical operation must be necessary in order to arrive at the intended answer, and the problem needed to require some degree of thought by an eighth-grade student. The mathematics code development team's rationale for such a broad definition was that mathematical problems would be explored in depth by a variety of additional codes by groups of coders each looking into different aspects of the problems.

Within the CC code, mathematical problems were broken down into three types: independent, concurrent, and answered only. For problems worked on one at a time (that is, independent problems) it was relatively straightforward to discern how much lesson time was devoted to each problem. On the other hand, for problems that were assigned as a set and then worked on privately (that is, concurrent problems) it was unknown how long students in the lesson spent working on each problem. However, time spent on concurrent problems as a set could be ascertained. Furthermore, concurrent problems could be described in terms of the following four work phases: set-up, seatwork, classwork, and a mixture of classwork and seatwork.

Answered only problems were defined as problems that had been completed by students prior to the videotaped lesson, and for which only answers were shared. These were typically either homework problems or problems worked on in an earlier lesson.

Non-problem segments were periods of time that contained mathematical information, but not problems. For example, the teacher might have presented a new concept, connected mathematical ideas to the real world, or discussed some historical background. These non-problem segments were coded in greater detail in later passes.

Break and technical difficulty segments were identified in rare cases when students were given an official break (such as during double lessons), or when the lesson could not be coded due to a temporary loss of video footage or audio.

6.3.3 Pass 3: Concurrent Problems

Because concurrent problems were treated as a set in Pass 2, the code concurrent problem (CP) was created for Pass 3. Coders marked the in- and out-point of each CP, and numbered them sequentially. Marking the approximate in and out-points allowed for further examination of each CP by subsequent codes. As noted above, concurrent problems by definition shared some private working on time; therefore the amount of time spent on individual CPs was not computed.

As part of Pass 3, coders also created a lesson table for each video. Lesson tables displayed all of the coding in Passes 1–3, along with the "problem statement" and "target result" for each independent, concurrent, and answered only problem. The problem statement described the task to be completed, and the target result was the answer or solution to the problem statement. These tables served a number of purposes: they acted as quick reference guides to each lesson, they were used in the development process for later codes, and they enabled problems to be further coded by specialist coding teams.[10]

6.3.4 Pass 4: Content Occurrence Codes

Pass 4 was comprised of six occurrence codes having to do with general content issues in the lesson. Coders marked whether each event happened in the lesson or not, and if so how many times. They also noted the in-point of each event (and in some cases the out-point as well). The six codes were: assignment of homework, goal statement, historical background, outside interruption, summary of lesson, and real life connection or application in non-problem segments.

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[10] A subset of these lesson tables were expanded and then coded by the Mathematics Quality Analysis Group, described in chapter 7.

The assignment of homework (AH) code indicated whether teachers gave students homework to complete for a future lesson. AH, in combination with another code about homework in Pass 5, provides information about whether or not homework was assigned and how much discussion there was about homework problems during the lesson.

Making a goal statement (GS) is one way for an instructor to tell his or her students what will be covered in the lesson. It can serve as an advanced organizer, and help students know what mathematics the teacher intends to cover. In order for a GS to be coded, the teacher had to note the specific topic that students were expected to learn from the entire lesson or from a large portion of the lesson.

Linking mathematical content to its historical background (HB) is one kind of connection teachers can provide in their lessons. This kind of linking sets the mathematics in context, and can help connect different subject areas. For example, the teacher might note that a Greek man named Pythagoras was the originator of a mathematical theorem. HB was coded whenever the teacher and/or students made such a connection.

Noting the occurrence of outside interruptions (OI) was essentially a replication of a TIMSS 1995 Video Code of the same name. The definition was slightly revised in this study to make application to a larger sample possible. Generally speaking, the 1999 Video Study definition is somewhat more inclusive than the 1995 Video Study definition.

Similar to goal statements, summaries of lessons (SL) informed students as to what mathematics they were expected to learn from the lesson. These summaries might organize the mathematical information presented in the lesson and highlight the most important concepts.

The last code in Pass 4 looked specifically at non-problem segments (as defined in Pass 2), and noted whether they contained a real life connection or application. This code, in combination with several others in later passes (such as real world connections within problems and the use of real world objects during the lesson), indicates how often teachers linked the mathematical material to students' experiences outside the classroom.

6.3.5 Pass 5: Problem-Level Codes

Fifteen codes in Pass 5 examined more closely the mathematical problems identified in each lesson. Since these codes were applied by an international team comprised of native speakers who were not necessarily mathematics experts, they emphasized the pedagogy surrounding the problems rather than their content. Other codes aimed at uncovering the mathematics content in a more precise manner were developed and applied by specialist teams, as described in chapter 7.

The TIMSS 1995 Video Study suggested that there was a difference in how much time countries spent going over homework problems from the previous night, or starting on homework problems due for the next lesson. In this study, a code was included to denote whether each mathematical problem was a homework or non-homework problem (H). Those designated as homework were further described as either previously assigned or assigned for a future lesson.

Based on this coding, it was possible to determine exactly what proportion of problems were homework, and estimate the amount of time spent on such problems.

Through initial viewings of the lessons, the mathematics code development team noticed that teachers sometimes assigned a large set of problems, but allocated subsets of these problems to particular students. For example, the teacher might have divided the class into groups, and assigned each group a different worksheet to complete. Therefore, a code was created to identify how many students (HS) each problem was intended for, or more specifically, whether it was intended for the entire class or not.

To complement the HS code, a required or optional (RO) code was developed to determine which problems were required of students and which were designated as optional. For example, a teacher might have required students to complete the first five problems on a worksheet, but allowed the next 10 problems to be optional. The HS and RO codes provide information on the exact mathematical problems students were given the opportunity to work on in the lesson, as well as some of the pedagogical techniques teachers used to assign these problems.

The next two codes in Pass 5 explored the degree to which problems were presented to students in a real world context. Problem context (PC) asked whether each problem was set up with mathematical language or symbols only, or with something more than numbers and symbols. For example, the problem statement may have been given in the form of a story. Real life connection (RLC) ascertained whether a reference to real life was contained in the problem set-up and, if not, whether such a reference occurred as the class worked on the problem. These codes, together with the Pass 2 code real life connection in non-problem segments (RLNP), indicate how often the material presented in the lesson was explicitly connected to the outside world.

Three codes were created that describe various forms of representation that may have been used when working on each problem. Like problem context (PC) and real life connection (RLC), these codes explored the degree to which mathematics was presented in a context that utilized other forms of representation besides numbers or mathematical symbols. For example, the problem may have contained a graph (GR), table (TA), or drawing or diagram (DD).

Of growing interest in many countries is the use of physical materials during mathematics lessons. A code was developed in the TIMSS 1995 Video Study to determine the number of lessons in which manipulatives were used, and by whom. In the TIMSS 1999 Video Study, this code was expanded to capture whether physical materials (PM) were manipulated during each mathematical problem, and if so whether they were used by the teacher, students, or both. Common physical materials found in mathematics classes included measuring instruments, geometric solids, and cut-out plane figures. Additional codes in Pass 6 helped to specify the type of resources that were used during the lesson.

Another code applied to problems was the degree of choice students were given in selecting a solution method (SC). For example, students might have been given an “open choice” to use any solution method they liked, a “limited choice” of several identified options, or no choice. (A related Pass 6 code was the number of solution methods presented publicly.)

If students did have some choice in selecting a solution method, the problem was further coded to specify whether it met several other criteria. For example, problems were coded for whether at least two methods presented, with at least one of the methods critiqued or discussed at length. This code, labeled facilitating exploration (FE), captured a very specific method of solving problems which is of interest to some mathematics educators.

Based on the results of the TIMSS 1995 Video Study, the code development team did not expect to find numerous instances of proofs, verifications, or derivations (PVD) in eighth-grade mathematics lessons. The PVD code was essentially a replication of the "proofs" code from the previous video study. Due to the larger number of lessons and coders in the TIMSS 1999 study, however, an expanded coding definition was written. To further ensure consistency across coders, each potential PVD was checked by a mathematics expert (who was familiar with the coding definition) before it was marked as such.

Two codes in Pass 5 provide information about whether the correct answer to a problem was provided publicly. Sometimes independent problems were started by the class but not completed or, more frequently, students were assigned a set of concurrent problems and none or only some of them were solved publicly. One code explored the number of target results presented publicly for each problem (NTR), and the other explored whether the target result was presented in different forms (DFTR). For example, a problem might have two correct answers, with both presented publicly. Or, a problem might have one correct answer, presented publicly in multiple forms (such as a decimal and a fraction).

The mathematics code development team also developed a code to separate longer problems from shorter ones. After much discussion and viewing of problems, forty-five seconds was agreed upon as a criterion to distinguish problems worked on for a relatively long time from briefer problems. Thus all problems were coded to determine whether they were greater than or equal to forty-five seconds or whether they were less than forty-five seconds (LWO).

The LWO and NTR codes not only provided important information about the nature of the problems in the lessons, they also served as gatekeepers for other codes by narrowing down the number of problems that need to be examined. For example, problems worked on for less than forty-five seconds or that did not have a target result publicly presented were excluded from the coding of facilitating exploration (FE – discussed in this section) and problem summary (PSM – discussed in Section 6.3.6). Excluding such problems made sense for such codes and reduced the workload of coders.

6.3.6 Pass 6: Resources, Private Work, and Non-Problem Segments

Pass 6 contained an assortment of codes related to various aspects of the lessons. The first set of codes had to do with resources in the classrooms. Coders marked whether any of the following were used during each lesson: chalkboard (CH), projector (PRO), television or video (TV), textbooks or worksheets (TXW), special mathematical materials (SMM; e.g., rulers, graph paper, or base-ten blocks), real world objects (RWO; e.g., maps or dice), calculators (CALC; further classified as either regular or graphing), and computers (COMP).

Some of the inspiration for these codes was drawn from the TIMSS 1995 Video Study. One of the often cited findings from that study is the extent to which chalkboards and overhead projectors were used in the United States as compared to Japan. For the TIMSS 1999 Video Study, the code developers wanted to explore the use of these and similar classroom resources, such as textbooks. Further, given the interest many of the participating countries had in contextualizing mathematics, usage of mathematical materials and real world objects was also noted. (In Pass 5 such objects were coded when they were used to solve a problem, however they were sometimes used in non-problem segments. Therefore, this set of resource codes was applied to each lesson as a unit.) In addition, a number of countries participating in the 1999 Video Study expressed an interest in knowing how often calculators and computers were used in the videotaped lessons.

Two additional codes about problems were included as part of Pass 6. One was similar to a code developed in the TIMSS 1995 Video Study regarding alternative solution methods. In that study, coders marked the largest number of alternative solution methods presented for any identified task. In the TIMSS 1999 Video Study a similar code was applied to each mathematical problem, and noted whether more than one solution method was publicly presented (MSM). If so, coders specified whether the students suggested any of the solution methods.

The problem summary (PSM) code was applied only to problems longer than 45 seconds that had a publicly presented target result (correct answer). This code ascertained whether the teacher summarized the major steps or critical rule involved in the problem. In many ways this code complements the goal statement (GS) and summary of lesson (SL) codes in Pass 4, as it identifies instances when the teacher emphasized the important mathematics that students were expected to learn from the videotaped lesson.

Four codes were developed as part of Pass 6 to classify the non-problem (NP) segments marked in Pass 2. These codes, along with the Pass 4 real life non-problem (RLNP) code, provide information about what mathematics the students were engaged in when they were not working on problems. Each NP segment was classified as containing at least one of the following: contextual information (CON), a mathematical concept, theory, or idea (CTI), a mathematical activity (AC), or the teacher discussing a homework assignment or test (HT).

All of the remaining codes in this pass had to do with the work students completed privately, at their seats. The code private work assignment (PWA) drew heavily on the TIMSS 1995 Video Study “performance expectations” code. Performance expectations referred to the kind of tasks students worked on during seatwork, such as practicing routine procedures, inventing new solutions, or applying concepts in new situations. The PWA code involved somewhat broader and more concrete categories. That is, coders determined whether the assignment involved using steps students were already familiar with to solve problems, or if it required something more. In other words, this code distinguished between assignments in which students used entirely known procedures from those in which students had to do something new. Cues from the lesson along with teachers’ questionnaire responses helped coders to determine whether the mathematical concept(s) and solution method(s) were known to students before they started the assignment.

The last four codes applied only to portions of lessons marked in Pass 1 as “private interaction.” Coders noted whether the majority of students worked individually, in pairs, or in groups, and marked any shifts in their organization. The organization of students code (OS) was very similar to the TIMSS 1995 Video Study coding of whether students worked by themselves or in a group during seatwork; however, the OS code differentiated between working in pairs from working in groups of three or more.

Several codes were developed to capture what teachers did while their students worked privately. For example, teachers might have spent this time displaying mathematical information on the board or overhead projector (DI). Such information could be intended for students to use as they worked on their assignment, or it could be in preparation for an upcoming public, whole class segment. Teachers might also have spent their time engaging in an administrative activity that was unrelated to the students’ current assignment (AA). For example, they could have taken roll or checked to make sure students completed their homework.

Teachers often made public announcements (PA) during private work. Such announcements appeared to be intended for all students to hear, and could either provide information related to the current assignment or they could be entirely unrelated to the current assignment. Announcements related to the assignment were further classified as containing either mathematical or organizational information. Unrelated announcements (such as disciplinary comments) could be considered interruptions to students’ work time.

6.3.7 Pass 7: Purpose

The last code applied by the international coding team provided information about the lesson purpose (P). This was a coverage code, meaning that every moment of each lesson had to be segmented into one of three mutually exclusive and exhaustive purpose types, which could shift as the lesson progressed.

The purpose code was developed through a somewhat different and more elaborated process than most of the codes described above. The intention was to create a simple, universal code with purpose categories flexible enough to fit each country. From their experience developing country models early in the study, the mathematics code development team knew that purpose segments were relatively easy to classify within countries, but much harder to agree upon across countries. In order to develop a purpose code that would satisfactorily represent the pedagogy in each of the participating nations, country teams were assembled. These teams, which included the national research coordinators, country associates, and coders, worked together to name and define purpose categories appropriate for their country. Then, all of the teams met to discuss each country’s ideas. Finally, the mathematics code development team agreed on three categories that incorporated all of the suggestions and fit well for each country.

The purpose code contained three categories: 1) addressing content introduced in a previous lesson, 2) introducing new content, and 3) practicing, applying, or consolidating new content introduced in the current lesson. Defining the boundaries between these three categories for any particular lesson required a great deal of cultural knowledge. Therefore, reliability for this code was established only between coders of the same country, and not across countries as was done for the other codes (see section 6.5 on reliability and quality control).

Although reliability was not established between coders from different countries, in many important ways the training, reliability, and application of the purpose code were the same as that of other codes. For example, coders were trained as a single group with equal access to instruction from the country associates and questions from fellow coders. When discussing and practicing the purpose code, lessons from all countries were used. Furthermore when coders applied this code to their designated set of lessons, they were encouraged to discuss difficult coding decisions with their fellow coders—regardless of country—just as they had done for prior codes. For the purposes of establishing reliability, however, it seemed most appropriate to pair coders from the same country, since marking the exact boundaries between purposes often required understanding cultural nuances in the lesson climate and language.

The purpose code provided information about the nature of the mathematics at different points in the lesson, and helped to place the content in a sequential context. For example, teachers might shift topics as they move from a review to a new phase. Fewer and longer problems might be worked on during the new phase. Looking at codes together in this manner could paint a more detailed portrait of the lesson videos and may be useful for creating broad descriptions of teaching in each country.

6.4 Coder Training

As described above, codes were developed, practiced and applied in passes. Once definitions were completed for each code in a pass, training materials were created and a reliability procedure was developed.

Training for each coding pass involved three stages: introduction, practice, and reliability. First, coders were provided with the coding manual, which contained carefully worded definitions for each code, as well as notes and examples. Coders and country associates met to introduce and discuss each code in the pass, including the definitions and accompanying notes. For most codes, video examples were shown of each coding category. Coders frequently raised questions about the rationale and purpose behind the codes, or requested further clarification of the definitions. The country associates sometimes used the coders' input to make minor revisions to the coding manual.

After learning the definitions and watching examples from a particular coding pass, coders were given the opportunity to practice applying the codes. In these practice sessions coders were provided with a select set of lessons, or portions of lessons, usually representing all the countries in the sample. Coders were instructed to work individually to apply the codes, and then compare their coding to an answer key. To create these answer keys, each country associate individually coded the lessons. Then the mathematics code development team met and reached consensus on the appropriate coding. Once they finished practicing, coders and country associates would meet again to discuss any problems or concerns that arose.[11]

Throughout the training process, coders were encouraged to make suggestions for improving the code definitions. For some of the later coding passes, particularly Passes 6 and 7, coders played a substantially more active role in assisting the mathematics code development team to create code definitions and train their colleagues. In particular, coders and country associates formed subgroups to test code definitions, assemble practice materials, and train other coders.

Once coders and country associates felt comfortable with the codes, and confident that they could apply them reliably, coders took an initial reliability test. Details of the initial reliability procedure and calculations are discussed in section 6.5.1 below. After establishing reliability on the codes in a pass, coders applied them to lessons from their country. Various additional quality control measures were put in place to ensure reliable and valid coding and data entry. For example, mid-point reliability was calculated for each code once coders completed at least half of their assigned lessons.

Occasionally coders did not reach an acceptable level of initial reliability on some codes in a pass. On two of these codes (lesson duration and content activity), coding definitions were then modified by the code development team, coders were re-trained, and they established reliability using a new set of lessons. On two other codes (elaborated problems and teacher assistance during private work), coders could not establish an acceptable level of reliability even after re-training and re-testing. Therefore these codes were dropped.

Coders were each responsible for a particular number of lessons, and coding was done individually. However, collaboration among coders was encouraged, especially among coders from the same country. Also, country associates were available to help with questions and difficult lessons. When coders came across lessons that were particularly hard to code, the entire mathematics code development team met to watch them and determine how to accurately apply the codes. These decisions were then explained in writing and distributed to all coders (see the TIMSS 1999 Video Study Mathematics Coding Manual included as appendix I.).

6.5 Reliability and Quality Control

Coders established initial reliability for all codes prior to their implementation. After they finished coding approximately half of their assigned set of lessons (in most cases about 40–50 lessons), coders established midpoint reliability. The minimum acceptable reliability score for each code was 85 percent (averaged across coders). Individual coders or coder pairs had to reach at least 80 percent reliability on each code.[12]

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[11] Lessons or portions of lessons that were coded by the country associates and then by coders as "practice" were considered coded. Therefore, the coders assigned to those particular lessons simply had to enter the coding into the appropriate software.

[12] The minimum acceptable reliability score for all codes (across coders and countries) was 85 percent. For coders and countries, the minimum acceptable reliability score was 80 percent. That is, the reliability of an individual coder OR the average of all coders within a particular country was occasionally between 80–85 percent. In these cases clarification was provided as necessary, but re-testing for reliability was not deemed appropriate.

Reliability was computed either as agreement between coders and a master document, or as inter-rater agreement between pairs of coders. In all cases, reliability statistics were calculated based on a “percent correct” approach (Bakeman and Gottman 1997). A master refers to a lesson or part of a lesson coded by consensus by the mathematics code development team. To create a master, the country associates independently coded the same lesson and then met to compare their coding and discuss disagreements until consensus was achieved. Masters often were used to establish initial reliability, particularly in the early passes. Inter-rater agreement between coders typically was used to establish midpoint reliability. Inter-rater agreement was also used to establish initial reliability in some of the later passes, for which coders helped to develop coding definitions.

The formula used, in all cases, to compute reliability was:

Number of Agreements ÷ (Number of Agreements + Number of Disagreements).

This formula was used regardless of whether reliability was established between coders and a master document, or as inter-rater agreement. What counted as an agreement or disagreement depended on the specific nature of each code, and is explained in detail in sections 6.5.1 and 6.5.2. Note that when codes required timing and categorization decisions, both were taken into account as either agreements or disagreements.

Table 6.3 lists the initial and midpoint reliability scores for each code, averaged across coders. Since the computation of reliability for codes differed somewhat, the specific procedures used to calculate initial and midpoint reliability for each code are presented in sections 6.5.1 and 6.5.2.

Table 6.3. Initial and midpoint reliability statistics for each code applied by the International Coding Team, by code: 1999

Pass	Code	Initial reliability[1] (percent)	Midpoint reliability[2] (percent)
1	Lesson (LES)	93	99
1	Classroom interaction (CI)	94	92
2	Content activity (CC)	90	87
3	Concurrent problem (CP)	94	90
4	Assignment of homework (AH)	99	93
4	Goal statement (GS)	99	89
4	Historical background (HB)	100	100
4	Outside interruption (OI)	96	96
4	Summary of lesson (SL)	98	99
4	Real life within non-problem (RLNP)	98	96
5	Homework (H)	99	98
5	How many students (HS)	98	100
5	Required or optional (RO)	98	100
5	Problem context (PC)	97	92
5	Real life connection (RLC)	98	100
5	Graphs (GR)	97	98
5	Tables (TA)	99	98
5	Drawings/diagrams (DD)	97	94
5	Physical materials (PM)	95	97
5	Student choice of solution method (SC)	90	93
5	Proof/verification/derivation (PVD)	99	97
5	Number of target results (NTR)	96	94
5	Number of different forms of the target result (DFTR)	92	94
5	Length of working on (LWO)	95	94
5	Facilitating exploration (FE)	96	95
6	Chalkboard (CH)	96	100
6	Projector (PRO)	98	100
6	Television or video (TV)	100	100
6	Textbook or worksheets (TXW)	98	98
6	Special mathematical materials (SMM)	92	93
6	Real-world objects (RWO)	98	100
6	Calculators (CALC)	98	95
6	Computers (COMP)	100	98
6	Multiple solution methods (MSM)	99	98
6	Problem summary (PSM)	97	95

Table 6.3. Initial and midpoint reliability statistics for each code applied by the International Coding Team, by code: 1999—Continued

Pass	Code	Initial reliability[1] (percent)	Midpoint reliability[2] (percent)
6	Contextual information (CON)	92	91
6	Mathematical concept/theory/idea (CTI)	92	94
6	Activity (AC)	97	97
6	Announcing or clarifying homework or test (HT)	95	98
6	Private work assignment (PWA)	93	98
6	Display information (DI)	96	89
6	Administrative activity (AA)	93	95
6	Organization of students (OS)	96	96
6	Public announcements (PA)	86	86
7	Purpose (P)	87	94

[1]Initial reliability refers to reliability established on a designated set of lessons before coders began work on their assigned lessons.
[2]Midpoint reliability refers to reliability established on a designated set of lessons after coders completed approximately half of their assigned lessons.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

6.5.1 Initial Reliability

Most frequently, initial reliability was determined by comparing coders' individual markings of lessons to masters of those lessons, as described above. This method is considered a rigorous and cost-effective alternative to inter-coder reliability (Bakeman and Gottman 1997).

For some codes, standard, inter-coder testing was deemed the most appropriate method of determining reliability. For example, the videotape coders played a large role in the development of the Pass 6 codes, and the mathematics code development team did not consider themselves expert enough to create masters for these codes. Additionally, only within-country reliability was established for the purpose code, and it would not have been appropriate to calculate reliability against the international code development team (see section 6.3.7).

A percent agreement reliability statistic was computed for each coder by dividing the number of agreements by the sum of agreements and disagreements (Bakeman and Gottman 1997). Then, average reliability was calculated across coders and across countries for each code. In cases where coders did not reach the set reliability standard, they were re-trained and re-tested using a new set of lessons. Codes were dropped if 85 percent reliability could not be achieved (or if individual coders could not reach at least 80 percent reliability) (see section 6.4).

Some codes required coders to indicate a time. In these cases, coders' time markings had to fall within a predetermined margin of error. This margin of error varied depending on the nature of the code, ranging from 10 seconds to 2 minutes. Rationales for each code's margin of error are provided in the sections that follow.

Exact agreement was required for codes that had categorical coding options. In other words, if a code had four possible coding categories, coders had to select the same coding category as the master. In some cases, coders had to both mark a time (i.e., note the in- and/or out-point of a particular event) and designate a coding category. Reliability for the coding category was calculated only if coders marked the time within the given margin of error.

Reliability calculations differed somewhat depending on the nature of each code. A detailed explanation of how the initial reliability was computed for each code is provided below.

6.5.1.1 ***<u>Initial Reliability for Lesson</u>***

Coders watched six videos (from six countries) and marked the in- and out-points of each lesson. Coders' markings were compared against master lessons. Each in- and out-point had to be within 30 seconds of the master to be counted as an agreement. A 30-second margin of error was deemed appropriate and reasonable for this code based on the notion that eighth-grade mathematics lessons typically last about 30–50 minutes.

6.5.1.2 ***<u>Initial Reliability for Classroom Interaction</u>***

Coders watched two lessons (one from their own country plus one from another country), and noted all shifts and categories for classroom interaction. Coders' markings were compared against master lessons. Each in- and out-point had to be within 20 seconds of the master to be counted as an agreement. A 20-second margin of error was deemed appropriate and reasonable for this code because the definition of classroom interaction required that these segments last at least 1 minute in order to be coded as such. Each categorization had to be exactly the same as the master to be counted as an agreement.

If coders marked the in- or out-points incorrectly, this was counted as a disagreement. However, they were then told the correct time(s) and given the opportunity to adjust their labels. This two-step process was deemed reasonable because categorizations were dependent on the placement of classroom interaction shifts.

6.5.1.3 ***<u>Initial Reliability for Content Activity</u>***

Coders watched three lessons (one from their own country plus two from other countries), and noted all shifts and categories for content activity. Coders' markings were compared against master lessons. Each in- and out-point had to be within 10 seconds of the master to be counted as an agreement. A 10-second margin of error was deemed appropriate and reasonable for this code because certain content activity categories were required to last at least 20 seconds in order to be counted as such.[13] Each categorization had to be exactly the same as the master to be counted as an agreement.

If coders marked the in- or out-points incorrectly, this was counted as a disagreement. However, they were then told the correct time(s) and given the opportunity to adjust their labels. This two-step process was deemed reasonable because categorizations were dependent on the placement of content activity shifts.

*6.5.1.4 **Initial Reliability for Concurrent Problems***

Coders watched three lessons (one from their own country plus two from other countries), and noted all of the concurrent problems. Coders' markings were compared against master lessons. Each in- and out-point had to be within 10 seconds of the master marking to be counted as an agreement. A 10-second margin of error was deemed appropriate and reasonable for this code because other types of problems—categories of content coverage—had a 10-second margin. The number of concurrent problems marked by coders was compared to the number of concurrent problems in the master.

*6.5.1.5 **Initial Reliability for Pass 4 (6 Occurrence Codes)***

Coders watched 14 lesson segments (two per country), and noted the appearance(s) of any occurrence code. Coders' markings were compared against master lessons. Reliability was calculated separately for each code.

For each lesson segment, an agreement was counted if the coder marked an occurrence with an in-point within 1 minute of the master. A 1-minute margin of error was deemed appropriate and reasonable because the unit of analysis for occurrence codes was the lesson. That is, analyses were most likely to explore whether a particular event occurred within a given lesson (not how many times it occurred). A disagreement was counted if the coder omitted an occurrence marked on the master, or marked an occurrence not on the master.

*6.5.1.6 **Initial Reliability for Pass 5 (15 Codes about Problems)***

Coders watched 44 mathematical problems (at least four per country, as marked in Passes 2 and 3), and applied the 15 problem-level codes to all problems. Coders' markings were compared against master lessons. Reliability was calculated separately for each code.

For each problem, an agreement was counted on a given code if the coder marked exactly the same coding category as the master, and a disagreement was counted if the coder marked a coding category different from the master. Time was not included in the reliability calculations for these codes because the in- and out-points of each problem had previously been determined in Pass 2.

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[13] A smaller margin of error was found to be problematic because teachers often pause between sentences or between activities. Therefore, a buffer time of a few seconds proved necessary to accommodate variation in how these pauses were treated by coders.

6.5.1.7 Initial Reliability for Pass 6 (19 Codes about Resources, Mathematical Problems, Non-Problem Segments, and Private Work)

Reliability for all Pass 6 codes was determined by calculating the mean inter-rater agreement among pairs of coders. Coders were paired randomly; however, coders from the same country could not be grouped together.[14] For each coder, 3 lessons were randomly chosen from among their assigned set of lessons. Coders coded their selected lessons and their partner's selected lessons. Reliability was calculated separately for each code.

Most codes in Pass 6 only required coders to make categorization decisions. An agreement was counted if both coders marked the same coding category, and a disagreement was counted if coders marked different coding categories. Time was not included in the reliability calculations for the resource codes because they applied to the entire lesson (e.g., was a blackboard used or not). For the codes applied to mathematical problems and non-problem segments, time was not included in the reliability calculations because the in- and out-points had previously been determined in Pass 2.

The codes about private work—organization of students (OS) and public announcement (PA) — required coders to both mark a time and designate a coding category. The shifts or in-points had to be within 20 seconds of one another in order to be calculated as an agreement. This period of time was deemed appropriate and reasonable because both of these codes represented relatively short periods of lesson time. Each categorization had to be exactly the same to be counted as an agreement.

6.5.1.8 Initial Reliability for Purpose

Reliability for purpose (P) was determined by calculating the mean inter-rater agreement among pairs of coders from the same country. Coders watched four lessons (two from each coder's assigned set of lessons plus two from another country), and noted all shifts and categories for purpose. For each lesson, a coder's markings were compared to his/her coding partner's markings. Each in- and out-point had to be within 2 minutes of his/her partner's marks to be counted as an agreement. A 2-minute margin of error was deemed appropriate and reasonable for this code because purpose segments were generally long (approximately 17 minutes, on average across countries), and noting their beginning and end points often required a great deal of inference. Each categorization had to be exactly the same to be counted as an agreement.

6.5.2 Midpoint Reliability

Midpoint reliability for the code lesson duration (LES) was determined by comparing coders' marking of lessons to master lessons. For all other codes, midpoint reliability was determined by calculating the mean inter-rater agreement among pairs of coders. By halfway through the coding process, coders were considered to be more expert in the code definitions and applications than the mathematics code development team. Therefore, in general, the most appropriate assessment of their reliability was a comparison with other coders.

[14] The Swiss coders established only within country inter-rater reliability because they were trained separately from the other videotape coders and carried out their coding in Switzerland rather than at LessonLab.

Coder pairs were always randomly assigned according to the following conditions: 1) coders could not be from the same country,[15] and 2) coders could not have the same partner for initial and midpoint reliability. Lessons were selected for each coder by randomly choosing from among their seven most recently coded lessons. Coders reviewed their selected lessons and coded their partner's lessons. In the process, coders were instructed to consult the coding manual and keep notes regarding the “implicit” rules they applied. That way if disagreements arose, the coder pairs could support their decisions. After their reliability scores were calculated, coder pairs were encouraged to resolve such coding differences on their own, seeking help from other coders and country associates as needed.

Reliability calculations differed somewhat depending on the nature of each code. A detailed explanation of how the midpoint reliability was calculated for each code is provided in the sections that follow.

*6.5.2.1 **Midpoint Reliability for Lesson***

Midpoint reliability for lesson duration (LES) was calculated in exactly the same way as initial reliability.

Midpoint Reliability for Classroom Interaction

Inter-rater midpoint reliability was established for classroom interaction (CI). For each lesson, a coder's markings were compared to his/her coding partner's markings. Each in- and out-point had to be within 40 seconds of his/her partner's marks to be counted as an agreement. This was the same as allowing a 20-second margin of error when comparing an individual coder’s markings against a master lesson, as used to determine initial reliability. (Coders could mark a segment 20 seconds before or after the master, thus the range between pairs of coders could be up to 40 seconds.) Other calculations were exactly the same as for initial reliability.

*6.5.2.2 **Midpoint Reliability for Content Activity***

Inter-rater midpoint reliability was established for content activity (CC). For each lesson, a coder's markings were compared to his/her coding partner's markings. Each in- and out-point had to be within 20 seconds of his/her partner's marks to be counted as an agreement. This was the same as allowing a 10-second margin of error when comparing an individual coder’s markings against a master lesson, as used to determine initial reliability. (Coders could mark a segment 10 seconds before or after the master, thus the range between pairs of coders could be up to 20 seconds.). Other calculations were exactly the same as for initial reliability, except that coders watched two lessons (one from their own country and one from their partner’s country) rather than three lessons.

*6.5.2.3 **Midpoint Reliability for Concurrent Problem***

[15] There were two exceptions: within country inter-rater reliability was determined for the Swiss coders on all codes (for reasons explained in an earlier footnote), and for all coders on the Purpose code.

Inter-rater midpoint reliability was established for concurrent problem (CP). For each lesson, a coder's markings were compared to his/her coding partner's markings. Each in- and out-point had to be within 20 seconds of his/her partner's marks to be counted as an agreement. This was the same as allowing a 10- second margin of error when comparing an individual coder's markings against a master lesson, as used to determine initial reliability. (Coders could mark a segment 10 seconds before or after the master, thus the range between pairs of coders could be up to 20 seconds.) Other calculations were exactly the same as for initial reliability, except that coders watched two lessons (one from their own country and one from their partner's country) rather than three lessons.

*6.5.2.4 **Midpoint Reliability for Pass 4 (6 Occurrence Codes)***

Inter-rater midpoint reliability was established for all Pass 4 codes. For each lesson, a coder's markings were compared to his/her coding partner's markings. Each in- and out-point had to be within 2 minutes of his/her partner's marks to be counted as an agreement.This was the same as allowing a 1-minute margin of error when comparing an individual coder's markings against a master lesson, as used to determine initial reliability. (Coders could mark a segment 1 minute before or after the master, thus the range between pairs of coders could be up to 2 minutes.) Other calculations were exactly the same as for initial reliability, except that coders watched 16 lesson segments (eight from their own country plus eight from another country) rather than 14 segments.

*6.5.2.5 **Midpoint Reliability for Pass 5 (15 Codes Regarding Problems)***

Inter-rater midpoint reliability was established for all Pass 5 codes. Other calculations were exactly the same as for initial reliability, except that coders watched four lessons (two from their own country plus two from another country), and applied each code to all of the mathematical problems in these lessons rather than watching 44 mathematical problems.

*6.5.2.6 **Midpoint Reliability for Pass 6 (19 Codes Regarding Resources, Problems, Non-Problem Segments, and Private Work)***

Midpoint reliability for all Pass 6 codes was calculated in exactly the same way as initial reliability.

*6.5.2.7 **Midpoint Reliability for Purpose***

Midpoint reliability for purpose (P) was calculated in exactly the same way as initial reliability.

6.5.3 Other Quality Control Measures

A variety of additional quality control measures were put in place to ensure accurate coding. These measures included: 1) discussing difficulties in coding lessons reliably with the mathematics code development team and/or other coders, 2) checking the first two lessons coded by each coder, either by a country associate or by another coder, and 3) discussing hard-to-code lessons with country associates and/or other coders.

6.5.4 Data Entry, Cleaning, and Statistical Analyses

Most codes were entered directly into the multimedia database, so that the videotapes and English transcripts could be linked directly with specific codes. The data then were exported either in spreadsheet format for statistical analyses, or in table format for further study by specialist coding groups. In some cases, where the vPrism software was not conducive for particular types of coding, codes were entered into an Excel spreadsheet.

Codes from Passes 1–4 were entered directly into a vPrism database. Codes from Pass 5 were entered into an Excel database. For Pass 6, all codes were entered into vPrism except the two regarding problems, which were entered into Excel. Pass 7 coding was entered into vPrism.

A data cleaning process was put in place for both the vPrism and Excel databases. For the vPrism data, coders first recorded their coding decisions in writing onto printed lesson transcripts. Then they entered this information into vPrism. Lastly, coders exported the vPrism data for each lesson and compared it to their markings on the transcripts. In this way, data entry errors were immediately noted and corrected. In addition, errors detected through preliminary data analyses were examined and corrected. For example, coding that was outside of a possible range was detected and extreme outliers on particular codes were studied.

For the Excel data, coders first recorded their coding decisions in writing onto a printed spreadsheet for each lesson. Then they entered this information into Excel. Every tenth lesson was checked for accuracy, and errors were corrected.

Once they were cleaned, all of the data were aggregated to the lesson level, with each coding pass in a separate datafile. The full sample and replicate weights were then appended to each file. Finally, statistical analyses were run using the weighted data in Wesvar and/or SPSS.

6.6 Conclusion

In summary, the mathematics code development team created 45 codes that were applied to the video data in seven passes by an international team of coders. Initial and midpoint statistics were computed on each code, using the percent correct procedure described in Bakeman and Gottman (1997), and in all cases exceed 85 percent.

Chapter 7. Coding Video Data II: Specialists

Most codes were applied to the video data by a team of international coders, who were cultural insiders and fluent in the language of the lessons they coded. However, not all of them were experts in mathematics or teaching. Therefore, several specialist coding teams with different areas of expertise were employed to create and apply codes regarding the mathematical nature of the content, the pedagogy, and the discourse.

7.1 Mathematics Problem Analysis Group

The mathematics problem analysis group was comprised of individuals with expertise in mathematics and mathematics education. The group was directed by Diana Wearne (University of Delaware) and included Margaret Smith (University of Iowa) and Eric Sisofo (University of Delaware). They developed and applied a series of codes to all of the mathematical problems in the videotaped lessons. The group worked from written records of the lessons that listed the statement for every problem the students were asked to solve and a solution of the problems presented during the lesson.

7.1.1 Coding for Topic

The purpose of the topic code was to assist in describing the mathematics that students were encountering during each lesson. The mathematics problem analysis group constructed a comprehensive, detailed, and structured list of mathematical topics covered in eighth grade in all participating countries. Initially, the list was created by reviewing textbooks and national/state/regional curriculum guidelines from each country and watching lesson videos. The list was refined and expanded during the coding process. Whenever the latter occurred, the group members conferred and had to agree to the designation of a new topic code—that it described a situation for which no topic code existed—before it was added to the list.

All problems worked on in the lesson (i.e., coded as "independent problems" or "concurrent problems" by the international coding team), were assigned a mathematics topic code. For example, a problem could be assigned the topic of determining the surface area of a given three-dimensional object, finding the mean of a distribution, or graphing a linear function.

The final topic code list was fairly specific and consisted of 564 codes. The 22 broad categories of topic codes are described below. These categories were mutually exclusive.

Within each of the 22 broad categories, one or more subcategories were used to classify problems as "applications"—that is, problems that required students to apply procedures they have learned in one context in order to solve problems presented in a different context. Using these categorizations, the mathematics problem analysis group was able to identify how many problems were applications.

Applications might, or might not, be presented in real-life settings. The following problem is an example of real-life application: "A rectangular shaped garden is twice as long as it is wide. If the length of the fence enclosing the garden is 24 meters, what are the dimensions of the garden?” Non-real life applications include problems such as, “The sum of three consecutive integers is 240. Find the integers.”

Category 1. Whole Numbers/Number Theory

This category includes operations with whole numbers including ordering; properties of the operations; factors; integer exponents; roots when the result is a whole number; arithmetic and geometric sequences and series; and applications and proofs associated with these topics. This category includes 33 topic codes.

Category 2. Fractions and Decimals

This category includes operations with fractions and decimals; order of fractions and decimals; properties of the operations; equivalent/improper/complex fractions; creating a representation of the numbers; translating between decimal and common fraction form; raising to powers and finding roots; significant digits; rational and irrational numbers; and applications and proofs associated with these topics. This category includes 35 topic codes.

Category 3. Ratio, Proportion, and Percent

This category includes ratio; proportion; percent; trigonometric ratios defined in a right triangle; relationships among the trigonometric ratios; inverse proportion and variation; and applications and proofs associated with these topics. There are 27 topic codes in this category.

Category 4. Integers

This category includes operations with integers; properties of operations; models for integers; ordering; exponents (positive and negative integers, fractional); scientific notation; and applications associated with these topics. There are 20 topic codes in this category.

Category 5. Geometry: Angles

This category includes classification of angles; relationships among angles of particular triangles; relationships among interior and exterior angles of a triangle; angles associated with parallel lines; angles associated with a circle; the sum of the measures of the angles of a polygon; and applications and proofs associated with any of these topics. There are 35 topic codes in this category.

Category 6. Geometry: Triangles and Lines in a Two-Dimensional Plane (excluding area and perimeter)

This category includes parallel lines; classification of triangles; relationships among sides of certain triangles; relationships among interior and exterior angles of a triangle; Pythagorean Theorem; congruent triangles; similar polygons; and applications and proofs related to these topics. This category includes 42 topic codes.

Category 7. Geometry: Quadrilaterals and other N-Gons (excluding perimeter and area)

This category includes definitions of various quadrilaterals; theorems relating to parallelograms including specific parallelograms; exterior and interior angles of regular polygons; and applications and proofs related to these topics. This category includes 28 topic codes.

Category 8. Geometry: Perimeter and Area of Figures in a Two-Dimensional Plane

This category includes finding perimeter and area of polygons and circles; finding areas of sectors; computing arc lengths; developing these procedures; Hero's formula; and applications associated with these topics. There are 28 topic codes in this category.

Category 9. Geometry: Three Dimensional Figures: Descriptions

This category includes descriptions of three-dimensional figures; categorizing the figures; constructing or using nets of figures; Euler's formula; and applications and proofs (not involving computing area or volume) associated with these topics. There are 26 topic codes in this category.

Category 10. Geometry: Three-Dimensional Figures: Surface Area

This category includes defining surface area; developing procedures for computing surface areas of prisms, cylinders, cones, pyramids, and spheres; and applications involving surface areas of three-dimensional figures. There are 15 topic codes in this category.

Category 11. Geometry: Three-Dimensional Figures: Volume

This category includes defining volume; developing procedures for computing volume of prisms, cylinders, cones, pyramids, and spheres; and applications involving volumes of three dimensional figures. There are 16 topic codes in this category.

Category 12. Geometry: Geometric Transformation

This category includes defining various transformations (translation, rotation, reflection) and applications involving single and multiple transformations. There are 12 topic codes in this category.

Category 13. Geometry: Constructions

This category includes constructing perpendicular and parallel lines; angle bisectors; angles (including specific angles such as 60º angle); constructing triangles under given conditions (e.g., all possible triangles given an angle and two sides of a triangle); constructing quadrilaterals under given conditions, constructing tangents to circles; inscribing certain polygons in a circle; and dividing lines into specific ratios. Also included is the use of computer software. There are 26 topic codes in this category.

Category 14. Statistics/Probability: Graphical Representations of Data

This category includes constructing and interpreting bar graphs, circle graphs, line graphs, histograms, scatter plots, stem and leaf plots, and frequency polygons. Also included are gathering data and selecting the appropriate graph; recognizing bias in a sample; and recognizing misuse of graphs. Thee are 21 topic codes in this category.

Category 15. Statistics/Probability: Statistics

This category includes defining measures of central tendency and measures of dispersions; and determining procedures for computing these measures. Also included are applications involving selecting the appropriate measure; determining the measure; and identifying misinterpretation and misuses of these measures. Other coded topics include standard deviation; various distributions (e.g., normal, skewed); and identifying a representative sample. There are 27 topic codes in this category.

Category 16. Statistics/Probability: Probability

This category includes definitions and applications of theoretical and empirical probability. Also included are definition and applications of complementary, independent, and dependent events. Other topics included are expected outcome; odds; conditional probability; and advanced counting principles. There are 27 topic codes in this category.

Category 17. Algebra: Linear Functions: Simplifying Expressions and Solving Equations.

This category includes simplifying algebraic expressions; solving linear equations; applications involving linear equations; solving pairs of linear equations and their related applications; solving linear inequalities and related applications; and solving absolute value equations and inequalities. This category includes 49 topic codes.

Category 18. Algebra: Linear Functions: Graphs

This category includes plotting points; determining slope and y-intercepts from the associated linear function or from the graph; determining slopes of parallel and perpendicular lines; determining the domain and range of functions; graphing linear functions; representing a graph with a linear function; solving pairs of equations graphically; and responding to questions based on a situation and its associated graph. Also included are graphing linear inequalities; graphing absolute value equalities and inequalities; determining the procedure for computing the distance between two points and computing these distances; and determining the co-ordinates of the mid-point of a line segment. This category includes 39 topic codes.

Category 19. Algebra: Quadratic Functions and Other Non-linear, Non-trigonometric Functions

This category includes operations with quadratic functions; factoring quadratic functions; real and irrational numbers; operations with complex numbers; developing the quadratic formula; the quadratic discriminant; solving quadratic equations; solving applications involving quadratic equations; and direct and inverse variation. Also included are solving higher order equations. This category includes 21 topic codes.

Category 20. Algebra: Graphing Non-Linear, Non-Trigonometric Functions

This category includes graphing equations by plotting points; estimating solutions to quadratic equations from the graph; applications based on the graph; graphing exponential functions; graphing conic sections given by name; graphing higher powers; and applications based on the graphs of higher powers. This category includes 13 topic codes.

Category 21. Trigonometry

This category includes definitions of trigonometric functions (both based on the right triangle and the unit circle); applications involving trigonometric functions; graphing trigonometric functions; and finding values for specific angles (e.g., $\sin 30^{\circ}$). Also included are proving trigonometric identities and solving equations based on identities. There are 14 topic codes associated with this category.

Category 22. Miscellaneous Topics

This category includes Venn diagrams and applications using Venn diagrams; properties of real numbers; operations using other bases or alternative algorithms (e.g., lattice multiplication); and logic problems. There are 10 topic codes for this category.

7.1.2 Coding for Complexity

Procedural complexity was judged primarily on the number of steps leading to a solution and the number of sub-problems which must be completed in order to solve the original problem. It should be emphasized that this code was related to the procedural and not the conceptual complexity of the problem.

Three coding categories were developed:

Low Complexity

General guidelines for assigning this category were as follows: The solution process for the problem required four or fewer steps/decisions and no sub-problems. If a student represented a situation with an equation, this constituted one step. If the problem required obtaining information from a graph or table when the exact information was provided in the table/graph, this would designated as a low procedural complexity problem—assuming the problem did not require more than four steps to resolution. Examples of low procedural complexity problems are: (a) solve the equation $3(x + 2) + 5 = 7$ and (b) find the surface area of a right cylinder, given the height and the radius of the base.

Moderate Complexity

These problems required one or more of the following: (a) solving a sub-problem, (b) more than four steps/decisions are necessary to solve the problem, (c) the need to extrapolate from quantities in a table or graph. Examples of moderate procedural complexity problems are: (a) $3(x - 2) = 7 - (x + 4)$ and (b) determine the height of a right circular cylinder given the radius and the surface area.

High Complexity

These problems required at least two sub-problems. For example, (a) construct a set of 20 scores such that the mean and median differ by one, and (b) compare the surface areas of a sphere and a right circular cylinder which contain the same volume.

7.1.3 Coding for Relationship

The relationship among problems was judged by examining each problem and a preceding problem in the lesson. For example, a problem could require the same solution procedures as a previous problem, it could require some important additional operations, or it could be totally unrelated to any preceding problem.

An initial set of four coding categories was suggested by the mathematics code development team. After coding a number of lessons, the members of the mathematics problem analysis group found it necessary to add another seven categories in order to fully capture the relationship among the various problems in the lesson.

The 11 relationship categories are described below:

Repetition [R]

This category indicates the problem was exactly or mostly the same as the preceding problem. The numbers or algebraic expressions may have been different, but the procedures were the same.

Repetition [RR]

This category indicates the problem was exactly or mostly the same as one of the preceding problems in the lesson.

Dependent [D]

This category indicates the solution to the previous problem is necessary to solve the current problem.

Dependent [DD]

This category indicates the solution to one of the previous problems in the lessons was necessary to solve the current problem.

Extension [EX]

This category indicates the problem required many of the same operations as the preceding problem plus some important additional operations. The category also includes cases where the problem was a generalization of previous problems.

Extension [EEX]

This category indicates the problem required many of the same operations as a previous problem in the lesson plus some important additional operations.

Simplification [S]

This category was assigned when the problem illustrated a simpler example of the previous problem or was used to provide emphasis (e.g., to compare $a + a$ with $a \cdot a$).

Elaboration [E]

This category indicates the problem was similar to the previous problem but used a different set of operations (e.g., solving the problem another way).

Thematic Connection 1 [T1]

This category indicates the problem required operations that were much different than the first. However the mathematics topic was similar. This code was only used when there was a mathematical thematic connection and no other relationship applied (e.g., finding the mean and the median of a set of numbers)

Thematic Connection 2 [T2]

This category indicates the connection was with the scenario. The code was only used when no other relationship applied and a thematic connection was apparent.

Unrelated [U]

This category was assigned when the problem required operations much different than other problems in the lessons and neither of the thematic codes applied.

Since initial reliability scores for this code were below 85 percent, the team agreed to collapse some of the coding categories. R and RR were collapsed, D and DD were collapsed, and EX and EEX were collapsed, resulting in 8 final categories of relationships.

7.1.4 Reliability

The members of this group each established reliability with the director by coding a randomly selected set of lessons from each country. They computed initial reliability as well as reliability after approximately two-thirds of the lessons had been coded. Their percent agreement was above 85 percent for each of the three codes at both time points.

Initial reliability was computed on a set of 33 randomly selected lessons. The set included five lessons from each of six countries (Australia, the Czech Republic, Hong Kong SAR, the Netherlands, Switzerland, and the United States), and three lessons from Japan.
Altogether the 33 lessons contained 747 problems. This meant there were 747 topic and procedural complexity codes and 713 relationship codes (since the initial problem in each lesson was not assigned a relationship code).

The director of the mathematics problem analysis group prepared a “master” for each lesson. Table 7.1 lists the percentage agreement for each code between each of the two coders and the director. Also noted is the average percentage agreement for each code with the two coders’ scores combined.

Table 7.1. The mathematics problem analysis group’s initial reliability scores: 1999

Coders	Topic (percent agreement)	Procedural complexity (percent agreement)	Relationship (percent agreement)
Coder 1	90	83	87
Coder 2	88	90	88
Combined	89	87	88

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Midpoint reliability was established after approximately two-thirds of the lessons had been coded. Again, the director prepared a “master” for each lesson. However, the two coders each coded different lessons. Coder 1 coded 10 lessons and coder 2 coded 8 lessons. Coder 1’s lessons included 237 problems (237 topic and procedural complexity codes, and 227 relationship codes). Coder 2’s lessons included 135 problems (135 topic and procedural complexity codes, and 127 relationship codes). Their reliability is presented in table 7.2

Table 7.2. The mathematics problem analysis group's midpoint reliability scores: 1999

Coders	Topic (percent agreement)	Procedural complexity (percent agreement)	Relationship (percent agreement)
Coder 1	92	92	84
Coder 2	87	88	87
Combined	90	90	88

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

7.2 Mathematics Quality Analysis Group

A second specialist team possessed special expertise in mathematics and teaching mathematics at the postsecondary level. The mathematics quality analysis group was directed by Alfred Manaster (University of California, San Diego) and included Phillip Emig (California State University, Northridge), Wallace Etterbeek (Sacramento State University), and Barbara Wells (University of California, Los Angeles). The same team previously was commissioned to develop and apply codes for the TIMSS 1995 Video Study. The mathematics quality analysis group reviewed country-blind written records for a randomly selected subset of 20 lessons from each country except Japan. Japan was not included because the group already had analyzed a subsample of the Japanese lessons as part of the TIMSS 1995 Video Study which meant, among other things, that country blindness could not be ensured (see Stigler et al. (1999) and Manaster (1998) for a report of the group's findings in the 1995 Study).

7.2.1 Developing Extended Lesson Tables

Specially trained members of the international video coding team created extended written records for each lesson in this subset. These records contained substantially more detail about the mathematics and pedagogy in the lesson than those used by the mathematics problem analysis group. These 120 tables all followed the same format: they included details about the classroom interaction, the nature of the mathematical problems worked on during class time, descriptions of time periods during which problems were not worked on, mathematical generalizations, labels, links, goal statements, lesson summaries, and other information deemed relevant to understanding the content covered during the lesson. Most tables were accompanied by an appendix that contained screen-shots from the video[16], mainly including graphics that provided information about the statement or solution of a problem or other mathematical assertion.

The tables were "country-blind," with all indicators that might reveal the country removed. For example, "pesos" and "centavos" were used as units of currency, proper names were changed to those deemed neutral to Americans, and lessons were identified only by an arbitrarily assigned ID number. The mathematics quality analysis group worked solely from these written records, and had no access to the video data.

[16] These screen shots did not include pictures of teachers or students, or any other information which could be used to identify the country.

7.2.2 Constructing Timelines

The group's first step in analyzing these tables was to divide each lesson into segments and construct a timeline that reflected the flow of the mathematics in the lesson. The timeline began with the first presentation of material or discussion directly related to mathematics. A new segment started when there appeared to be a significant shift in the mathematics content. Each segment was described according to the mathematics presented, and also indicated how the content was treated—for example by students working individually or in groups, or by a public presentation of problems.

A draft timeline and description of each segment was prepared by at least one of the four group members, and then reviewed and revised until there was unanimous agreement by the entire team. Considerable discussion sometimes occurred prior to agreement on the segment divisions and the description of content within each segment.

7.2.3 Developing and Applying the Coding Scheme

Based on the extended lesson tables and timelines, the mathematics quality analysis group created and applied a coding scheme to describe both the segments and the lessons as whole units. The scheme was reviewed by mathematics experts in each country and then revised based on the feedback received.

The group applied their coding scheme by studying the written records of the lessons and reaching consensus about each judgment. In the sections below each code is described in more detail, following the order in which they were discussed in the international report.

7.2.3.1 Content Level

The group rated the content level of each lesson on a scale from 1 (elementary) to 5 (advanced), considering the curriculum covered over the span of the lesson. A score of 3 (moderate) was given to lessons that included content often encountered by students just prior to the standard topics of late elementary or early secondary algebra. One rating was assigned to each lesson based on the rating that best described the content of the lesson, taken as a whole.

7.2.3.2 Procedural, Conceptual, or Notational Mathematics

Each lesson segment was classified as containing procedural, conceptual, and/or notational mathematics. Segments might have contained one or more of these types of mathematics, or none of them.

Lesson segments containing procedural mathematics included those in which problems were solved by executing procedures that appeared to be known by the students. They were also coded when a procedure was presented without much explanation.

In conceptual segments the mathematical concepts, ideas, or procedures were developed. For example, a procedure might have been introduced as the outgrowth of an underlying mathematical property. Segments of conceptual mathematics might have included examples and explanations for why things work like they do. Often the development and first application of a solution procedure was coded as conceptual, whereas subsequent occurrences of the method were coded as procedural.

Segments were characterized as notational when a mathematical definition was presented, or when notational conventions commonly used in mathematical activity were discussed.

*7.2.3.3 **Mathematical Reasoning: Deductive, Developing a Rationale, Generalizations, and Counter-examples***

The mathematics quality analysis group found few instances of mathematical reasoning in the TIMSS 1995 Video Study data. Therefore, for the TIMSS 1999 Video Study, they elaborated and sharpened their coding scheme in an attempt to identify a variety of special reasoning forms that might be present in eighth-grade mathematics lesson. They still required the reasoning to be explicit in order to be marked as such. An exception to this general rule was made when the nature of the problem being solved required reasoning for its solution.

Several kinds of reasoning were recorded whenever they were seen explicitly in a segment of the lesson. Deductive reasoning refers to the derivation of a conclusion from stated assumptions using a logical chain of inferences. There was no requirement that the derivation be formal (e.g., a formal proof), but there was usually an accompanying explanation.

Developing a rationale was coded when there was an explanation or motivation, in broad mathematical terms, of a mathematical assertion or procedure. This type of reasoning was less systematic or precise than deductive reasoning. For example, teachers might show that the rules for adding and subtracting integers are logical extensions of those for adding and subtracting whole numbers, and that these more general rules work for all numbers. When such explanations took a systematic logical form, they were coded as deductive reasoning; when they took a less systematic or precise form, they were coded as developing a rationale.

Generalizations were marked when several examples led to the formulation of an assertion about their shared properties. This process is similar to what many people call inductive reasoning. Generalizations might involve, for example, graphing several linear equations such as $y = 2x + 3$, $2y = x – 2$, and $y=-4x$, and making an assertion about the role played by the numbers in these equations in determining the position and slope of the associated lines.

Segments were coded as containing a counter-example whenever an example was used to show that an assertion cannot be true. For instance, suppose someone claims that the area of a rectangle gets larger whenever the perimeter gets larger. A counter-example would be a rectangle whose perimeter becomes larger but the area does not become larger.

7.2.3.4 <u>Overall Judgment of Mathematical Quality: Coherence, Presentation, Student Engagement, and Overall Quality</u>

The mathematics quality analysis group made four judgments about the mathematical quality in the lessons, using a 5-point rating scale for each judgment. First they rated the lessons on coherence. That is, how well the mathematical components of the lesson were interrelated, ranging from "fragmented" to "thematic." A rating of 1 indicated that the lesson had multiple unrelated themes or topics, and a rating of 5 indicated that the lesson had a central theme that progressed saliently through the whole lesson.

Presentation ratings were based on the extent to which the mathematics was developed over the course of the lesson, on a scale ranging from "undeveloped" to "fully developed." The rating depended upon the extent to which mathematical reasons and justifications were provided for the mathematical results presented or used in the lesson and the quality of these mathematical arguments. This judgment also took into account whether links were made between known material and less familiar material, and whether mathematical errors were made by the teacher. The lowest rating was applied to lessons that were descriptive or routinely algorithmic with little mathematical justification provided for why things work like they do. The highest rating was applied to lessons in which concepts and procedures were mathematically motivated, supported, and justified.

The group also examined the likely extent of students being actively engaged with meaningful mathematics during each lesson. The scale ranged from very unlikely to very likely. A rating of very unlikely indicated a lesson in which students were asked to work on very few problems and those problems did not appear to stimulate reflection on mathematical concepts or procedures. A rating of very likely indicated a lesson in which students were expected to work actively on, and make progress solving, problems that appeared to raise interesting mathematical questions for them and then to discuss their solutions with the class.

The last judgment made by the mathematics quality analysis group concerned the overall quality of the lesson. This judgment took into account the three codes described above— coherence, presentation, and student engagement—and was defined as the opportunities that the lesson provided for students to construct important mathematical understandings. The rating scale ranged from low to high.

7.3 Problem Implementation Analysis Team

The problem implementation analysis team was directed by Margaret Smith (University of Iowa) and included Christopher S. Hlas (University of Iowa). They analyzed a subset of mathematical problems and examined 1) the types of mathematical thought processes implied by the problem statement and 2) whether or not those mathematical processes were publicly addressed in the completion of the problem. That is, the team explored whether the assumptions about the kinds of mathematics students would participate in—based on the kinds of problems they were assigned—were realized in the completion of those problems.

Mathematical processes in the problem statement and completion of the problem were determined by examining the types of mathematical thinking and reasoning typically associated with the problem statement and those made explicit during public discussion of the problem. For example, the team determined whether the problem asked students to conjecture or reason, or whether the problem statement was one typically associated with the execution of a mathematical procedure. Then they explored whether the problem was completed in a way that reflected the problem statement, or whether there was evidence of mathematical reasoning not implied by the problem statement.

Using the video data, translated transcripts, and the same lesson tables provided to the mathematics problem analysis group (see section 7.1), the problem implementation analysis team analyzed only those problems that were publicly completed during the videotaped lesson (that is, those independent and concurrent problems for which a target result was publicly presented, as described in chapter 6). Problems had to be publicly completed in order for the group to validly code "problem implementation." Furthermore, the group did not analyze data from Switzerland, since most of the Swiss transcripts were not translated into English.

Reliability was established by comparing a random set of 10 lessons from each country coded by the director of the group with one outside coder. Reliability of at least 85 percent was achieved for both codes across all countries.

Coding by the problem implementation analysis group was carried out in two phases. In the first phase, coders identified the nature of each problem statement that was assigned to students. In the second phase, coders identified the problem implementation type for each problem completed publicly during the videotaped lesson.

7.3.1 Coding Problem Statement Types

Problem statements for all independent and concurrent problems were identified in lesson tables created by the international coding group (see chapter 6). One of three mutually exclusive and exhaustive coding categories was applied to each problem statement, which identified the main mathematical process objective implied by the problem statement. These categories were assigned without consideration of the information or problems that had previously been presented in the lesson. It was assumed that such contextual information would be captured in the problem implementation code (National Assessment Governing Board 1999; Robitaille 1995; Schmidt et al. 1997; U.S. Department of Education 1999).

7.3.1.1 Problem Statement—Using Procedures

Problem statements coded as "using procedures" were those typically associated with routine algorithms such as calculations, symbol manipulation, and practicing of formulae. These problems are generally associated with following a routine process or set of "steps." This category did not imply that there were no mathematical decisions to be made, but rather that the decisions assumed a set path—such as in a computer decision-making scheme. For example, in a problem such as "Solve for x in the equation 3x+4=2x–1" students could make decisions about how to rearrange the equation that lead to a certain routine path (i.e., a student could choose to add 1 to both sides or subtract 2x from both sides.) Other examples of problem statements coded as using procedures are the following: "Given two sides of a rectangle find the area" and "Calculate the length of the hypotenuse of a right triangle given the length of two sides."

Not all using procedures problems were decontextualized. For instance, the following "application" problem would be coded as using procedures: "A summer parks recreation program has space for 60 campers. On the first day of enrollment 32 campers enrolled. Reduce 32/60 to lowest terms to find out what fraction of the space is filled." The key aspect was that the problem asked students to complete a problem typically associated with routine procedure.

7.3.1.2 __Problem Statement—Making Connections__

Problem statements coded as making connections were those that asked students to engage in special forms of mathematical reasoning such as conjecturing, generalizing, and verifying. They were situations that asked students to think about mathematical concepts, develop mathematical ideas, or extend concepts and ideas.

As noted above, application or contextualized problem statements were not necessarily coded as making connections. Conversely, making connections problem statements did not need to be contextualized. An example of a decontextualized making connections problem statement would be if students were given an equation and then asked to determine the effect of changing one of the coefficients on the corresponding graph (e.g., "What if instead of y=3x+4 I had a negative three, so it was y=-3x+4. Would that do anything to my graph?").

Some other examples of making connections problem statements included those that asked students to find a pattern, describe a relationship, generalize, compare results and methods, find examples of a mathematical principle, or write a problem with given conditions.

7.3.1.3 __Problem Statement—Stating Concepts__

Problem statements coded as stating concepts asked students to recall information regarding a mathematical definition, formula, or property. These problems typically had one step in which the recall of such information was needed to fit the example to a definition or property. Examples include: "Plot the point (3, 2) on a coordinate plane" and "Draw a polygon that is not convex."

7.3.2 Coding Problem Implementation Types

After coding the types of problem statements in a lesson, coders identified the way in which each problem was completed, or implemented, during the videotaped lesson. Because the problem implementation code was designed to capture the types of mathematical processes made explicit during the lesson, only communication that was available to the whole class was used for these coding decisions. Coders relied upon all public verbal and non-verbal communication occurring after the problem statement and through the completion of the problem to apply this code.

When coding for problem implementation, coders were asked to consider the underlying mathematical concepts of the problem and to think about the connections that were discussed during the lesson. There were no "cue" words that coders could depend upon to identify the type of implementation. For example a teacher asking a student to "explain why" did not necessarily mean that there would be a discussion of mathematical principles and relationships. Additionally, coders could not consider time as indicative of the type of mathematical processes that transpired. For example, a class might have taken a long time to work through a problem, the discussion of which consisted solely of listing of the procedures that were used.

Coders needed to rely heavily on their knowledge of mathematics when considering the nature of the mathematical processes made explicit during the implementation. To help coders to make coding decisions, two rules of thumb were created:

> Rule 1: When unsure of the code you would like to apply, pretend that the problem is being completed in a different country and decide what code you would assign if it took place in that country. It will be useful to consider using a country that appears different from the one coding. For example, if coding a lesson in the United States, consider the code you would apply if the conversation were taking place in a Japanese lesson.
>
> Rule 2: When unsure about how explicit the nature of the mathematical talk is, assume that you are a student struggling to understand the intended concept. Consider the types of communication available for you, as the student, to try to make sense of it.

Using these rules, one of four mutually exclusive and exhaustive coding categories was applied to each problem implementation, as described in the sections below.

7.3.2.1 ***Problem Implementation—Giving Results Only***

Problem implementations were marked as giving results only when the public talk about the problem centered solely on the statement of the final result. The only additional talk that may have occurred was a statement of the problem. No intermediary steps or connections were discussed or shown publicly.

This implementation type was applied to problems where the teacher read off the solutions, or "cycled" through students trying to solicit the correct answer. It was also possible that the final result was displayed on the board or overhead. If such a display included the steps used to complete the problem then it was not coded as giving results only.

7.3.2.2 ***Problem Implementation—Using Procedures***

The problem implementation was coded as using procedures when the routine execution of an algorithm was used to work on and complete a problem. Generally speaking, in this type of problem students and teacher talked only about how to progress to find the answer, such as stating the steps taken along the way.

Some "why" questions may have been addressed during the execution of the problem, but in using procedures implementations the responses to such questions included only descriptions of how to complete the problem or the "rule" that was being followed, rather than focusing on the underlying mathematical concepts. For example, the teacher might have responded to a why question by saying "You need to divide 5 on both sides because whatever you do to one side you do to the other," rather than addressing what it means for two groups to contain equal quantities or some other underlying mathematical concept.

7.3.2.3 ***Problem Implementation—Making Connections***

Problem implementations were coded as making connections when the completion of such problems included mathematically rich discussions. Such discussions might focus on mathematical relationships, and include descriptions of properties and concepts containing mathematical justifications that were not stated as rules but as logically necessary consequences. If applicable, relationships between examples and principles might be demonstrated. Moreover, these mathematical ideas and relationships needed to be made explicit for all members of the class to see and think about the connections.

Some examples of making connections problem implementations included: describing connections between multiple representations (i.e., pictorial and numeric), making and justifying generalizations, comparing the mathematics of different solution methods, and considering why a particular process was mathematically appropriate.

7.3.2.4 ***Problem Implementation—Stating Concepts***

A problem implementation was coded as stating concepts if, during the completion of the problem, the class alluded to a mathematical concept but did not provide any descriptions of mathematical relationships or note why the concept was appropriate for the given situation. In other words, the mathematics discussed included more than a statement of the steps that were followed, but there was no description of how the example was related to underlying mathematical concepts.

Stating connections problem implementations included: stating a formula without addressing why the formula was appropriate for the given example, stating a property as justification (i.e., distributive property), and citing a definition without describing its relationship to the given problem.

Early coding attempts revealed a tendency to apply this code more frequently than others, likely because it was a "middle ground." To help to avoid this error in coding, coders were asked to identify what mathematical concept(s) were addressed and then to identify what additional explanation would have been necessary for the problem implementation to be coded as making connections. Making these explicit allowed coders to identify features of the implementation that differentiated stating concepts implementations from using procedures or making connections implementations.

7.3.3 Examples

To help describe how problems were coded and to show how different implementations of the same problem statement might look, some examples are provided. The first example shows how a using procedures problem statement could be implemented as either using procedures or as making connections. The second example shows how a making connections problem statement could be implemented as making connection or as using procedures. These examples are based on problems that occurred during the videotaped lessons.

7.3.3.1 <u>Using Procedures Problem Statement Implemented as Using Procedures</u>

The following problem would be coded as a using procedures problem statement with a using procedures implementation:

Solve for x in the equation 2x + 3 = x - 5.
A student describes the steps used to arrive at the result of x=-8.
Student: *First I subtracted x from both sides and got 2x + 3 - x = x - 5 -x and then I combined like terms and got x + 3 = -5. So then I subtracted 3 from both sides and got x = -5 - 3 which is equal to -8.*

7.3.3.2 <u>Using Procedures Problem Statement Implemented as Making Connections</u>

The same problem statement as in the example above (*Solve for x in the equation 2x + 3 = x – 5)* would have a making connections implementation in the following scenario:

The class discusses the fact that this equation has one solution (i.e., x = -8). They compare this equation with those equations that are identities—for which all values of x hold true. Such a discussion would lead the implementation to be considered as making connections because the class is trying to connect ideas about what makes an equation have one solution rather than an infinite number of solutions.

Teacher: *What did you do?*
Student 1: *First I tried to see if all values of x would solve the problem.*
Teacher: *How did you do that?*

Student 1: *Well, first I tried some values and found that they did not always come out equal if I plugged them in for x. So, 2 times 1 is 2, plus 3 is 5, but 1 minus 5 is negative 4 not positive 5.*

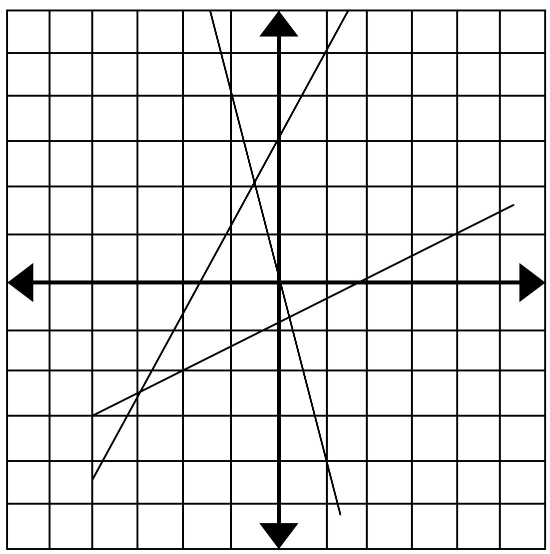
Teacher: *So, do you know for sure?*
Student 2: *I tried to make the two sides look the same. I multiplied x and negative 5 by negative 2 and got 2x - 10 but -10 is not +3 so they were not the same.*
Student 3: *Well, Student 1 would have to try all the numbers which would take a very long time. But Student 2 does not because she could not find one number that would make the two sides equal when multiplying.*

Student 4: *I just went and tried to make x equal to something, not just x equal to x. So, I worked the problem and got x equal to -8. If I had not gotten x equal to -8 but got something like 2 equals 2 or something like that, then I would know that anything I put in for x could be used because both sides of the equation are saying the same thing. Like when we did 2x - 6 = 2(x-3) and we found that we could use any number for x and always get both sides to equal each other. Then we had to see what was making both sides of the equation the same thing. But in this problem since I got a value for x that means it can only be that one value.*

7.3.3.3 <u>Making Connections Problem Statement Implemented as Making Connections</u>

The following problem would be coded as a making connections problem statement with a making connections implementation:

Using the equations y=2x+3, 2y=x-2, and y=-4x, examine the role of the numbers in determining the position and slope of the associated lines.
After constructing the graph, students discuss different aspects of the lines and how these aspects relate to the graphs of each line.



As part of this discussion, students try to make sense of the connection between an equation written in y=mx+b form to its graphical representation. After considering the role the constant plays in determining where the line crosses the y-axis, the class begins to discuss the relationship between the equation, the graph, and substituting 0 for x. They resolve that it is okay to generalize that in y=mx+b form the constant determines where the line crosses the y-axis because substituting zero for x in this form of the equation is the same thing. The second part of the discussion transpires in a similar manner and looks at the effect the sign of "m" has on the position of a line. This discussion involves examining the role of the sign in the equation as well as in the graph.

This type of implementation would be coded as making connections because the class connects different representations, discusses the effects that changes have on these representations, and considers ways to generalize and justify these generalizations. (Sample dialogue was not provided for this example because it would be complex and lengthy.)

7.3.3.4 __Making Connections Problem Statement Implemented as Using Procedures__

The same problem statement as in the example above (*Using the equations y=2x+3, 2y=x-2, and y=-4x, examine the role of the numbers in determining the position and slope of the associated lines)* would have a using procedures implementation in the following scenario:

A student graphs each of the lines on the chalkboard, and then discusses the steps he used.

Student: *The first one is already in y = mx + b form, so I started at 3 on the y-axis and went up 2 and over 1 because m is 2. Then I connected the points. For the next one I had to divide both sides by 2 so I got y = 1/2 x - 1. I started at -1 and went up 1 and over 2 this time because m is ½, not 2, here. For the last one there was no b, so I plugged in 0 for x and got 0 for y, then I plugged in 1 for x and got negative 4 for y, and then I plugged in -1 for x and got 4 for y. I plotted those three points then connected them.*

Teacher: *Okay, so those are your three lines. Any questions?. . .No? Okay, next lines.*

7.3.4 Reliability

Two coders independently coded 10 lessons from each country, which is at least 10 percent of the lessons from each country. These lessons were randomly selected from those lessons that included at least one problem that was completed publicly during the lesson. Reliability was calculated by comparing the number of agreements with the total number of independent problems (IPs) and concurrent (sets of) problems (CPs) with the at least one target result presented publicly in the videotaped lesson. Average inter-rater agreement for problem statements and implementations is shown in table 7.3.

Table 7.3. Average inter-rater agreement in coding for problem statement and problem implementation types, by country: 1999

Country	Agreement on problem statements (percent)	Agreement on problem implementations (percent)
Australia	87	90
Czech Republic	90	91
Hong Kong SAR	92	90
Japan	95	93
Netherlands	87	89
United States	90	88
Average reliability	90	90

NOTE: Inter-rater agreement was calculated as the number of agreements divided by the sum of the number of agreements and disagreements.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

7.4 Text Analysis Group

The text analysis group used designated portions of the mathematics lesson transcripts to conduct various discourse analyses. The group was directed by Bruce Lambert (University of Illinois at Chicago) and included Clement Yu (University of Illinois at Chicago), David Lewis, Fang Liu (University of Illinois at Chicago), Rodica Waivio (University of Illinois at Chicago) and Sam Mansukhani (University of Southern California). The group employed computer software to conduct quantitative analyses of classroom talk during periods of public interaction. Word-based or lexical features were used to analyze the teacher and student talk in the mathematics lessons.

Because of resource limitations, computer-assisted analyses were applied to English translations of lesson transcripts. In the case of the Czech Republic, Japan, and the Netherlands all lessons were translated from the respective native languages, and in the case of Hong Kong SAR, 34 percent of the lessons were conducted in English, so only 66 percent were translated. English translations of Swiss lessons were not available.

Transcriber/translators were fluent in both English and their native language, educated at least through 8th grade in the country whose lessons they translated, and had completed two-weeks training in the procedures detailed in the TIMSS 1999 Video Study Transcription and Translation Manual. A glossary of terms to was developed to help standardize translation within each country.

The translation and transcription of lesson videos was organized and supervised by David Olsher (University of California at Los Angeles), Wendy Klein (University of California at Los Angeles), Lindsey Engle (University of California at Los Angeles), Don Favareau (University of California at Los Angeles), and Susan Reese (LessonLab).

7.5 Conclusion

In addition to the team of international coders described in chapter 6, four specialist groups were enlisted to analyze portions of the TIMSS 1999 Video Study mathematics data. The mathematics problem analysis group and the problem implementation analysis group studied the mathematical problems in the lessons, and the mathematics quality analysis group made judgments about the nature of the mathematics presented in the lessons. Each of these three groups was comprised of individuals with particular expertise in mathematics, mathematics education, and teaching. A fourth group, the text analysis group, created and implemented specially designed software to study the nature of the classroom talk in the lessons.

Chapter 8. Weighting and Variance Estimation

8.1 Introduction

As described in chapter 3, the samples of classrooms for the study were selected using two-stage probability sampling methods. The first stage of selection was the sample of schools. For each subject area (mathematics and science) the second stage involved the random selection of one eighth-grade classroom. Some countries participated for only one subject area, so that one classroom was selected from the eighth-grade classes in that subject area.

To make valid inferences from the data, it was necessary to account for the features of the sample design in the analysis. There were two components to this process. The first was to incorporate into the analysis survey weights that reflected the selection mechanism (in particular the selection probabilities used to draw the samples) and also any nonresponse at the school or classroom level. These survey weights were added so that the estimates from the data would be unbiased as estimates of the relevant parameters in the full population of classes.

The second feature that needed to be accounted for was the effect of the design on the sampling variances of the estimates. Usually in a two-stage design, there is concern about the effects of clustering the data within first-stage sampling units. Because in the TIMSS 1999 Video Study only one classroom was selected from each school, per subject, the important feature that must be accounted for was the stratification employed as part of the school sampling process. For the United States it was also important to reflect the slight clustering of the school sample within the selected geographic primary sampling units (see chapter 3). This was achieved by using the jackknife procedure, which could be implemented in data analyses by utilizing a set of 50 jackknife replicate weights.

This chapter includes the following information:

- the procedure for applying base weights to the sampled classes, reflecting the probability of selection;
- the procedure for conducting nonresponse adjustments to the weights;
- the jackknife replication variance estimation procedure and how it was implemented;
- how the survey weights and replicate weights should be used for analyzing the data; and,
- the response rates for the study.

Flowcharts that describe the detailed steps for weighting the data for each country are included in appendix J. These charts show the order in which the various steps were implemented in each country and the number of records processed at each step. Although each country required a unique approach to weighting, common features applied. The output from the school sampling for each country was obtained from the country representative. This was used to create initial school weights, giving the reciprocal of the selection probability of the school, and also to establish the pattern for the jackknife replicate weights. Then these weights were adjusted for school nonresponse, where required. In most cases Westat proprietary SAS (Statistical Analysis Software) macros for creating jackknife replicate weights and carrying out nonresponse adjustments were used for this purpose, as is reflected in the flowcharts by reference to "REP_BWGT.MAC", "REP_PREP.MAC", and "COLL_ADJ.MAC".

The material in this chapter covers the weighting procedures for the TIMSS 1999 Video Study. The weighting procedures for the TIMSS 1995 Video Study, conducted in Germany, Japan, and the United States, are described in a separate report (Rizzo 1996).

8.2 Classroom Base Weights

Classroom base weights were calculated from two components: school selection probabilities and classroom selection probabilities. In all countries except the United States, the school selection probabilities were based on the probability of each school in the school sample. Classroom selection probabilities were based on the probability, within each school, of the selected classroom.

8.2.1 School Selection Probabilities

Classroom base weights were created by Westat, based on information about the school sampling process provided by the national research coordinators in each country. Such information either included the probability of selection of each school in the sample, or enough detail so that the probability could be readily determined. The selection probability for school, i, was denoted as P_i.

In most countries replacement schools were used to replace selected schools that did not participate. The exceptions were the Italian-speaking area of Switzerland (where all schools were included in the study) and the United States. When replacement schools were used, they were assigned the selection probability that was associated with the replacement school itself. That is, each school was assigned the probability that it would have been selected in the initial sample (although, of course, it was not selected initially). In most cases the original and replacements were very similar schools, and in particular they were similar in size. This meant that the original and replacement schools generally had very similar probabilities of selection to the initial sample.

For the United States the first stage of sample selection consisted of selecting 52 geographic primary sampling units (PSUs). These PSUs were selected with probabilities proportional to population size, with the ten largest metropolitan areas in the country selected with certainty. Then from an aggregate list of schools within the 52 PSUs, a sample of 110 schools was selected. The school selection probability of each of these 110 schools was, therefore, the product of two probabilities: 1) the PSU selection probability, and 2) the school within PSU selection probability.

The school within PSU probabilities were constructed such that when the two probability components are multiplied together, the school selection probability looks just as it would if the sample had been drawn directly from the entire list of schools in the country. Thus the introduction of this additional stage of sampling had no real impact on the base weights assigned to the schools. It did, however, affect the sampling variability of the study estimates. This was therefore reflected in the method of estimating sampling variances via the jackknife procedure, as described in section 8.4.

8.2.2 Classroom Selection Probabilities

One classroom (per subject area) was selected from each school. The classrooms within a school were each given an equal chance of selection. Thus if the number of classes for a subject area in school i was C_i, the classroom selection probability of the selected classroom was $\frac{1}{C_i}$.

8.2.3 Classroom Base Weights

The base weight for each classroom was the reciprocal of the product of the school selection and classroom selection probabilities. That is, for a classroom selected from school i, the base weight, BW_i, was calculated as:

$$BW_i = \frac{C_i}{P_i}.$$

The classroom base weights have the following property: had all schools participated (or been successfully replaced), then the sum of these weights across the entire sample within the country would give an unbiased estimate of the total number of classrooms in a country (or close to an unbiased estimate when replacement schools were used). This property also holds true for subpopulations within a country, such as those defined by type of school or geographic region.

Thus in the absence of nonresponse, these classroom base weights are a mechanism to provide valid generalizations from the sample to the national population. They correct any imbalance that may have arisen in the sample, either as the result of intentional oversampling of some kinds of schools or due to imperfections in the information about the size of a school available at the time of sampling.

In the Czech Republic and Hong Kong SAR, there was 100 percent response once replacement schools were taken into account. Therefore the base weights have the property described above. In the other countries, however, nonresponse adjustments were needed to ensure that the results from data analyses would be close to unbiased.

8.3 Nonresponse Adjustments

This section describes the procedure for creating nonresponse adjustments to compensate for cases where a sampled school had one or more eligible classes but none was videotaped.

First, schools were grouped into cells. The principles in forming cells were that: a) schools within the same cell should be somewhat similar with respect to characteristics that might relate to the phenomena being studied; b) there were at least six responding schools (i.e., the selected classroom was videotaped) in each cell; and c) as many cells could be formed as were reasonable given constraints a) and b).

The idea behind nonresponse adjustments was to compensate for missing data from nonresponding schools by increasing the weights of similar responding schools. Principles a) and c) above were aimed at making the schools that receive such weight adjustments as similar to the nonresponding schools as possible. If such an effort were carried to too great an extreme, however, the beneficial effects of reducing nonresponse bias could be outweighed by the increase in sampling variance that results from assigning different weights to different classes. Principle b) above addressed this concern.

The nonresponse cells were generally based on the sampling stratification variables. There were two reasons for this. The sampling strata were often chosen for the sample design because they were known or thought to be related to the study outcomes. Thus they also make good characteristics for forming nonresponse adjustment cells. The second reason was that the stratification variables were known for the nonresponding schools, but there was little other relevant information available about them. Table 8.1 presents the variables used to form nonresponse adjustment cells and the number of cells created for each country.

Table 8.1. Variables used to form nonresponse adjustment cells and the number of cells created, by country: 1999

Country	Variables used to define nonresponse adjustment cells	Number of nonresponse adjustment cells	Maximum nonresponse adjustment
Australia	Explicit sampling strata	8 (4 of these cells had no nonresponse)	1.57
Czech Republic	No nonresponse after replacement	—	—
Hong Kong SAR	No nonresponse after replacement	—	—
Japan	Explicit sampling strata	4 (2 of these cells had no nonresponse)	1.31
Netherlands	Explicit sampling strata	7 (1 of these cells had no nonresponse for math; 2 for science)	1.42 (mathematics) 1.42 (science)
Switzerland			
French-speaking	Canton[1]	2 (1 of these cells had no nonresponse)	1.48
German-speaking	Nonresponse adjustments made by the national research coordinator	—	—
Italian-speaking	School level and size	3	1.44
United States	Urban/suburban/rural (derived from type of location)	3	1.41 (mathematics) 1.34 (science)

— Not applicable
[1]A canton is the equivalent of a province or state.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Within each nonresponse adjustment cell, a nonresponse adjustment factor was calculated as:

$$NRF = \frac{\sum_{i \in \left\{\begin{array}{c}\text{eligible}\\ \text{sampled}\\ \text{schools}\end{array}\right\}} BW_i}{\sum_{i \in \left\{\begin{array}{c}\text{responding}\\ \text{schools}\end{array}\right\}} BW_i}$$

The final weight for the classroom selected from school i (FW_i) was given as the product of the classroom base weight, BW_i, and the nonresponse adjustment factor for the cell to which the school belonged, NRF_i. That is:

$$FW_i = BW_i \times NRF_i$$

Note that in the Netherlands and the United States, the nonresponse adjustments sometimes varied by subject area. This variation was due to the fact that in some schools in these countries the selected class was videotaped for one subject but not the other. In addition, in some schools in the United States the number of eighth-grade mathematics and science classes were not the same.

8.4 Variance Estimation using the Jackknife Technique

Sampling variances were computed for each country using the jackknife technique. This technique takes into account the design used to select the classroom samples as well as the effect on sampling variance due to the nonresponse adjustments. Nonresponse adjustments were computed in order to mitigate against any nonresponse bias. However, since these adjustments involved calculating ratios of sample estimates within cells and then applying these ratios to the weights, they also have an impact on the sampling variances of estimates derived from the study. The variance estimates obtained via the jackknife approach reflect this appropriately.

The general jackknife technique was implemented as follows: The selected schools were sorted in the order in which they were sampled. That is, they were sorted by explicit sample stratum and then within that sort they were arranged in the order that they were in prior to the systematic selection. Then successive schools were paired.

A single jackknife replicate was created by dropping one of the schools from the sample and doubling the contribution of the complementary pair member of the dropped school. Then the statistic of interest was re-estimated using the modified data set so created. This process was repeated by successively dropping one member (chosen at random) from each of the pairs of schools. For this study the typical design was to select 100 schools, giving rise to 50 pairs of schools. Thus in this way 50 replicate estimates could be derived corresponding to each estimate made from the full data set.

If in general T jackknife replicates are formed, numbered by t = 1,2, …., T, then the appropriate formula for the variance of an estimate, $\hat{X}$, is given by

$$\mathrm{var}\left(\hat{X}\right)=\sum_{t=1}^{T}\left(\hat{X}_{(t)}-\hat{X}\right)^2$$

where the sum from $t=1$ to T is over the replicate estimates, and $\hat{X}_{(t)}$ denotes the estimate of X derived from replicate t.

In practice the jackknife replication procedure is most straightforwardly implemented by creating a set of separate weight variables, one corresponding to each replicate. The weight variable was constructed by setting to zero the replicate weight of the school that was dropped for the replicate in question and giving its complementary school a replicate weight that was double its base weight. All the other schools got a replicate weight for that particular replicate that was the same as its base weight. Thus if 50 replicates were formed, a given school would have 49 of its replicate weights equal to the base weight with the fiftieth being either zero or twice the base weight.

Once these replicate weights have been created from the base weights, the nonresponse adjustment procedures are applied to the full set of replicate weights, just as for the full sample base weight. Thus the final replicate weights for each school may vary somewhat from being equal to the school's full sample weight, or double that weight, or zero, because of different nonresponse adjustment factors calculated for each replicate.

For example, the full sample nonresponse adjustment that applies to a particular school might have a value of 1.1. When the nonresponse adjustment is recalculated for a given replicate (the first, say), the nonresponse adjustment calculated for that school for that replicate might be 1.09, for example. Thus once the nonresponse adjustments are applied to the base weights, for the full sample and each replicate, the pattern of replicate weights will no longer follow the simple relationship to the full sample weight (that applied to the replicate base weights) whereby each replicate weight was either equal to its full sample weight, double that weight, or zero. In this way the replicate weights are able to reflect the impact of the nonresponse adjustments on sampling variance.

Some countries did not have 50 pairs of schools. In those cases replicate pairs were formed as described above, and the unused replicate weights were filled out with values equal to the full sample weight. It can be seen from the above formula that one can add an arbitrary number of additional replicate weights, all equal to the full sample weight, without changing the variance estimate. This was done so that all countries would have the same number of replicate weights on the file. This was needed to make analyses that involved multiple countries practical to carry out.

In the United States a modified approach was needed to reflect the use of the PSU stage of sample selection. For schools from within the ten certainty PSUs, the procedure was as described above. For schools in the other 42 PSUs, 21 replicates were formed by pairing the selected PSUs, again by considering the stratification and sample selection ordering. This resulted in 36 pairs within the United States—21 pairs of PSUs and 15 pairs of schools from within the 10 certainty PSUs. The replicate for a pair of PSUs was formed by deleting all the sampled schools from one of the PSUs and doubling the base weights of all the classes from its paired PSU. Then a final set of an additional 14 replicate weights were created by giving each class the full sample weight for each.

The jackknife technique is described in detail in Wolter (1985) and summarized in Rust (1985), and Rust and Rao (1996). Theoretical properties are summarized in Shao (1996). This jackknife approach is essentially the same as that used in 1994–1995 TIMSS, the TIMSS 1995 Video Study, and TIMSS 1999.

8.5 Using the Weights in Data Analyses

As mentioned earlier, valid population inference using the TIMSS 1999 Video Study data required the use of the full sample weights for parameter estimation and the replicate weights for sampling variance estimation.

For estimating parameters, each variable value from a classroom in the data file should be associated with its full sample weight for all statistics. Thus, to estimate the population mean of variable, *X*, measured for each classroom in the sample, the appropriate formula is:

$$\hat{\bar{X}} = \left(\sum_i FW_i \times X_i \right) \bigg/ \left(\sum_i FW_i \right),$$

where X_i is the value of *X* for school *i*.

If estimating the median (or other quartiles), it is the median of the empirical distribution where each class contributes to the distribution in proportion to its value of FW_i. When complex analysis, such as linear regression, are carried out, again each unit should be weighted by FW_i to carry out the analysis.

To obtain appropriate estimates of sampling error, as measured by the estimated standard error of a parameter estimate, the 50 jackknife replicate weights included with the data should be used following the approach described in Section 8.4.

Both the weighting and variance estimation can be carried out using standard statistical software (such as SAS or STATA), or specialized statistical software such as WesVar (Westat 2000) or SUDAAN (version 8 only) (Research Triangle Institute 2001). These specialized programs read in the full sample weights and the 50 replicate weights and automatically apply the approaches to parameter estimation and jackknife replicated variance estimation that are described here.

Most general statistical software can readily apply the full sample weights to arrive at unbiased parameter estimates. However, appropriate standard error estimates cannot be routinely obtained by such software. One must write specific routines to carry out the calculations described in Section 8.4. Because the formula for the jackknife variance estimator takes the same form no matter what the parameter estimator looks like, this is feasible. However, most analysts are likely to find that they can more readily and surely derive appropriate standard error estimates using WesVar or SUDAAN.

The use of the replicate design based on paired schools means that statistical tests on the data should be conducted assuming that the degrees of freedom available for variance estimation is equal to half the number of classrooms in the data. This compares to the standard situation where the number of classrooms would be used as the number of degrees of freedom.

When data from several countries are combined, in general 50 degrees of freedom should be assumed in any analyses. This is because there are only 50 replicate weights on the file no matter how many countries' data are being combined for the analysis.

When conducting analyses that combine data from several countries, it is important to note that, in the absence of any special steps to the contrary, the countries contribute to the combined estimate in proportion to the number of grade 8 classes in the county. Thus the United States will dominate any combined mean, for example. In the case of the mathematics data collected in the TIMSS 1995 Video Study, the situation was exacerbated greatly by the fact that the weights summed to the number of grade 8 students in the country, rather than the number of grade 8 classes (as was the case with TIMSS 1999 Video Study data). Thus a simple combination of the 1999 mathematics data with the 1995 data from Japan will have an overall mean that is dominated by the data from Japan.

8.6 Weighted Participation Rates

This section describes the procedures used to calculate the TIMSS 1999 Video Study's weighted participation rates. A participation rate reflects the proportion of total sampled eligible cases from which data were obtained. In the TIMSS 1999 Video Study, the participation rate indicates the percentage of sampled schools for which videotapes were completed. These rates are presented by country and with the rate components in tables 8.2 and 8.3.

Unweighted participation rates, computed using the actual numbers of schools, reflect the success of the operational aspects of the study (i.e., getting schools to participate). Participation rates weighted to reflect the probability of being selected into the sample describe the success of the study in terms of the population of schools to be represented.

Participation rates were computed both before and after replacement. The participation rate before replacement identifies the proportion of originally sampled schools that participated; the participation rates after replacement gives the percentage of all schools sampled (including original and replacement schools) that participated.

Table 8.2. Mathematics participation rates before replacement, by country: 1995 and 1999

Country	Weighted school participation, before replacement (percentage)	Weighted numerator, before replacement[1]	Weighted denominator, before replacement[2]	Unweighted school participation, before replacement (percentage)	Unweighted numerator, before replacement[3]	Unweighted denominator, before replacement[4]
Australia	61	5,839	9,586	59	59	100
Czech Republic	89	110,877	124,583	89	89	100
Hong Kong SAR	63	49,950	79,286	63	63	100
Japan[5]	96	1,507,288	1,573,369	96	48	50
Netherlands	50	54,454	108,501	50	49	98
Switzerland[6]	71			76	114	151
French-speaking	90	799	886	90	37	41
German-speaking	64	26,089	40,506	67	50	75
Italian-speaking	77	27	35	77	27	35
United States	76	2,105,483	2,755,605	77	83	108

[1]The weighted numerator is the sum of the sampling weights of all the participating schools in the sample.
[2]The weighted denominator is the sum of the sampling weights of all the eligible schools in the sample.
[3]The unweighted numerator is the number of participating schools in the sample.
[4]The unweighted denominator is the number of eligible schools in the sample.
[5]Japanese mathematics videos were collected for the TIMSS 1995 Video Study.
[6] The weighted overall Switzerland participation rates incorporate the student population distribution of the three language-speaking regions of the country: German (74.4 percent), French (21.8 percent), and Italian (3.8 percent). This distribution is based on estimates for the 9th-grade population of Switzerland from OECD (2001). *Knowledge and skills for life: First results from the OECD Programme for International Student Assessment (PISA) 2000*. Organization for Economic Co-operation and Development: Paris. The weights of the separate parts are not analogous. Each area used a different definition for the first-stage sampling measure of size.
NOTE: For Australia, the Czech Republic, and the Netherlands, these figures represent the participation rates for the combined mathematics and science samples.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Table 8.3. Mathematics participation rates after replacement, by country: 1995 and 1999

Country	Weighted school participation, after replacement (percentage)	Weighted numerator, after replacement[1]	Weighted denominator, after replacement[2]	Unweighted school participation, after replacement (percentage)	Unweighted numerator, after replacement[3]	Unweighted denominator, after replacement[4]
Australia	85	8,127	9,586	85	85	100
Czech Republic	100	124,583	124,583	100	100	100
Hong Kong SAR	100	79,286	79,286	100	100	100
Japan[5]	100	1,573,369	1,573,369	100	50	50
Netherlands	85	92,339	108,501	87	85	98
Switzerland[6]	97			93	140	151
French-speaking	95	842	886	95	39	41
German-speaking	99	40,054	40,506	99	74	75
Italian-speaking	77	27	35	77	27	35
United States	76	2,105,483	2,755,605	77	83	108

[1]The weighted numerator is the sum of the sampling weights of all the participating schools in the sample.
[2]The weighted denominator is the sum of the sampling weights of all the eligible schools in the sample.
[3]The unweighted numerator is the number of participating schools in the sample.
[4]The unweighted denominator is the number of eligible schools in the sample.
[5]Japanese mathematics videos were collected for the TIMSS 1995 Video Study. The response rates after replacement for Japan differ from that reported previously (e.g., Stigler et al. 1999). This is because the procedure for calculating response rates after replacement has been revised to correspond with the method used in the TIMSS 1995 and TIMSS 1999 Achievement Studies.
[6] The weighted overall Switzerland participation rates incorporate the student population distribution of the three language-speaking regions of the country: German (74.4 percent), French (21.8 percent), and Italian (3.8 percent). This distribution is based on estimates for the 9th-grade population of Switzerland from OECD (2001). *Knowledge and skills for life: First results from the OECD Programme for International Student Assessment (PISA) 2000*. Organization for Economic Co-operation and Development: Paris. The weights of the separate parts are not analogous. Each area used a different definition for the first-stage sampling measure of size.
NOTE: For Australia, the Czech Republic, and the Netherlands, these figures represent the participation rates for the combined mathematics and science samples.
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

8.6.1 General procedure for weighted participation rate calculations

In general each country's weighted school participation rate was the sum of base weight times the measure of size for all eligible participating sampled schools divided by the combined sum of the base weight times the measure of size of both the eligible participating schools and the eligible refusing schools. Ineligible and excluded schools were not included in the calculations. The basic formulae are:

$$\text{Weighted response rate, before replacement} = 100 \times \frac{\sum_{i \in \left\{\substack{\text{responding}\\ \text{original}\\ \text{schools}}\right\}} MOS_i / P_i}{\sum_{i \in \left\{\substack{\text{eligible}\\ \text{original}\\ \text{schools}}\right\}} MOS_i / P_i}$$

$$\text{Weighted response rate, after replacement} = 100 \times \frac{\sum_{i \in \left\{\substack{\text{all}\\ \text{responding}\\ \text{schools}}\right\}} MOS_i / P_i}{\sum_{i \in \left\{\substack{\text{responding schools}\\ \text{+ refusing originals}\\ \text{not replaced}}\right\}} MOS_i / P_i}$$

The base weights used in the participation rate calculations were those derived directly from the sampling probabilities, prior to any adjustments for school refusals. They were not the final weights delivered to LessonLab but were contained within them, as those final weights consisted of the base weights adjusted to compensate for patterns of nonresponse.

8.6.2 Country-specific procedures

Each country provided a unique measure of size variable. Furthermore, there were possible sample design differences among countries which could potentially affect the way in which an eligible participating school was represented in the participation rate calculation. Therefore, the rate calculation methodology by country is provided for full disclosure and documentation completeness. Table 8.4 shows, by country, the name of the variable that was used to derive the measure of size (MOS) that was used, together with the school base weights, to derive the participation rates.

Table 8.4. Variables used for participation rate calculations, by country: 1999

Country	Measure of size (MOS)
Australia	Number of grade 8 classes
Czech Republic	Number of grade 8 students
Hong Kong	Number of grade 8 students
Japan - science	Number of grade 8 students
Netherlands	Number of grade 8 students
Switzerland	
French-speaking	1 (this is a factor, not a variable)
German-speaking	Number of grade 8 students
Italian-speaking	1 (this is a factor, not a variable)
United States	Number of grade 8 students

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

In the French-speaking area of Switzerland, classes were sampled directly from class lists assembled by canton. Since these were selected from each canton by equal probability, the MOS value for each class was 1. In the Italian-speaking area of Switzerland, all classes were included in the study; so again the MOS value for each class was 1.

The sample for the German-speaking area of Switzerland was a subsample of the TIMSS 1995 schools selected with equal probability (75 desired video schools from 133 schools of unconfirmed participation or selection status in the 1994–1995 TIMSS). School weights were provided to Westat after nonresponse and other adjustments were incorporated, but the TIMSS 1995 participation and replacement status were not readily available to incorporate into the TIMSS 1999 Video Study participation rate calculations. The sampling interval from TIMSS 1995 and the school measure of size was provided with the adjusted school base weights. This allowed for the TIMSS 1999 Video Study participation rates to be based on a derived TIMSS 1995 school base weight, sclwt_0, where sclwt_0=(smplint[17]/MOS2), which removed all adjustment factors and redistributed the base weights back to the refusing original video schools. The sampling rate for the video study (75/133) was not included in the provided school base weights since the video schools were selected with equal probability. It was also not included in the participation rates.

8.7 Summary

Analyses on the TIMSS 1999 Video Study data were conducted using data weighted with survey weights. These weights were calculated specifically for the classrooms in this study. This chapter described how the classroom base weights were calculated and what adjustments were made for nonrespondent selected schools. In addition, the jackknife technique was explained, along with a description of how the weights are intended to be used by anyone wishing to conduct analyses using this data.

[17] Smplint is the school sampling interval used to select the TIMSS 1995 Swiss sample.

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Appendix A

TIMSS 1999 Video Study Transcription/Translation Manual

TIMSS
VIDEO STUDIES

Third International Mathematics and Science Study

TIMSS 1999 Video Study

TRANSCRIPTION/ TRANSLATION MANUAL

Overview of the TIMSS 1999 Video Study

This manual describes the protocol used for transcribing/translating the video data collected for the Third International Mathematics and Science Study, known as TIMSS 1999 Video Study.

TIMSS 1999 Video Study is a cross-national study of eighth-grade mathematics and science classrooms. The study involves videotaping and analyzing teaching practices in more than one thousand classrooms in six countries.

The study is funded by the U.S. Department of Education and the National Center for Education Statistics (NCES) and conducted by LessonLab, Inc. of Los Angeles, California.

Goals of the Study

The TIMSS 1999 Video Study has the following six goals:

- To investigate mathematics and science teaching practices in U.S. classrooms.
- To compare U.S. teaching practices with those found in high-achieving countries.
- To discover new ideas about teaching mathematics and science.
- To develop new teaching research methods and tools for teacher professional development.
- To create a digital library of images to inform U.S. educational policy.
- To stimulate and focus discussion of teaching practices among educators, policy makers, and the public.

To achieve our goals we will collect data from 100 randomly sampled schools in each participating country. There are three sources of data: videotaped lessons, teacher and student questionnaires, and supplementary materials (e.g. worksheets, copies of textbook pages) used by the teacher and students during the videotaped lessons.

<u>Data collection</u>. From each of the 100 schools, we will videotape one mathematics and one science lesson. All are eighth-grade lessons. Each lesson will be videotaped using two digital camcorders by one videographer, one focusing mainly on the teacher and the other on the students.

<u>Data processing</u>. Both videotapes will be digitized and burned onto CD-ROM. The tapes that focus on the teacher will be copied to VHS tapes and sent to transcribers/translators. The lessons will be transcribed from the original language into English, and sent back to LessonLab as Microsoft Word files. The transcripts will then be timecoded, linked to the video footage, and stored in a multimedia database.

<u>Data analysis</u>. The video data will be reviewed by our research group who will code various aspects of lessons to describe mathematics and science teaching in each country, and the results of the coding will be analyzed statistically and reported to NCES by LessonLab.

The Importance of Standardized Transcription Procedure

The transcript is not intended to be a replacement for the viewing of the actual videotaped interaction; however, the transcript will serve as an aid in the coding and subsequent analysis of classroom interactions. Therefore, the transcription of the videotaped data should reflect, as accurately as possible, the words spoken by both teachers and students alike. It is imperative that this process be executed in a careful and consistent manner, as it is crucial to the success of the entire project. Therefore:

> Do not summarize or paraphrase what the participants are saying.
>
> Do not translate/transcribe the data to interpret what the speaker "meant to say."

Chapter 1: Transcription/Translation Procedure

In dealing with face-to-face interaction between teachers and students, various issues will arise that may, at first, seem insignificant. However, phenomena such as overlapping talk and pauses will have an impact on how the data will be coded and analyzed.

Though every classroom interaction will have its own unique qualities and attributes, there is sufficient similarity between these interactions to create a consistent system for the representation of the interactions in a transcript. This manual details this system and explains all of the transcription conventions you will be using in your work.

Identifying the Speaker

In a normal situation, there is one teacher and a group of students in a classroom who are doing most of the talking. The teacher's voice will be captured by a radio microphone that will be wired to the teacher. The microphone sends a mono-signal to the first camera. This radio mike will also capture the students' voices who are a few feet away from the teacher. A stereo microphone mounted on the same camera will capture the voices of students who are farther away from the teacher. This stereo microphone sends another mono-signal to the camera. When you listen to the dialogue with a headphone, you will hear the audio from the teacher's radio mike on one side and the camera-mounted mike on the other side of the headphone. When the audio from the two sources is confusing, you may need to listen to one side of the headphones at a time.

Speaker Codes

The following five speaker codes have been developed to try to deal with, as reasonably as possible, the discourse of the classroom:

T	Teacher
S	Single student
SN	Student-new**.** A single student whose identity differs from the last student to speak
S?	When the identity of the student (whether the speaker is S or SN) is unclear
Ss	Multiple students, but not the entire class
E	Entire class (or sounds like the entire class); used to indicate choral responses
O	Other; used to indicate speech by a non-member of the class, such as school personnel, office monitors, or talk from public address systems

While it is generally easy to distinguish the teacher's voice from that of the students', it is not always possible to distinguish between individual student voices. Thus, there will be no attempt to track the voice of any individual student in the ongoing discourse (e.g., marking Student 1, Student 2, Student 3, etc.).

- Whenever *more than one student* (but not all) speak simultaneously, the code **Ss** is entered.

- In order to keep track of a single student's continued speech, an **S** should be used to indicated a given student's speech until another student begins to speak. The next student should be indicated with **SN** (Student-new). If the new student continues to speak, an **S** should be used to mark their next turn. **SN** is always used to indicate that a new student (i.e., a student whose identity differs from the previous student speaker) is speaking. The very first student to speak in a lesson is identified with the **SN** code.
- Whenever it sounds as if *the entire class* speaks simultaneously (i.e., a "choral" response), the code **E** is entered.

It is important at this point to understand what is meant by "simultaneously" in this particular setting. Simultaneous talk refers to those occasions when more than one student is speaking (1) *the exact same word(s)* (2) *at the exact same time*. Both of these conditions must be met in order to use either the Ss or the E speaker code.

<u>Blackboard</u>

There is one additional code used to mark material written on the blackboard:

B	Blackboard; used to indicate the translation of foreign words/phrases written on the blackboard

The code B is used to indicate the translation of foreign words/phrases written on the blackboard. Only those **words** or **phrases** that cannot otherwise be recovered from the ongoing discourse are to be translated and added to the transcript.

For example, if a teacher writes a word problem on the blackboard but does not say the word problem out loud or otherwise indicate what the problem is about, then this should be translated and added as a separate turn in the transcript.

If, however, a teacher writes a word problem (or other phrase) on the board and then says it out loud to the class, the translation of the written word(s) should not be added to the transcript as it is fully understandable by following the transcript of the teacher's discourse.

Formulae written on the blackboard which contain only numbers or other mathematical notations (e.g., x, y, ß,__) should be added as a separate entry into the transcript (e.g., 2x+3=10 does not need to be "translated") ONLY the first time a problem is discussed. After the initial reference to a problem, it is not necessary to transcribe it again. Numerical problems that are not discussed do not need to be transcribed.

Transcription Conventions

Take a look at the sample transcript below. The letters to the left of the text are the speaker codes. Notice in the text various symbols are used.

T So by looking at- this one is ... eight square units this one is twelve square units this one's twenty-four square units how do I find the area of a rectangle? Now find me a mathematical way of doing it. So I don't have to count all the time. BRIAN?

S Multiply the vertical squares times the horizontal squares.

T That's exactly correct … Who could state it in another way?

T Anyone //else?

S //Well maybe…

Besides using the same speaker codes to transcribe the videodata, it is necessary that all transcribers use transcription conventions in a standardized manner so that they convey the same meanings. This section explains all the conventions that are to be used in transcribing the videodata for our project.

Overlapping Speech

Each speaker contribution is to be entered as a separate turn at talk if two speakers are speaking at the same time, but they are saying two different utterances.

Likewise, if two speakers are saying the exact same thing, but are not speaking at the exact same time (e.g., one student begins to speak in the middle of the other student's utterance), this does not constitute "simultaneous" speech. Although the two speakers are saying the exact same words, such moments will be treated as cases of "overlap," and each speaker contribution is to be entered as a separate turn at talk.

In the transcription system adopted here, moments of overlapping speech will be indicated by double backslashes (//) to indicate where the overlap begins, as in the following example:

T All right giggle boxes. What is so silly?

S When you //were holding up a ten Jordan was holding up a ten.

SN //When you were holding up a ten Jordan was holding up a ten.

The double backslashes should always come in a set. The point where the two speakers begin to talk over each other should always be marked in both the overlapped turn (the one who began speaking before being overlapped, as in the second line above) and in the overlapping turn (the one who began speaking during the talk of another, as in the third line above).

One Exception to the Simultaneous Speech Code

Since the speaker code **Ss** does not include the teacher, the teacher's talk should always be treated as a new and separate turn, regardless of whether the teacher overlaps or speaks simultaneously with another interactant.

One important exception to the "simultaneous speech" rule concerns when the teacher and a student (or students) speak the same words at the same time (a very rare occurrence). In such a case, the teacher's utterance should ALWAYS be entered as a separate turn from the student's turn. Double backslash (//) should be used to show that the teacher and student overlapped in speech.

For instance, in the following example, although the teacher and the student are saying the exact same words at the exact same time, their respective turns at talk should not be combined as one turn, but as two separate turns:

T What's five plus one?

S Seven.

T //No.

S //No.

Entering a New Speaker Code: Lengths of Pauses and Activity Shifts

Pauses.
If a pause lasts longer than three seconds, a new speaker code should be entered, even when the same speaker resumes speaking. Organizing the speech in this manner will allow timecodes to correspond with the actual utterances in the video.

In the following utterance, a new speaker code should be entered after the pause:

T: If you turn to page five, you will see…[4 seconds]

T: This page has several problem sets that relate to your homework.

Activity Shifts.
Several activities occur in the classroom, for example: the teacher's lecture, student group work, question and answer, students at the blackboard, etc. If such a shift occurs during an utterance, a new speaker code should be entered.

T: So that's how you would solve such a problem.

T: Now, please take out your worksheets and get into your groups.

Punctuation, Diacritical Marks, and Other Conventions

The use of punctuation marks (such as a comma, period, colon, etc.) in the transcription of videotapes in this study will follow the normal rules used in written English. In addition the following conventions will be used as part of the transcribing system:

[Bell.]	Please indicate when the bell rings at the very beginning of the and at the end of each lesson by putting the word "bell" in brackets**.**

PROPER NAMES	Proper names of teachers, students, and school personnel must be changed due to confidentiality issues.

The transcripts currently use real names, which are in all CAPS:

T	Okay, for the perimeter you add up the sides. How many sides are there? JESSICA?

Change the name using the same first letter, if possible, and delete all caps:

T	Okay, for the perimeter you add up the sides. How many sides are there? Jane?

- (HYPHEN) A hyphen indicates that a speaker has "cut-off" (or self-interrupted) his/her speech.

T	So, I**-** if I wanted**-** if you wanted to give me nine of those

? (QUESTION MARK) A question mark indicates that the utterance is to be understood as a question (usually determined through intonation), as in the following.

T	Why can't the five unifix cubes be stuck together?

S	Uh cause they're one.

T	What?

. (PERIOD) A period marks the end of a phrase, a sentence, or a turn at talk that is NOT to be understood as being a question.

T	Ah ha. Okay. I'd like you to put all of your unifix cubes on your name tag. So your place value chart should be empty.

When a period is placed in the middle of a turn, insert two blank spaces after the period.

OTHER PUNCTUATION MARKS Other punctuation marks such as commas, exclamation points, semi-colons, and colons may be used when appropriate.

T	Be quiet!

. . . (THREE DOTS) A series of three dots, separated by a blank space before and after, is used to indicate a pause.

T	So if you had ... is this your hand?

(   ) Empty parentheses indicates that some speaker has spoken, but the words cannot be made out.

T When you measure these two points, can you then figure out the direction?

S Yes. ( ).

(a word or words)	Word(s) surrounded by parentheses indicate that the transcriber has made a best guess at what the speaker has said, but cannot guarantee it.

T The fixed amount is one hundred. What are they paying a day?

S Ah, (I don't know).

(word A/word B)	If there are two alternative hearings, both of these should be included within single parentheses separated by a single backslash.

T This is seven thousand. So this line is?

S (Sixty/sixteen).

T Good.

Numerals	Numbers should always be written out as words, in the way in which they are said (e.g. "two" instead of "2").

T How many did we start with?

S Two.

Capital	Capital letters should only be used with proper nouns (names, cities, countries, languages, etc.), at the beginning of a new turn at talk, or after a period or question mark.

T Remember your test is on Friday? After your field trip to Palm Springs. Okay?

(**Exception**: For first pass translation, remember to put the names of the teachers and students in ALL CAPS.)

ALL CAPS	When speakers refer to points, lines, angles, etc. by their alphabetical label, these labels should be transcribed in capital letters, even if it would otherwise appear as a lowercase letter.

T So this triangle ABC, write a little A here. Between the angle A and B.

C-A-P-S	When speakers spell out words, each letter should be placed in capital letters, with a dash between each letter.

T How do you spell triangle?

S T-R-I-A-N-G-L-E

[Transcriber's Note]	In cases where a bracketed comment is essential to the understanding of an utterance, the transcriber may enter a note, in brackets. This convention should only be used in cases that have been discussed with the translation managers, such as ironic or sarcastic phrases, or code-switching from one language to another. No non-verbal actions should be indicated in notes.

Common Backchannels

Throughout their talk, the speakers make use of "backchannel" devices, "discourse markers," and "hesitation indicators" to show that they are, for example, paying attention (e.g., mm hm, uh huh), agreeing (e.g., yeah, yep), hesitating (e.g., uh, mm), showing surprise or displaying some new understanding (e.g., ah ha, oh, ah). In order to be relatively consistent throughout the transcription, these should always be transcribed as follows:

- Ah; Uh; Um, Oh
- Ah-ha; Uh-huh; Nn-hnh; Mm-hm
- Yeah; Yep
- Okay

Foreign language equivalents should be similarly transcribed in order to remain consistent.

Cantonese examples:

Backchannels:	Discourse Markers:	Hesitation Indicators:
Mm – Mm hm/Uh huh	dak/ho la – okay	uh/er – uh
Ho yeh – yeah	gam le/gam a – well	Um/ee - Um
Hai – yep	sho yee le – so	o go yi shi hai –I mean
Hai la – Ah ha	kei ming/lei ming la – y'know	

Czech examples:

Backchannels:	Discourse Markers:	Hesitation Indicators:
Mm hm	no jo – alright	Ehm - Um
Uh huh	sup – hurry	tim myslim – I mean
Jo, Tak jo - Yeah	dobre – okay, well	
Jo, Tak jo – Yep	no – well	
	tak/tak jo – okay, well	
	tak, takze - so	

Dutch examples:

Backchannels:	Discourse Markers:	Hesitation Indicators:
Mm hm	Ja maar – Yes, but	Um
Uh huh	Heh – Right	ik bedoel – I mean
Goh – wow!, oh!, gosh!	Nou – Well	
	Dus – So	

Italian examples:

Backchannels:	Discourse Markers:	Hesitation Indicators:
E poi – And then	Vero -- Right	Eh -- Uh
Be(h)	Allora, Quindi – So	Chioè – I mean
	Insomma – y'know	
	Dunque – So	

Japanese examples:

Backchannels:	Discourse Markers:	Hesitation Indicators:
M; N (↘) – Yeah	Ja/Soreja - Well then	Ee (→) - Well; Uhh
So-so-so – Right	Ano ne - Well/Let me see…	Etto - Um
Ee (↘) – Yes	Ne – Right/isn't it?	
Ee (↗) - What?	Sorede - So	
Iya – No		

Swiss German examples:

Backchannels:	Discourse Markers:	Hesitation Indicators:
Eh hn, Ae-aeh – Uh huh	Ei, [or] Dann -- well	ehm, eh – um, uh
Ehm, eh -- Uh	Also -- Okay	
	Oder? -- Right? Isn't it?	
	Hä – right?, okay? or huh?	

Chapter 2: Second-Pass Transcription Procedures

The videodata are transcribed in two phases: first pass and second pass. Most of our first pass work is done by our subcontractors, who use VHS copies of the videos to translate the lessons from the original language into English. The lessons are then sent back to LessonLab as Microsoft Word files. In the second pass, the transcripts are linked to the video footage in a multimedia database, and are then reviewed, corrected, and timecoded by the translator/transcribers.

In this section, the second-pass transcription/translation process will be explained. This process includes keeping track of problems, glossary terms, and transcribing hours. The following instructions will assume that training has already taken place. Please read through this section carefully and thoroughly.

Items You Will Need to Transcribe/Translate/Timecode the Videodata

- Work station (i-Mac)
- Lesson Folder from the Lesson Files
- Forms: Checklist, Translation/Transcription Log, Glossary/Problem Form, Name Change Form

Step-By-Step Procedures

<u>Step 1: Sign Up for Lesson in the Sign Out Book</u>
Rather than pre-assign lessons to particular individuals, we ask that transcribers check the Sign Out Book to find the lessons available for second-pass work. This book is kept on top of the file cabinet and contains lists separated according to country (i.e., US, the Netherlands, the Czech Republic). Transcribers should work on the next available lesson (as noted on the Lesson List), and write their names and the date next to the lesson identification number to indicate that it is being worked on.

<u>Step 2: Access the file</u>
All second-pass transcription/translation and timecoding will be done at a computer work station using **vPrism** software. Videos of the lessons have been digitized and stored on the server as Mpeg files. Transcripts completed by first-pass reviewers are imported into the **vPrism** database and linked to the Mpeg files on the server. You can access the **vPrism** database that is stored on the **4-D** server from your work station by opening **4-D Clien**t from the Apple Menu. Detailed instructions about **4-D Client** and **vPrism** are provided separately.

<u>Step 3: Review Transcription/Translation</u>
Review first-pass transcripts and make corrections following the system outlined in the first section. Additional materials have been collected along with videotapes, (i.e., copies of worksheets, textbook pages, and overhead projection materials used in the videotaped lessons), so use them to clarify or confirm the content of conversations.

Transcript 1 and Transcript 2 Text Fields

The **vPrism** software allows you to transcribe in two fields: Transcript 1, and Transcript 2. All material should be transcribed in Transcript 1, with the following exception: Two simultaneous conversations where the camera is on a student to student conversation but the teacher, who is speaking to a student in another part of the classroom is still audible and overlaps with the student-student conversation. In these cases, the teacher-student talk should be transcribed in Transcript 1, while the student-student conversation should be transcribed Transcript 2.

Problems

While working on second-pass transcription, you may encounter some technical or translation problems. Problems can include, but are not limited to, difficulty in hearing, finding English language equivalencies for translation, or translating idiomatic expressions. Whenever you encounter a problem, please make note of it on the Glossary/Problems form. Please fill out these forms *neatly* and note the screen time before continuing with your 2nd pass work. These forms will help us keep track of problematic areas and issues for discussion. This will also help you keep track of those portions of the videotape that you were unable to translate/transcribe and that need to be re-examined once you have consulted with others.

Editing

Three Line Segments

As part of the 2nd pass. Long turns should be divided into segments of three lines or less. This is because completed transcripts are later displayed as subtitles on the video, and the video frame can only contain three lines of text. In the following example, the teacher's original utterance (a) is displayed as two separate turns in the transcript (b):

(a) Before editing:

T So by looking at- this one is ... eight square units this one is twelve square units this one's twenty-four square units how do I find the area of a rectangle? Now find me a mathematical way of doing it so I don't have to count all the time. You can look at your notes from yesterday to review the methods we discussed. Any ideas? BRIAN?

(b) After editing:

T So by looking at- this one is ... eight square units this one is twelve square units this one's twenty-four square units how do I find the area of a rectangle?

T Now find me a mathematical way of doing it so I don't have to count all the time. You can look at your notes from yesterday to review the methods we discussed. Any ideas? BRIAN?

The above text is organized into two separate turns by determining an appropriate break in the text while keeping each turn within three lines. Appropriate breaks can be made at the end of an utterance that is syntactically and/or intonationally complete.

Time Coding

Once a lesson has been completely transcribed/translated, speaker turns will need to be time coded. It is important that the time coding procedures occur as the *last* step of the second pass, rather than a *simultaneous* step, since it provides a final chance to review the transcript. This is a separate procedure that will be explained in detail during a training. The process involves placing time codes on each turn segment. More details will be provided in the training session.

Logging Hours

There is one other form that should be filled out whenever you begin to transcribe/translate: Transcription/Translation Log. This form is used to keep an accurate record of the amount of time it takes you to transcribe or translate each lesson.

Whenever you sit down to work, make a note of your beginning time and the time you finish working. This information will be used to help us predict how many hours it will take to transcribe or translate each lesson. This information is crucial for establishing our project timeline and budget allocations.

Both forms, "Glossary/Problems" and the "Translation/Transcription Log", should be kept together in a single file folder labeled with the name code of the lesson you have been working on (e.g., US-0004). This file should be kept in the filing cabinet in the main transcription area. You will be requested to turn these forms in along with the lesson folder once you have finished transcription/translation.

Completing a Lesson

The second pass of the transcription/translation is finished when you have completely reviewed the entire lesson. If there are sections of the lesson that you cannot transcribe or translate, this matter should be brought up in an individual meeting with the transcription supervisors. All issues noted on the Glossary/Problems form should be resolved before you move on to the next tape. *Please make sure you print out a hard copy of the transcript for the lesson file.*

- Use checklist to make sure all forms are complete
- Print out transcript
- Put all forms and transcript in lesson folder
- Place lesson folder in "In Box" on file cabinet

Chapter 3: Transcription/Translation Issues

The discourse of both the teachers and students should be reflected in the transcription as accurately as possible. Given that the study includes videodata from seven countries, the process of transcription will vary depending on the language of the classroom. In the American context, standard spelling conventions of American English will be followed. Regional accents should not be reflected in the transcription, but production problems, such as mispronunciation, are to be reflected in the transcription.

In the other linguistic contexts, translators should attempt to capture, as accurately as possible, the meaning of the original language terms in English, without sacrificing readability. There will always exist a tension between a literal translation and a readable (i.e., "flowing") text. Translators must, therefore, make on-going decisions, in consultation with other members of the team and the transcription supervisor, concerning such issues.

T/T Meetings

Regular group meetings will be scheduled to deal with problematic issues regarding translation and transcription. During these meetings, the translators and the transcription supervisor will discuss and agree upon standard translations for mathematical and non-mathematical terminology and phrases. Translators should use the glossary forms that are provided to record any technical terms used in the data, along with the English translations they use when transcribing. The translators' glossary will be assembled, continually updated, and distributed to the members of the translation teams *so that consistency and uniformity can be achieved in the transcription/translation of the videotapes*. If members of the translation teams cannot readily agree on succinct translations of terms or phrases, members of the larger mathematical education community will be consulted for their input.

Some dictionaries and mathematics and science textbooks are provided in the main transcription area for your use, though we do request that you return them to their proper place after you have finished using them. If you feel that there is any other resource (or resources) that would make translation easier, please make your request known. We are open to any suggestions and look forward to a highly interactive and highly collaborative approach to the translation of the videodata.

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Appendix B

Information Given to U.S. Superintendents, Principals, and Teachers Prior to Videotaping

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LESSONLAB

Information for District Superintendents

I am writing to ask your permission to include one of the schools in your district in a major cross-national investigation of mathematics and science teaching. The study, the TIMSS-R (Third International Mathematics and Science Study-Repeat) Video Study, which is being conducted by the National Center for Education Statistics, U.S. Department of Education, involves videotaping one eighth-grade mathematics lesson and one eighth-grade science lesson from each participating school. The study is part of a follow-up to the Third International Mathematics and Science Study (TIMSS).

The TIMSS-R Video Study builds on an earlier study, the TIMSS Video Study that compared mathematics teaching in the U.S., Japan, and Germany. The earlier study was the first ever to collect video records from nationally-representative samples of classrooms. Since the fall of 1996 when the TIMSS Video Study was released, there has been much interest and speculation among educators regarding its implications for mathematics teaching in the United States. Profiles of eighth-grade mathematics classrooms that resulted from the study, validated by objective coding methods, continue to play a prominent role in current policy discussions.

The new video study will improve on the earlier one in several ways. It will include more countries; altogether we will be videotaping over a thousand lessons in the United States and various countries spanning Europe and Asia. Data on science teaching as well as mathematics teaching will be collected. For your information we have enclosed a brochure that describes the new TIMSS-R Video Study, and an article reprinted from *Phi Delta Kappan* (September, 1997) that presents some of the results of the earlier video study.

Selection of Teachers and What They Would Do

The specific teachers to be included in the study (one mathematics and one science) will be selected by a random process in collaboration with the school principal.

Each participating teacher is videotaped a single time teaching a lesson in his or her classroom. Our goal is to see what typically happens in U.S. eighth-grade mathematics and science classrooms. Although teachers are contacted ahead of time to schedule a time for videotaping. Teachers are asked to not make any special preparations for the day our videographer comes to their classroom. Whatever lesson the teacher had planned will be appropriate – whether it is introducing new material or reviewing old. Participating in the project should have no effect on the curriculum provided to students.

After the videotaping, the teacher will be asked to fill out a questionnaire about the lesson, and to collect very brief questionnaire responses from the students in the class. The teacher will be provided a prepaid envelope in which to mail back the questionnaires, along with copies of worksheets, test pages, etc. that are relevant to the lesson.

Confidentiality

The tapes we collect in your district will be used for research purposes only. Access will be restricted to researchers analyzing the tapes; no one else will be allowed to view the tapes. The results of this study will be reported as averages across a large number of classrooms, never as information about a single classroom, school, school district, or state. The identities of the teachers, schools, and districts will be kept in locked storage; even persons hired to code and analyze the tapes will not have access to this information.

Teachers will be asked to sign a form indicating their agreement to participate in the study. In some districts it may also be necessary to secure written permission from parents. If a school chooses to require such releases we will assist the school in wording the documents.

Benefits of Participation

We are offering each teacher $300 in appreciation for his or her participation. Use of these funds is at the discretion of the teacher, unless there is a district policy that takes precedence.

While we know of no special benefit to teachers who participated in the earlier video study, we have documented many instances in which educators have used the video results to focus attention in their district on new approaches to mathematics teaching. Because a part of our project's work is to disseminate widely the results of the new study, we will make the findings accessible through various means, including electronic access via the Internet.

What's Next?

Within the next few days someone from the TIMSS-R Video Study will contact you to answer questions and to discuss further details regarding the aforementioned school's participation in the study. If you have any immediate questions please do not hesitate to contact me by phone (310-820-6612 ext. 230), fax (310-820-6619), or email (jims@lessonlab.com).

LESSONLAB

Information for Principals

I am writing to ask your permission to include your school in a major cross-national investigation of mathematics and science teaching. The study, TIMSS-R Video Study, is being conducted by the National Center for Education Statistics, U.S. Department of Education. It involves videotaping one eighth-grade mathematics lesson and one eighth-grade science lesson from each participating school. The study is part of a follow-up to the Third International Mathematics and Science Study (TIMSS). Your Superintendent has given us permission to approach you concerning participation in the study.

The TIMSS-R Video Study builds on an earlier study, the TIMSS Video Study, which compared mathematics teaching in the U.S., Japan, and Germany. The earlier study was the first ever to collect video records from nationally-representative samples of classrooms. Since the fall of 1996 when the TIMSS Video Study was released, there has been much interest and speculation among educators regarding its implications for mathematics teaching in the United States. Profiles of eighth-grade mathematics classrooms that resulted from the study, validated by objective coding methods, continue to play a prominent role in current policy discussions.

The new video study will improve on the earlier one in several ways. It will include more countries; altogether, we will be videotaping over a thousand lessons in the United States and various nations in Europe and Asia. Data on science teaching as well as mathematics teaching will be collected. For your information we have enclosed a brochure that describes the new TIMSS-R Video Study, and an article reprinted from *Phi Delta Kappan* (September, 1997) that presents some of the results of the earlier video study.

Selection of Teachers, and What They Would Do

The specific teachers to be included in the study (one mathematics and one science) have not yet been selected. They will be selected by a random process in collaboration with you.

Each participating teacher is videotaped a single time teaching a lesson in his or her classroom. Our goal is to see what typically happens in U.S. mathematics and science classrooms. Although teachers are contacted ahead of time to schedule a time for a videotaping, teachers are asked to not make any special preparations for the day our videographer comes to their classroom. Whatever lesson the teacher had planned will be appropriated- whether it is introducing new material or reviewing old. Participating in the project should have no effect on the curriculum provided to students.

After the videotaping, the teacher will be asked to fill out a questionnaire about the lesson, and to collect very brief questionnaire responses from the students in the class. The teacher will be provided a prepaid envelope in which to mail back the questionnaires, along with copies of worksheets, text pages, etc. that are relevant to the lesson.

Confidentiality

The tapes we collect in your school will be used for research purposes only. Access will be restricted to researchers analyzing the tapes; no one else will be allowed to view the tapes. The results of this study will be reported as averages across a large number of classrooms, never as information about a single classroom, school, school district, or state. The identities of the teachers, schools and districts will be kept in locked storage; even persons hired to code and analyze the tapes will not have access to this information.

Teachers will be asked to sign a form indicating their agreement to participate in the study. In some districts it may also be necessary to secure written permission from parents. Procedures for securing permission will be carried out by project personnel, in consultation with the teacher and principal.

Benefits of Participation

We are offering each teacher $300 in appreciation for his or her participation. Use of these funds is at the discretion of the teacher, unless there is a district policy that takes precedence.

While we know of no special benefit to teachers who participated in the earlier video study, we have documented many instances in which educators have used the video results to focus attention in their district on new approaches to mathematics teaching. Because a part of our project's work is to disseminate widely the results of the new study, we will make the findings accessible through various means, including electronic access via the Internet.

What's Next?

Within the next few days, someone from the TIMSS-R Video Study will contact you to answer questions and to discuss further details regarding your school's participation in the study. If you have any immediate questions please do not hesitate to contact me by phone (310-820-6612 ext. 230), fax (310-820-6619) or email (jims@lessonlab.com).

LESSONLAB

Information for Teachers

I am writing to invite you to participate in a major new study of mathematics and science teaching in different countries. The study is part of a follow-up to the Third International Mathematics and Science Study (TIMSS) and is being conducted by the National Center for Education Statistics, U.S. Department of Education. It involves videotaping eighth-grade mathematics and science lessons in more than one thousand classrooms in six countries. We are hoping you will agree to be one of the teachers we videotape.

The new study, TIMSS-R Video Study, builds on an earlier study, the TIMSS Videotape Classroom Study, which compared mathematics teaching in the U.S., Japan and Germany. The earlier study was the first ever to collect video records from nationally-representative samples of classrooms. Since the fall of 1996 when the TIMSS Video Study was released there has been much interest and speculation among educators regarding its implications for mathematics teaching in the United States. Profiles of eighth-grade mathematics classrooms that resulted from the study, validated by objective coding methods, continue to play a prominent role in current policy discussions.

The new video study will improve on the earlier one in several ways. It will include more countries (the U.S. and nations spanning Europe and Asia) and will collect data on science teaching as well as mathematics teaching. For your information we have included a brochure that describes the new TIMSS-R Video Study, and an article reprinted from *Phi Delta Kappan* (September, 1997) that presents some of the results of the earlier video study.

What You Will Be Asked to Do

Each participating teacher is videotaped a single time teaching a lesson in his or her classroom. Our goal is to see what typically happens in U.S. mathematics and science classrooms. Although you will be contacted ahead of time to schedule a time for videotaping, you will be asked to not make any special preparations for the day our videographer comes to your classroom. Whatever lesson you had planned is appropriate- whether it is introducing new material or reviewing old. Participating in the project should have no effect on the curriculum you provide to your students.

After the videotaping, you will be asked to fill out a questionnaire about the lesson, and to collect brief responses from the students in the class through a questionnaire that we will provide. You will be provided a prepaid envelope in which to mail back the questionnaires, along with copies of worksheets, text pages, etc. that are relevant to the lesson.

Confidentiality

The tapes we collect in this study will be used for research purposes only. Access will be restricted to researchers analyzing the tapes; no one else will be allowed to view the tapes. The results of this study will be reported as averages across a large number of classrooms, never as information about a single classroom, school, school district, or state. The identities of the teachers, schools and districts will be kept in locked storage; even persons hired to code and analyze the tapes will not have access to this information.

Payment

You will be paid $300 as an expression of our appreciation for your help. Use of these funds is at your discretion, unless there is a district policy that takes precedence. (Please discuss this with your school principal.)

If You Are Willing to Participate

If you are willing to participate in this study, please fill out and sign the enclosed form. You will soon be contacted by Mardi Gale (her card is enclosed) to discuss the details of the study, and to schedule your videotaping.

Appendix C

U.S. Teacher and Parent Consent Forms

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TIMSS-R Teacher Consent, Waiver and Release

I accept the invitation to participate in the Third International Mathematics and Science Video-Repeat Study (TIMSS-R Video Study) by permitting you to videotape my class one time in the next 12 months.

I understand that the videotape you will be recording will be made available only to researchers, that school, teacher, and student identity will remain confidential, and that you or the United States government itself may not make and distribute copies of the tapes to anyone without my explicit written permission.

I consent to the taping of my class. I also waive and release you—as well as anyone working with you on this study, the United States government and all of its employees—from claims I otherwise might have for defamation, invasion of privacy, infliction of emotional distress, violation of the right of publicity (which is the right to control the use of my name, likeness and other personality characteristics for commercial purposes), and all other claims of a similar sort, by whatever name such claims may be identified.

Name of School____

City ___________________________________State___________________

Name (please print)____

Signature____

Date____

Please return this release to: Brenda Krauss
LessonLab, Inc.
12436 Santa Monica Blvd
Los Angeles, CA 90025

Date Received by TIMSS-R _____

Dear Parent:

Your child's school has accepted an invitation to participate in the Third International Mathematics and Science Video-Repeat Study (TIMSS-R Video study). The TIMSS-R Video study is part of a larger study of students and teachers in more than 40 countries. The TIMSS Video-R Study is videotaping over 1,000 eighth-grade mathematics and science lessons in Europe, Asia, and the United States. We want to collect lesson tapes that show what typically happens in mathematics and science classrooms around the world. The purpose of the TIMSS-R Video study is to improve the teaching of these subjects. The TIMSS Video-R Study will be a major resource to the U.S. in monitoring performance of its education system by gathering videotaped records of what actually happens in nationally-representative samples of classrooms and to compare these records across countries.

What We Have Asked of Your Child's Teacher

One mathematics and one science teacher in your child's school have agreed to allow a trained TIMSS-R videographer to film in their classrooms. Because your child is in one or both of these classes, the school has given us permission to contact you. Before we proceed with the videotaping, we want to make sure that you do not have any objections to your child's participation. No instructional time will be lost; we have requested that the teachers continue with the planned activities on the day of the taping. The primary focus of the videotape will be the teacher. However, students who interact with the teacher will also appear on the tape. A copy of the videotape will be given to the teacher.

Potential Uses of the Videotape

The tapes will be used for research purposes only. Access will be restricted to researchers analyzing the tapes. Neither your child's name, nor the school's name, nor any identifying characteristics will appear in any materials or reports that result from this study. All of the videotapes we collect are treated as highly confidential. We shall not disclose the school's, teacher's, or students' identity. We are legally bound to use the videotapes only for purposes of research on mathematics and science instruction.

We also are asking your child to complete a brief questionnaire describing such background information as age, gender, birthplace, and parents' level of education. Your child will not be asked to put his or her name on this questionnaire, so it is entirely anonymous.

What We Are Asking You To Do

If you are willing to permit your child to participate in the lesson that will be videotaped, please sign the attached form and return it to your child's teacher.

If you do not sign the attached form we will make arrangements to ensure that your child is not included in any part of this videotape study.

Thank you very much for your consideration.

Sincerely,

James Stigler, Ph.D.
Director, TIMSS-R Video Study

Mardi A. Gale
U.S. School Liaison

PLEASE SIGN AND RETURN THIS FORM TO YOUR CHILD'S SCHOOL IF YOU ARE WILLING TO ALLOW HIM OR HER TO PARTICIPATE IN THE TIMSS-R VIDEOTAPING.

CONSENT, WAIVER and RELEASE

I have been informed of the nature of the Third International Mathematics and Science Video-Repeat Study and I hereby give permission for my child to participate.

I understand that the videotapes collected are treated as highly confidential and will be used only for purposes of research on mathematics and science instruction unless "I" and the other students' parents grant separate, written permission for other uses.

I understand my child will be asked to complete a brief questionnaire describing such background information as age, gender, birthplace, and parents' level of education. I understand my child will ***not*** be asked to put his or her name on this questionnaire, so it will remain anonymous.

I hereby waive and release you -- as well as anyone working with you on this study, the United States Government and all of its employees -- from claims I or my child otherwise might have for defamation, invasion of privacy, infliction of emotional distress, violation of the right of publicity (which is the right to control the use of one's name, likeness and other personality characteristics for commercial purposes), and all other claims of a similar sort, by whatever name such claims may be identified.

I hereby consent to my child participating in the study, and the taping of my child's class. I sign this Consent, Waiver and Release on my own behalf, as well as on behalf of my child.

____
(name of child for whom consent is given)

signature of parent :____

name ____
(print please)

date: ________________________________

Appendix D

TIMSS 1999 Video Study Data Collection Manual

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TIMSS
VIDEO STUDIES

Third International Mathematics and Science Study

TIMSS 1999 Video Study

DATA COLLECTION MANUAL

Overview

TIMSS 1999 Video Study

This manual describes data collection procedures for the video component of the Third International Mathematics and Science Study- Repeat, known as TIMSS 1999 Video Study.

TIMSS 1999 Video Study is a cross-national study of eighth-grade mathematics and science classrooms. The study involves videotaping and analyzing teaching practices in more than one thousand classrooms in six countries.

The study is funded by the U.S. Department of Education and the National Center for Education Statistics (NCES) and conducted by LessonLab, Inc. of Los Angeles, California.

Goal of the Study

The TIMSS 1999 Video Study has the following six goals:

- To investigate mathematics and science teaching practices in U.S. classrooms.
- To compare U.S. teaching practices with those found in high-achieving countries.
- To discover new ideas about teaching mathematics and science.
- To develop new teaching research methods and tools for teacher professional development.
- To create a digital library of images to inform U.S. educational policy.
- To stimulate and focus discussion of teaching practices among educators, policy makers, and the public.

Method of the Study

<u>Samples</u>. To achieve our goals we will collect data from 100 randomly sampled schools in each participating country. There are three sources of data: videotaped lessons, teacher and student questionnaires, and supplementary materials used by the teacher and students during the videotaped lessons.

<u>Data collection</u>. One videographer will be sent to each school to videotape both mathematics and science lessons and to hand questionnaires to the teacher after the videotaping. Supplementary materials will either be given to the videographer after the class or sent back to LessonLab by the teacher.

<u>Video cameras</u>. Two digital video camcorders will be used to videotape each lesson. One camera will be operated by the videographer to document mainly the teacher, and the other camera will be used as a stationary camera to document mainly the students. In the rest of this manual we will call the first camera the “teacher camera” and the second camera the “student camera.”

Videotapes. Each tape used to videotape the lesson will be labeled and shipped back to LessonLab by the videographer. To avoid accidental loss of the tapes, the videographer should ship the tapes after every two schools via FedEx or another similar shipping service with a reliable tracking system.

Data processing. The tapes shipped back to LessonLab from the videographers will be digitized and burned onto CD-ROM. All the lessons will be transcribed/translated into English and timecoded. The teacher camera videos will be linked to the transcripts and stored in a multimedia database.

Data analysis. The video data will be reviewed by our research group who will code various aspects of lessons to describe mathematics and science teaching in each country, and the results of the coding will be analyzed statistically and reported to NCES by LessonLab.

Importance of Standardized Camera Procedure

As a videographer you must make many decisions about where to point the camera. At any given moment you might focus on the teacher, the students, or the chalkboard. You might frame the shot close-up or wide.

It is of critical importance that these decisions be made in a standardized way so that the tapes we collect are comparable across different countries and different classrooms. Not following standard procedures could bias our view of what is happening in the lesson, or it could keep us from seeing some aspect of the lesson that is important for our analysis.

Chapter 1: Data Collection Procedures

To line up each taping requires a tremendous amount of work and represents a huge expense so it is of extreme importance that the videographer attend to every detail of the job in order to avoid mistakes or oversights. Often the videographer will be working under extreme time pressure and therefore it is essential that he or she be very organized and methodical. Below is a step by step description of everything the videographer will need to do before, during, and after every taping. A series of checklists are also provided with this manual and should be used each and every time that the videographer goes out into the field.

Before Going to the School

Charge Batteries

- Make sure that all of your camera batteries have been recharged.
- Both the transmitter and the receiver of the lavaliere radio microphone use 9-volt batteries. Put a fresh 9-volt battery in both the receiver and transmitter before each taping.
- Remember also to always carry plenty of spare batteries with you.

Check Equipment

- Pack all your equipment using the checklist provided in the appendix. Always use this checklist. There are lots of little pieces of equipment that are of crucial importance but which nevertheless are easily forgotten.

Check Directions to School

- Make sure you have gone over the directions to the school and that it is clear to you how to get there and where to park your car.
- Pack these directions as well as the school phone number. Also make sure that you pack the name of the principal of the school or of your official contact person, as well as the name of the teacher you will be taping.

Pack Questionnaires

- The videographer will also be responsible for delivering questionnaires to the teacher. The questionnaires will be used to help interpret the video and must be completed soon after the taping. Make sure that you pack a box/envelope that contains teacher and student questionnaires, several barcode labels and instructions to the teacher. The questionnaires with labels will be shipped back by the teacher in the self-addressed mailing envelopes to LessonLab or to our country collaborator in each country.

Arriving at School

Arrive One Hour Early

- Make sure you arrive at school one hour before the scheduled shooting. A lot of work will go into scheduling a taping. If you get there late it will be a minor tragedy, so plan to get there an hour before the taping is scheduled.

Meet First with School Officials

- When you arrive at school, go to the school's main office and meet the contact person. You should never go directly to the teacher's classroom. Always go to the main office first and meet with the principal or the person who has been assigned as your official contact person. In many schools you will be expected to make a stop by the office on your way out to sign out or report back to your contact person. Find out exactly what they want you to do after you are done taping.

Once in the Classroom

As soon as you get to the classroom where you will shoot the lesson, two factors will help you determine where to position the camera: 1) information about what will happen during the lesson, and 2) the physical arrangement of the classroom.

Ask the Teacher about the Lesson

- Try to find out from the teacher about what will happen in the lesson. Often there will be little time for you to talk to the teacher because even though you arrive early, he or she might be busy teaching. However, if you have a chance, ask the teacher and find out as much as possible about the lesson.
- The information you want to find out is:
  - roughly how long the lesson will last (longer than 60 minutes?)
  - general outline of the activities of the teacher and students that will take place during the lesson
  - whether the chalkboard will be used
  - which chalkboard, if there are more than one, will be used
  - whether AV materials will be used and where they will be placed
  - whether there will be a homeroom meeting before the lesson starts (Note: do not tape homeroom activities)

Choose Camera Positions

- Try to set up the cameras with the windows at your back, thereby avoiding back light problems.
- Close windows, doors, and blinds as needed to adjust the light and reduce noise. Make sure the teacher doesn't mind before you do any of this.
- Find the location of the nearest electrical outlet. If at all possible you will want to plug your camera into this outlet so that in the unlikely event of a battery failure you can use electricity as a back up while you replace the battery.
- Move student desks as needed to set up the cameras. We are interested in how desks in classrooms are arranged so you should not ask the teacher to significantly alter the lay out of the classroom. However, it is fine to scoot a few desks over in order to have better visibility. Before you move any desks make sure that the teacher doesn't mind.

Attach Barcode Stickers to the Tapes

- Before you put the tapes in the cameras, make sure you attach a barcode sticker to each tape.

Shoot Time Clock

- Shoot the time clock with each camera. This will help us to synchronize the tapes later.

Class Cancellation

- If class is canceled, please contact your country's scheduler for further instructions. Elizabeth Tully, Phone: (323) 512-5130 or Cell Phone: (310) 210-2860.

Fire Drill

- If a fire drill interrupts class, leave the equipment and follow the class outside.

After Taping the Lesson

Give the Questionnaire Packet to the Teacher

- After you are done taping you will give the teacher the box or envelope that contains teacher and student questionnaires, instructions for the teacher, and mailing envelopes for the teacher to use. Remind the teacher that it is essential that he/she completes the teacher questionnaire before the day is over.

Pack Up

- All equipment should be packed using the equipment checklist so that nothing is forgotten.
- If you used more than one tape per camera to shoot a long lesson (more than 60 minutes), make sure you attach a barcode label to each tape before the tapes get mixed up.

Completing the Log Sheet

- The tapes collected must be accompanied by a log sheet that you fill out. This log sheet should be completed while the taping session is still fresh in your mind (i.e. no later than the evening of the taping). Log sheets should be returned to LessonLab with the tapes. Make sure that each log sheet has the barcode sticker attached that is the same as the ones on the tapes.

Shipping the Videotapes

- To ship the videotapes into the United States, you will have to fill out various shipping forms. Please refer to Appendix E for more instructions.

A Note on Behavior and Dress Code

Always try to be polite and considerate.

- You should always remember that teachers have volunteered to let us video tape their classrooms. So please be polite and considerate and thank the teacher profusely. In addition some teachers will be very nervous so try to make them feel comfortable. In general you should try to not be a burden and make your presence felt as little as possible. However, make sure you collect all the materials teachers have agreed to give us.

Dress appropriately.

- You are visiting schools not as an individual videographer but as a representative of TIMSS 1999 Video Study. Always dress appropriately based on the standard in your culture.

Do not eat, drink, or chew gum while in the classroom.

Chapter 2: Documenting Lessons

Classrooms are complex environments where many things are occurring at once. In this chapter, we describe which aspects of the classroom environment we want to document. We discuss how to locate the two cameras in the classroom, one stationary and the other operated by you. And, we present some general rules, as well as some specific guidelines, designed to help the camera operator make consistent decisions about where to point the camera and how to shoot the action being documented.

Goals of Videotaping

As mentioned earlier in this manual, the main objectives of this project include investigation of mathematics and science teaching in the U.S. and in other countries and the comparison of classroom instruction across countries. The goal of videotaping lessons is, therefore, to document what is happening in the classroom. The objectives of the study will not be achieved if videotaping of lessons is done inconsistently across countries and videographers. It is of crucial importance to the project that all the videographers strictly follow the procedures developed for this project.

Shooting in Real Time

Because we want to see each lesson in its entirety, all videotaping will be done in real time. The camera will be turned on at the beginning of the class and not turned off until the lesson is over. This means that we can study the duration of classroom activities by measuring their length on the videotape. Obviously, this would not be possible if there are any gaps in the recording.

The tapes will not be edited, but viewed from beginning to end in real time. This means that you must attend to what is being captured on the tape at all times. Nothing will be deleted. If you are used to editing, taping in real time will take some getting used to.

What to Document

Classroom lessons are complex. What kinds of things need to be captured in the videotape? To answer this question, imagine you are an observer. You walk into the classroom to see what is going on. What do you look at? You cannot look at everything; decisions must be made from moment to moment about what to include and what to leave out.

When you are in a mathematics or science classroom observing the lesson and trying to understand what is happening, you will probably attend to three things: the teacher, the students, and the tasks. These are the three things we want you to document.

Document the Teacher

During the lesson, teachers engage in a variety of activities. For example, they explain concepts and procedures, pose problems, assign tasks, ask questions, write information on the chalkboard, walk around the classroom and assist individual students, etc. Because the main goal of this project is to study teaching in different countries, it is necessary that we thoroughly and carefully document the teacher's activities and behaviors during the lesson.

Make sure that you capture what the teacher is doing, what he/she is saying, and what information he/she is presenting to the class.

Document the Students

When you are observing a lesson in a classroom, you would not only look at the teacher all the time but look at the students as well so that you understand what goes on in the classroom. Make sure that you capture what students are doing and saying during the whole-class interaction, when they are working in groups and on their own. Focus mainly on the activities and behaviors of the students who are interacting with the teacher, but turn to other students as well from time to time because students might be doing different things when the teacher is and is not with them. Of course you cannot document everything that every student says and does. The goal is to sample student behavior so that what is portrayed in the videotape is representative of what actually happened in the lesson.

Document the Tasks

During mathematics and science lessons, teachers assign various tasks to students. Normally the teacher presents the task to students clearly enough that students understand what they are supposed to do, and it is usually not hard to see in the video what the task is. This is not always the case, however. If the task is ambiguous or poorly described, many students will be uncertain how to proceed. Or, if the class is broken into small groups, each group may be working on a different task.

In all cases, what we want to see on the video is the task that students are actually engaged in doing, whether or not it is what the teacher intended. To see clearly what students are doing it is often necessary to zoom in close enough to capture what at least a few of the students are working on. Make sure you document how students are actually doing the assigned tasks.

Placing the Cameras

The Two Camera Strategy

We are using two cameras in this study. One will be stationary. It typically will be placed up high on a tripod along a side wall near the front of the room, set to the widest shot possible, and used to capture as many students in the classroom as possible. We will refer to this as the "student camera."

The videographer will operate the second camera. It, too, will be placed on a tripod, but will also be removed from the tripod whenever it is necessary to document the lesson. It will generally be placed between 1/3 and 1/2 of the way back from the front of the class, and will more often than not focus on the teacher and his or her zone of interaction. We will refer to this camera as the "teacher camera."

The physical arrangement of classrooms and the activities that take place within them vary greatly. The videographer must decide where to place the cameras so that the documentation requirements outlined above can be met to the greatest possible extent. It is helpful, if possible, to talk with the teacher before the class begins to find out generally what is going to happen, and where the action will take place. The camera should be placed so that it can easily tape the main chalkboard or audiovisual device, the teacher, and some of the students in a single master shot. The position should also allow for easy panning to other areas of the classroom.

Rationale for Camera Placement

It is not possible, due to varying classroom configurations, to define a single best position for the teacher camera. However, we have found that placing the camera along the side, 1/3 to 1/2 way back, works best in most classrooms.

This position allows good views of the board in medium and close-up shots, as well as good shots of the teacher's and students' faces in a wide master shot. This position also allows for quick panning to the front and rear of the room as well as an ideal view of the opposite side of the room especially if there is a supplementary chalkboard in that location.

Why not set up in the rear of the room? Although setting up in the rear of the room offers a good view of the entire classroom it also has two major disadvantages. The students are only seen from behind, and the camera will most likely have to zoom in to frame the front of the room, which will tend to accentuate camera movement.

Why not set up in the front of the room? Setting up too close to the front of the room results in oblique angles that make it difficult to see what the teacher is doing and to read the board.

The student camera should be mounted as high as possible so as to give the least obstructed view of what the most students are doing. Placing it on the side, a few feet from the front, will usually work best, and it should usually be on the same side as the teacher camera. This is important because it reduces the likelihood that the student camera will be included in the teacher camera's shot.

Light Sources

Both cameras should be set up on the same side of the classroom as the largest set of windows, thus keeping the major light source at the camera operator's back. This orientation will minimize overexposure due to backlighting. This position also allows a good view of the supplementary chalkboard that is often on the opposite wall from the windows.

If the classroom has windows on both sides of the room, choose the side that looks best overall. Be sure to maintain, however, careful manual exposure of the foreground. In any case, the camera's exposure should be set to manual and adjusted according to the situation (See "Exposure" below).

Also keep in mind that it often is possible to pull window shades if you feel positioning the camera opposite the windows would be a better alternative. In fact, often you will need to pull the blinds even if the windows are behind you so as to avoid reflection on the board or other equipment.

Tripod versus Hand-Held

Whole Classwork. It is preferable to keep the camera on the tripod during periods of whole classwork (when the teacher and/or a student is at the board). Circulating through the classroom can be distracting and can make the camera the center of attention.

Independent Work. If independent seatwork occurs for more than 2-3 minutes, it is preferable to handhold the camera, so that you can more closely capture individual interactions and students' work. Below are some examples of seatwork:

- When the teacher assists students individually or as a small group.
- When students break into groups and work on assigned tasks.
- When students gather to work around a computer

During these activities, take the camera off the tripod, handhold it, and walk around the room for the duration of the seatwork period. Try to remove the camera smoothly from the tripod so that you will not lose the action you are documenting. Then, at the end of the seatwork period, put the camera back on the tripod as smoothly as possible.

Keeping track of the teacher. It is very important to keep track of the teacher during periods of independent work. If the teacher is interacting with students, it is particularly important to capture these interactions. Most likely, during periods of independent seatwork you will be filming the teacher interacting with students, using a medium or wide shot. However, you should also try to periodically capture students' work, including what they have written on their paper, the materials they are using, and their textbooks.

Finding opportunities to shoot students' work. Shooting students' work means getting close-ups that are readable to a viewer. Try to get at least one good shot of a student's work. Ideally try to shoot as many different students' work as possible, without losing track of the teacher. One opportunity for shooting students' work is when you are filming the teacher providing assistance. Another opportunity is when the teacher is not doing anything, and you see a student whose work you could easily shoot.

The close-up shot. Getting a good close-up shot of students' work presents a somewhat difficult situation for the videographer. In order for the shot to be effective, the viewer must be able to read what the student has written. Such shots are critical for the viewer to know exactly what work students are doing, or have done, at their seats. However, getting this kind of shot can be disruptive to the student. Therefore, you will have to use your judgement as to when it is appropriate to attempt these close-ups.

For the ideal close-up shot, you should stand behind the student (or possibly to their side), zoom in, focus carefully, and film everything they have written. Please be aware that the camera only needs to be in this position long enough to zoom in and focus, because viewers can easily freeze this frame of video.

> Practice removing the camera from the tripod and placing it back on the tripod while you maintain a shot. This needs to become a smooth and automatic movement.

Other Issues to Consider in Placing the Cameras

There are still some other issues you will need to consider when choosing the camera positions in a classroom.

- Overhead projectors, slides, multiple AV presentations.

You should take into account the audiovisual materials that will be used so as to position yourself at a vantage point from which you can best capture see them.

- Direction in which students are facing.

Try to position the teacher camera so that you can see the faces of at least some of the children (if not the majority). This will reduce the chance that you have to remove the camera from the tripod.

- Clear view.

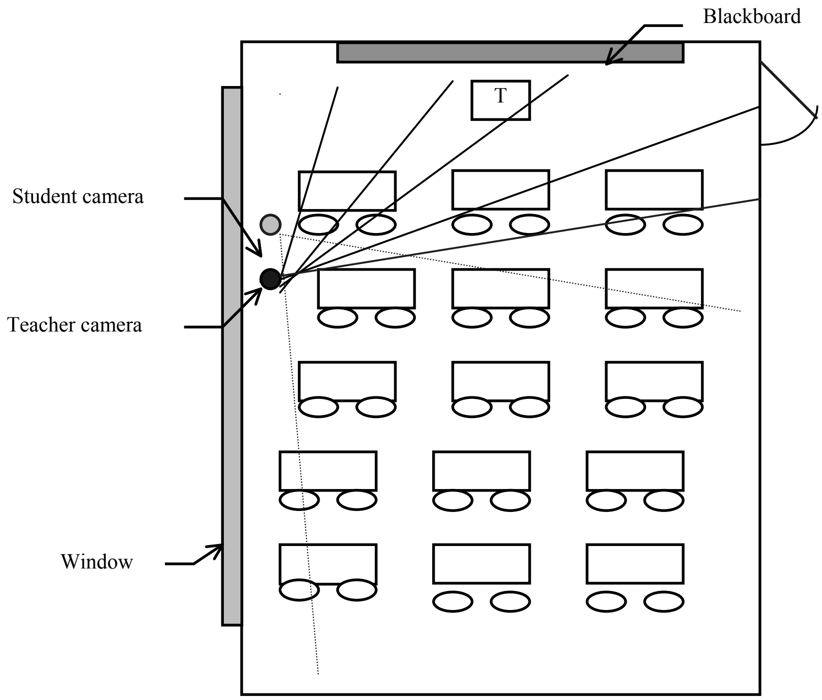
You want to avoid having students sitting directly in front of the camera because they will block your view. If you find a very good position but a student is in your way, you might want to consider asking the teacher if it is OK to ask the student to move.

Some Common Situations, and Where to Place the Cameras

In this section we will illustrate where to place cameras in a variety of classroom settings with different instructional activities. In general you may find mathematics lessons easier to videotape than science lessons because science lessons are often held in a lab, which tends to be much larger than a regular classroom, and desks are often built-in so that you cannot move them to secure the camera positions. Also science lessons involve demonstrations and experiments that often require a videographer to handhold the camera and move around in the room to document what the teacher and students are doing. In any event, you should always keep in mind in making your decisions of where to place cameras and what to videotape the principles and guidelines described above.

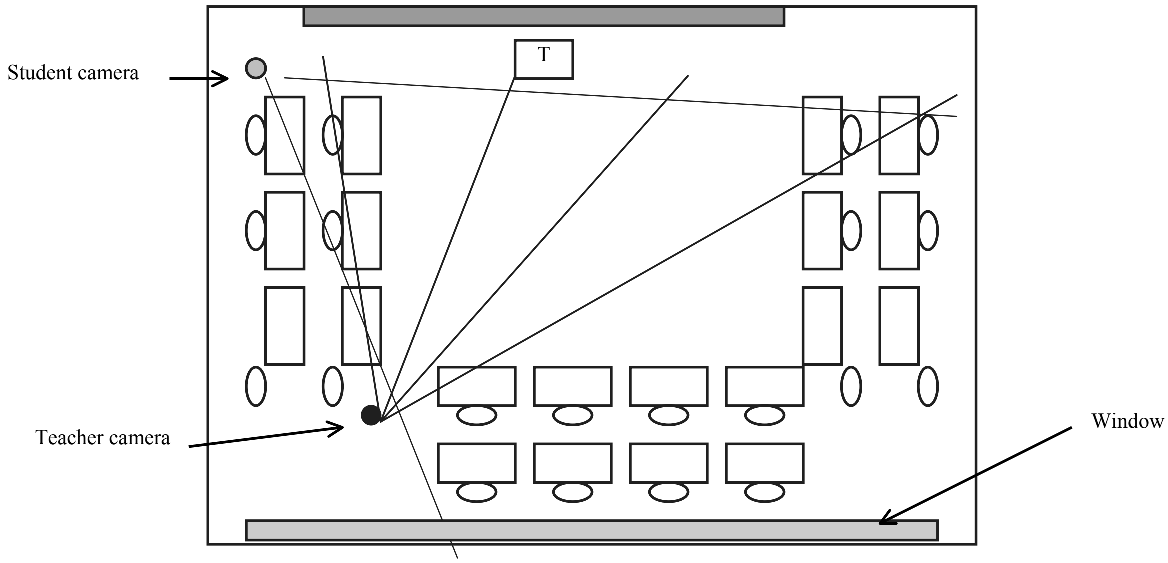
Situation 1: Window Opposite from the Door, Chalkboard at the Front, Movable Student-Desks Facing the Front

This situation is probably the most common classroom setting. You can place the teacher camera by the window, 1/3 of the way from the front, and the student camera near you, leaving it aimed at the students behind the camera. Keep the teacher camera on the tripod as long as you can document what the teacher and students are doing.



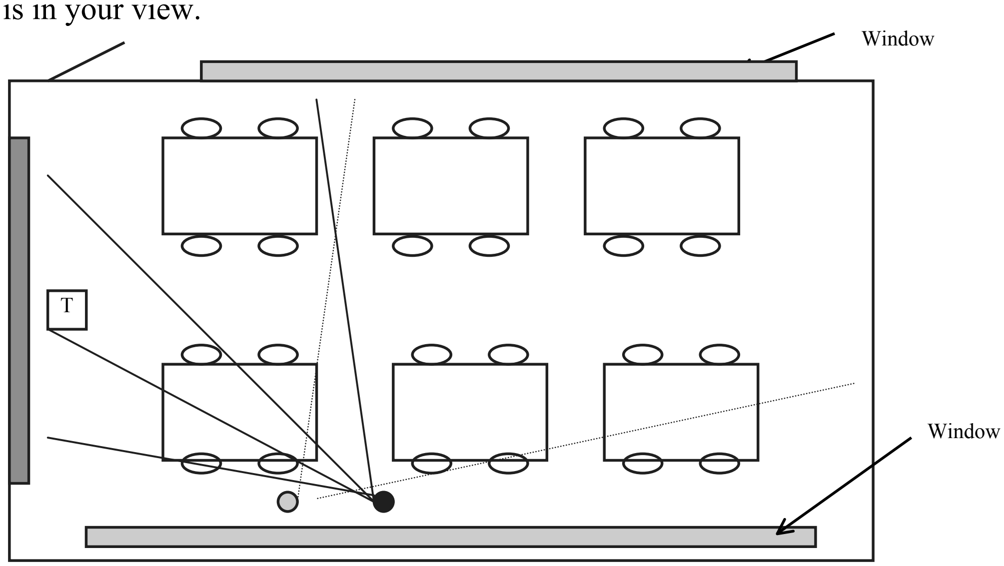
Situation 2: Chalkboard at the Front, Window On the One Side, Student Desks Arranged in a U-Shape

This situation does not allow you to apply the 1/3 view rule. You should place the teacher camera where you have a good view of the teacher and the chalkboard, and students are not blocking your view. Place the student camera in the front corner where the camera is not in the view of the teacher camera.



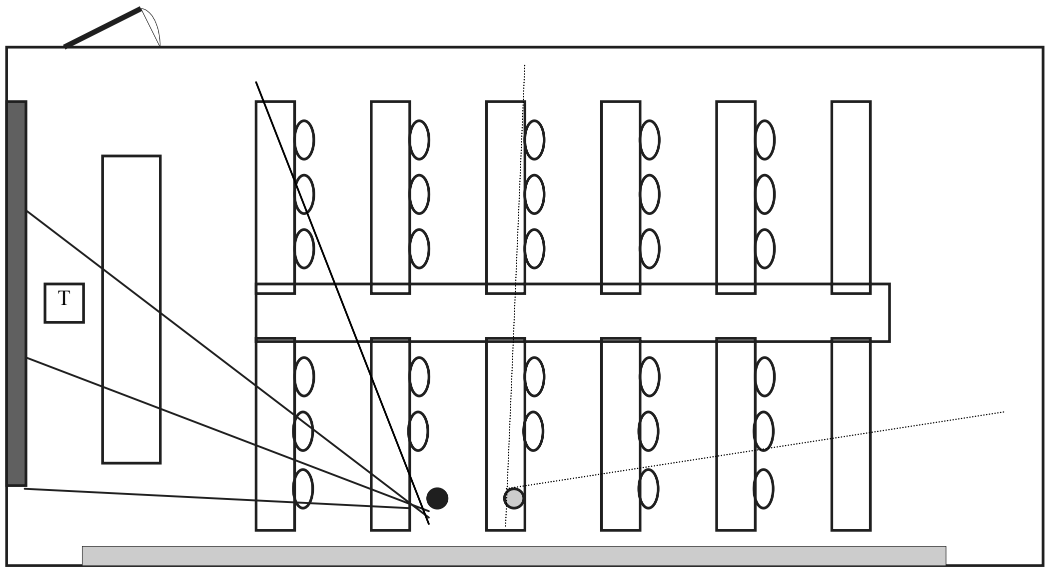
Make sure that you set up the student camera as high as possible to avoid students' heads blocking its view.

Situation 3: Students Sit in Groups, Windows on Two Sides of the Room
In this situation 1/3 view may apply. Again place the teacher camera so that you have a good view of the teacher. Try to avoid backlighting situation. If possible, close the blind of the window that is in your view.



Situation 4: Large Science Lab, Student-Desks Not Movable
Often science labs are much larger than normal classrooms, and student-desks are built-in so that you cannot move them. Because the room is large, often there are enough rooms for students to sit even if you occupy few seat spaces (see the diagram below). However, make sure you ask the teacher if it does not cause any problem. When group experiment starts, you may need to lower

the angle of the student camera slightly so that it captures the group in front of the camera while documenting other groups' activities as well.



Audio Recording

We are using three microphones to capture audio in the classroom. One is the built-in microphone on the student camera. The other two are fed into the teacher camera through a mixer, mounted underneath the camera. One of these is a wireless microphone worn by the teacher; the other is a small microphone attached to the top of the camera. Be sure to familiarize yourself thoroughly with the use of these microphones.
Always wear headphones while you are taping so you can monitor what the camera is picking up at all times.

Deciding Where to Point the Teacher Camera

Once you begin videotaping classroom lessons you will see that it is not enough simply to know what needs to be documented. It is impossible to simultaneously capture teacher, students, and tasks. You must decide, at any given moment, where to point the camera, and what to include in the shot.

One thing to keep in mind is that the student camera will always be taking a wide shot of the students. So, although you must sometimes get close-ups of students and their work, the primary focus of the teacher camera will be the teacher and the tasks.

<u>The Perspective of the Ideal Student</u>

Most of the time you can decide where to focus the camera by taking on the perspective of an ideal student in the class. Given what is going and what the teacher is trying to accomplish, where would the ideal student's attention be focused? This is usually where you want to focus the camera.

If the teacher is lecturing and the students are listening, you probably should focus on the teacher since that is where the ideal student would be looking. But you also should move now and then to get a close-up of what students are writing in their notebooks. If the students have been assigned to work on a task at their seat while the teacher walks around and helps students who are having difficulty, you should probably put most of your focus on the actual task that students are working on, while still keeping track of the teacher.

Keep Track of the Teacher at All Times

Because the teacher is an extremely important part of the lesson, we want to keep track of the teacher at all times. This does not mean, however, that you must always have the teacher in the camera view. We will have audio coming from the teacher's wireless microphone, so as long as you pan back to the teacher frequently we will be able to find out what the teacher is doing. If the teacher engages in a long interaction with a single student we want to capture it, but also we want to see what the other students in the class are doing.

Some Difficult Situations and Their Solutions

In general, you find it difficult to decide where to point the camera when: 1) separate activities are occurring at the same time, and 2) when events change very quickly. Here are the rules to keep in mind when you encounter those situations:

When Separate Activities are Occurring at the Same Time
If students are working on their own on an assigned task while the teacher prepares materials on the board, it is difficult to document both what the teacher is doing and what the students are working on.

The general solution to this situation is to focus on the teacher for a while, then pan slowly away from the teacher to document what the students are doing. It may be necessary to zoom in to see the task that students are working on. Then move back to the teacher.

Rule: Keep the shot mainly on the teacher but tape students activity from time to time to understand what task they are working on.

When Events Change Very Quickly
Sometimes things change constantly during the lesson. You must listen carefully to what is happening and try to predict what might happen next. This is the only way to be ready to react in time. However sometimes changes will occur very quickly and you are likely to miss what has happened.

If events change quickly and it is clear that the change is only a brief one, it is often impossible to catch the change in time and it is better to let it go. In general you should avoid moving the camera to capture brief events. We are likely to miss them anyway, and rapid moves compromise the quality of our tapes. It is not only the brief event that is missed, but parts of the more enduring event would be missed as well as you try to find your way back to the original event.

Rule: avoid moving the camera to capture brief events.

In the table below we describe some difficult situations that are likely to occur in mathematics and science classrooms and what to do when they occur and why.

Some possible situations

	Descriptions of possible situations	What to do	Why
1	• Teacher at the front talking • One student is at the board working on a problem and talking publicly • Rest of the class working individually at their seats	Focus on the teacher and the student at the board, but find a chance to document what other students are doing	Because we want to document: 1) the teacher, 2) teacher-student interaction, 3) new information on the board, and 4) students' task
2	• Teacher walks around assisting the students privately and talks to the whole class from time to time • One student at the board working on a problem • Rest of the class working individually	Document how the teacher instructs individual students, but document the student at the board and the information on the board when there is a chance	Because we want to document: 1) the teacher, 2) new information on the board, and 3) students' task
3	• Teacher stays at the teacher desk assisting students privately • Rest of the class working on their own	Document how the teacher instructs individual students (move close to them) and document what other students are doing	Because we want to document: 1) the teacher, 2) teacher-student interaction, and 3) students' task
4	• Every group works on the same task; • Teacher walks around assists each group	Document how the teacher assists individual groups (follow the teacher) and also document some groups when teacher is not with them	Because we want to document: 1) the teacher, 2) teacher-student interaction, and 3) students' task
5	• Every group works on different tasks; • Teacher walks around and assists each group	Document how the teacher assists each individual group (follow the teacher) and also document every different group work	Because we want to document: 1) the teacher, 2) teacher-student interaction, and 3) students' task
6	• Every group works on a different task, • One group works outside the classroom • Teacher walks around and assists each group	Same as #5 but find a chance to document the group outside	Because we want to document: 1) the teacher, 2) teacher-student interaction, and 3) students' task
7	Whole class leaves the classroom and work outside	Follow the class and videotape outside; but do not turn off the student camera	Because we want to document: 1) the teacher, 2) teacher-student interaction, and 3) students' task

How Close to Frame the Shot on the Teacher Camera

The Zone of Interaction (ZOI)

A space within which the action to be documented is occurring is called the zone of interaction (ZOI). For example, if one student is at the board writing something and the teacher is standing beside the student and asking questions to him/her, the ZOI includes the teacher, student, and the board (see the example below).

There are two types of ZOI: central and split. The ZOI is called *central* when it can be framed within a single shot. When it cannot be captured within a single shot, it is called *split.* Below are some examples of difficult situations of ZOI and the general rules to follow in those situations.

Aside from making sure that all videographers point the cameras at comparable things, we also need to make sure that their shots are framed in comparable ways. An extreme close up of the teacher talking would provide a very different sense of the action taking place than a wide shot where the teacher is seen in the context of the classroom.

The Master Shot

In general, we want the widest shot possible because that gives us the most information. And in general that means that you will use a shot called the Master of Scene (MOS) or, more simply, the "master shot. "

The master shot is achieved by zooming the lens out completely, allowing for the widest most encompassing view of the whole scene. By using a master shot we will be able to get as complete a picture as we can of the activity taking place in the lesson.

For example, a central ZOI, which encompasses the teacher talking to the class, could be captured with a zoomed in shot of the teacher's face or of the teacher from the waist up; this would probably be the nicest shot from an aesthetic point of view. However, from our point of view the preferred shot is still the master shot because it is the one that will give us the most information about the context within which the action is occurring (see the picture below).

Also, the master shot is less prone to bias because it does not artificially focus the viewer on whatever aspect of the lesson the videographer judges to be most interesting.

The Medium Shot

This shot frames a single individual or large object. The medium shot is not a close-up and not very wide (although in certain circumstances you will need to zoom all the way out to achieve a medium shot). For our purposes framing the teacher or any other individual from the thigh or waist up to six inches above his or her head will be called a medium shot.

The Close Up

This shot closely frames anything or anyone. For instance, if the teacher holds up a manipulative or refers to something small, and it is important that we see it, you should zoom in and tightly frame that object. (Note that this will affect focus.) In other situations it may be necessary to take a close-up of what a student is doing at a desk or an item on the chalkboard.

The Group Shot

This shot frames the teacher and a group of students, or any relevant group of individuals. Note that this shot can be achieved by either a wide-angle zoom or a longer focal length zoom, depending on the camera's distance from the group. (If the camera is handheld it is wise to keep the lens as wide as possible while adjusting the frame by moving closer or farther away from the group. This maximizes the depth of field, and minimizes camera movement making it easier to keep more in focus.)

The Two Shot

This shot frames any two individuals, most typically the teacher and the student that he or she is talking to. Again, the focal length of the zoom lens is determined by the distance the subjects are from the camera. (In handheld situations, it should remain medium to wide, adjusting the frame through camera to subject distance).

Some Example Situations and How to Handle Them

Situation 1: When Two Speakers Will Not Fit in a Single Shot

When the ZOI is split between different speakers, then you should move the shot from speaker to speaker as they take turns talking. There is however, an exception to this rule. If one of the speakers is taking such brief turns of speech that you do not have enough time to go to this speaker before his turn is over, just keep the camera on the person doing the most talking.

Rule: move from speaker to speaker as they take turns talking if the turns are long enough.

Situation 2: When the Speaker is Far from the Object Being Discussed

This situation happens frequently for instance when a student in the back of the classroom is talking about things written on the chalkboard. In this situation, the general rule is to keep the shot on the speaker. But before settling on the speaker you must first move the shot over to the object and document it long enough to provide the visual information needed to make sense of the talk. For example, if the teacher is talking about a problem on the chalkboard or a geometric shape, first tape these objects and then move to the speaker.

Rule: keep the shot mainly on the speaker but capture the object first.

Situation 3: When the Speaker is Close to the Object Being Discussed but They Will Not

Fit in a Single Shot: For example, the teacher is holding up an object and describing it, but in order to see the object clearly you need to zoom in closely and thus exclude the teacher from the frame. The ZOI presents a split because the teacher and the object cannot be captured in the same shot.

Also, if the speaker is pointing to specific features of the object as she talks, and if the direction of the points must be seen in order to understand the talk, then you must zoom in on the object to understand the teacher's talk.

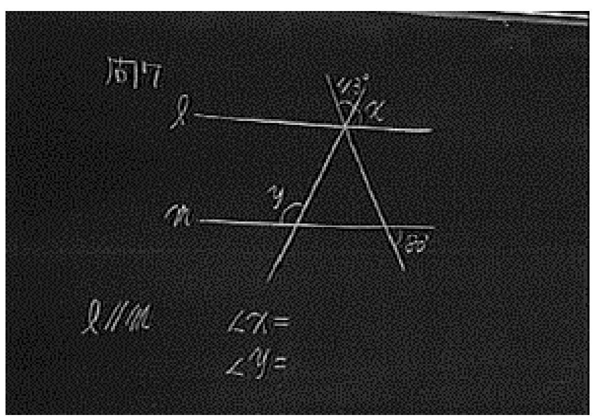
Rule: keep the shot mainly on the speaker but capture the object first or whenever the speaker points to specific features of the object.

Taping the Chalkboard and Overhead Projector

Because teachers often use the chalkboard or an overhead projector we will discuss in some detail how to handle these situations using the guidelines that were discussed above.

Chalkboard

Things written on the board during lessons are treated the same as other objects that get talked about. The camera usually has to zoom in tighter than a master shot in order to capture the information being presented. In fact, writing on the board is often so small that you will find yourself in a split situation where to read the writing you will lose the teacher from the shot. In any case, it is important to zoom in close enough--and for long enough--so that the writing on the board is clearly legible on your small, 4-inch LCD monitor.



Getting closer to read the chalkboard.

On the other hand, it is not necessary to stay in close for very long in most instances. We always prefer the master shot. So if something is being written on the board, and if it seems to take a while for the person to finish writing, stay on the master shot until the person is finished writing rather than immediately going in to capture what is being written. Then zoom in and capture what is on the board. The exception to this rule would be if in order to understand what is being said, you need to see what is being written as it is being written. (This often happens when the teacher is talking about what she is writing as she is writing it.)

One common mistake is to zoom in too close and for too long on the chalkboard. Often you can read what is on the board with a medium shot and you do not need a close up. Or, if you do need a close up you do not need to hold it for very long. Once you have captured what is on the board you can often understand a discussion of its contents without zooming back in. If you can remember enough of what is written to easily follow the discussion from a wider shot, the viewer probably will be able to also.

When the contents of the board changes you must zoom back in to document the change. We must be able to know what is on the board at all times.

Overhead Projector

Teachers use overhead projectors (OHP) in much the same way as they use the chalkboard. Generally speaking, the OHP should be photographed in the same way as the chalkboard. However, overheads present a special difficulty for the cameraperson because the aperture has to be changed in order to see what is being projected. Because zooming in and out of an overhead projection presents a challenge for the cameraperson; we allow the camera to remain more static when shooting overhead projections than when shooting the chalkboard or other objects. In general, you can forgo returning to the master shot if it is clear that the OHP will be modified soon. This will help you avoid a lot of zooming in and out while adjusting the aperture.

> Be sure to practice smoothly and quickly changing the camera settings so as to capture the OHP projection. This happens frequently, and it is essential that you not miss what is being projected.

Chapter 3: Camera Work

Now that we have discussed what you are expected to tape, we will give a more detailed description of the basic camera moves that you will be asked to carry out. It is important that the viewer's attention be directed towards events in the classroom and not the actions of the camera or the camera operator. If your images are jerky or if they do not follow certain basic cinematographic conventions, they will look strange and the focus will be taken away from the classroom events.

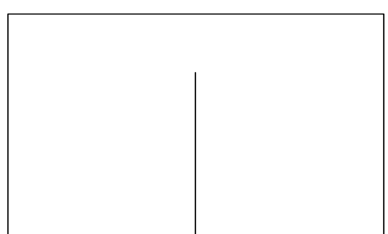
Below we will discuss some basic principles and conventions that should guide how you frame and compose your shots. We will also briefly discuss some tips for achieving smooth camerawork.

Framing and Composing

Basic Principles

In composing your shots you should be guided by the notion of visual weight. If your shot is not balanced it will produce a sense of unease in the viewer, which can be quite distracting.

When something appears in the image frame, it draws our attention and we look at it more than we would look at an area that contains "nothing". If something draws our attention it is said to have visual weight. Certain things carry more visual weight than others. Large items draw more attention than small ones. Moving, energetic elements have more weight than static elements. Complicated shapes draw more attention than simple shapes. People usually carry more visual weight than file cabinets. Also certain areas of the frame carry more visual weight than others. Elements in the center of the frame tend to exert less visual weight than elements at the edge of the frame. In fact the closer an element gets to the edge of the frame and the further it gets away from the "felt axis"(see figure below), the more visual weight it will have.

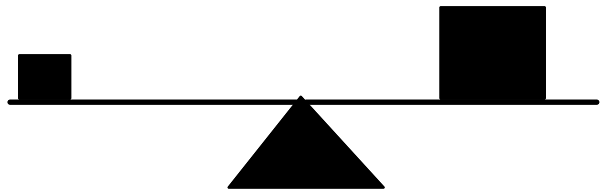


The "Felt Axis"[18]

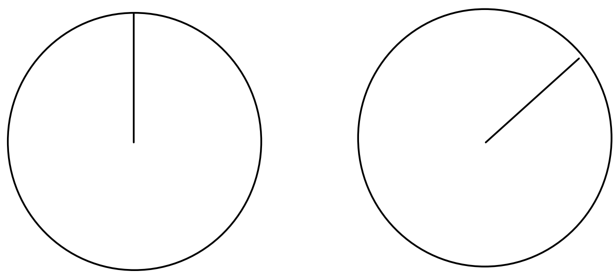
In addition, equilibrium is our strongest visual reference and greatly influences our sense of visual weight. All visual patterns have a center of gravity that is immediately intuited. The horizontal-vertical construct is the basic relationship between our environment and us. Our internalized awareness of steady uprightness is always in relationship to a stable base. If we are thrown off our center of gravity, we push an arm or leg out to regain our balance. As picture

[18] Figure taken from Dondis, Donis A. (1977), *Primer of visual literacy.* Cambridge, Mass.: MIT Press.

elements move away from the felt center of gravity, they carry more visual weight as shown in the figures below.

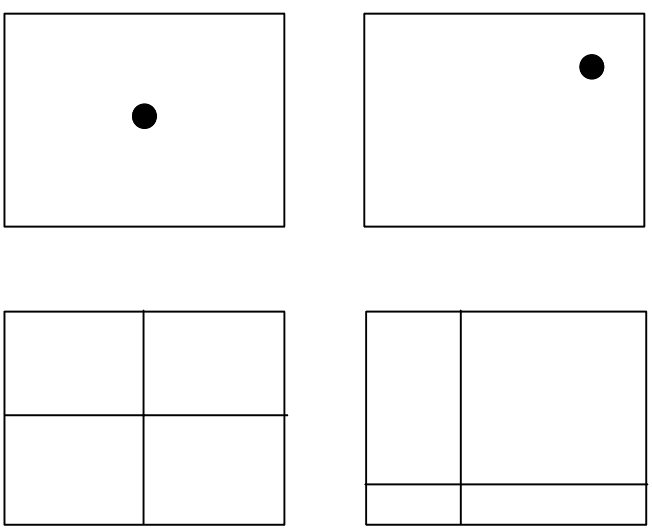


Something small and near an edge carries more weight than something larger at the center[19]



The circle with the "tipped" or non-conforming radius attracts the most attention. [20]

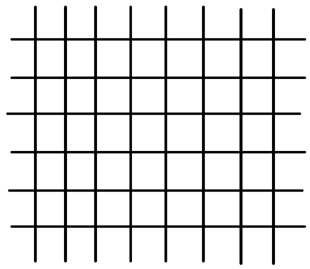
In composition, harmony and stability are the opposite of the visually unexpected and stressful. For instance, the placement of a dot in the center of the frame feels balanced and harmonious. By contrast, a dot or line placed off the felt axis carries more stress and more visual weight. To balance it, you must place another picture element opposite it (see Figure below).



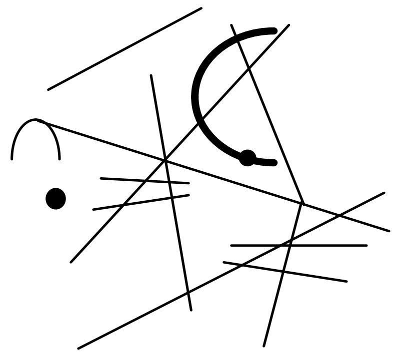
[19] Figure taken from Dondis, Donis A. (1977), *Primer of visual literacy.* Cambridge, Mass.: MIT Press.
[20] Figure taken from Dondis, Donis A. (1977), *Primer of visual literacy.* Cambridge, Mass.: MIT Press.

Comparison of balanced and un-balanced compositions due to differences in visual weight.[21]

Compositions that are bilaterally symmetrical do this well and harmoniously. However, compositions can also be balanced asymmetrically by combining image elements of different visual weights in different areas of the composition. The point is to move the viewer's eyes throughout the composition, favoring the image elements that are most important.



Symmetrical



Asymmetrical

Examples of symmetrically and asymmetrically balanced compositions

Most of the time you will be balancing the teacher <u>and</u> something else such as the chalkboard or a student. This means that generally you will be working with asymmetrical compositions. Your goal should be to make these compositions balanced and to make sure that they direct our attention to the most important elements in the frame. In other words you do not want a filing cabinet to carry more weight than the teacher instructing the class. In balancing your shots it will also be useful to keep in mind that the direction of the principal actor's gaze also carries visual weight. Sometimes called a vector, the direction of a gaze can be thought of as a powerful line that is irresistibly followed by the eye. Because of this, the direction of this vector must be balanced by the rest of the composition. For instance, if the teacher is looking at the students toward frame right, you will probably need to position the teacher to the left of the frame just enough to balance the weight of his or her gaze.

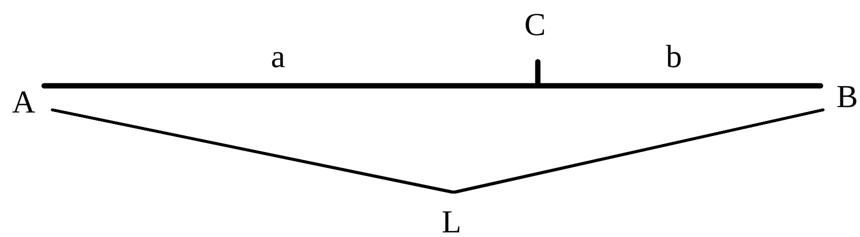
<u>Composing Along the Golden Section Lines</u>

As mentioned earlier, if you do not follow certain conventions you can create images that feel strange and call attention to themselves. One of these conventions is known as the Euclidean "Golden Section" (from Euclid II, 11). This method of cutting a line or other geometric form into "golden" proportions has been known and used in western art, mathematics and architecture for over 2000 years and is still evident today. The Golden proportion was used by the Greeks to design much of what they built from the classic Greek Amphora, to the floor plans of temples and their elevations. Although we do not have the space here to discuss this further, suffice it to

[21]Figure taken from Dondis, Donis A. (1977), *Primer of visual literacy.* Cambridge, Mass.: MIT Press.

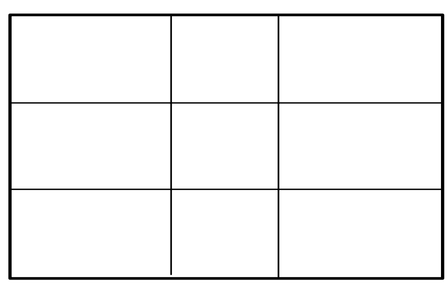
say that the Golden Proportion has had much influence over the organization of aesthetic production in Western history, and it should serve us adequately as a standard.

Euclid first demonstrated this proportion by cutting a line L, into two segments **a** and **b**, so that b/a = a/L, or BC:AC=AC:AB This makes C the "golden cut" of AB or line L.



The golden cut

If we segment each of the four sides of the rectangle of a video image according to the golden cut, and subsequently divide the rectangle with four lines running across to the section cuts on each side, we will have divided the video image as shown in the figure below. Our general rule of composition suggests that prominent features of the composition should be placed on one of these section lines, or on one of their four intersections. (Applying this rule to a 35mm frame results in section lines that divide the frame roughly into thirds. Hence the compositional rule known as the "Rule of Thirds").



Section lines for both horizontal and vertical axes for a 4:3 video aspect ratio

By this method it would be incorrect, save for an extreme close-up, to put the teacher in the middle of the frame; he or she should be placed slightly to the left or the right. When the teacher is writing on the chalkboard, it would be best to balance the teacher, on one side, and his or her writing on the other. Which side the teacher is placed on depends on his or her orientation. For example, should the vector of the teacher's gaze go off screen right, placing the teacher on the section line screen left would balance the weight of his or her gaze. In more complicated situations where there are more than two things in the frame, or a split of two items, it is still preferable to balance everything in the frame around the section lines, distributing the visual "weight" of the picture elements in relation to the section lines.

A Technical Note about Composition

Be careful not to be too tight with your framing. Use the safe line inside the camera viewfinder to ensure that relevant information will be seen on the edges. Compose your image within the safe lines. Remember that you are looking at a small camera monitor and the image will be displayed larger. Of course, vertical and horizontal lines in the image should be parallel with the edges of the frame.

Camera Moves

If the camera moves or zooms smoothly, infrequently and in reaction to events in the classroom, it will not draw attention to itself. If, however, it is moving constantly, zooming in and out, re-framing, and focusing, the viewer will be distracted and the camera work could conceivably interfere with the evaluation of the data. This is another reason why we have opted for a master shot as the preferred shot. If the lens is zoomed out as wide as possible, camera movement will be minimized, the increased depth of field will keep the image in focus, and less camera panning and tilting is necessary to cover events in the classroom. Conversely, if the lens is zoomed in close, the camera must move constantly to keep a moving subject in the frame; thus, focusing will become more difficult. Below we will briefly discuss some guidelines to follow for achieving camerawork that does not call attention to itself.

Achieving Smooth Camera Movement

In order to achieve smooth camera movement panning, tilting and zooming must be carried out in a coordinated and integrated way rather than as three separate moves. As you zoom out, you must tilt down to retain the same framing. As you zoom in, you must tilt up. In addition, some shots require simultaneous zooming, panning and tilting. For example, a common shot will be to zoom out from a medium shot of the teacher at the chalkboard to a master shot of the teacher and classroom. In this maneuver, you must zoom out, pan (say) right, toward the students, keeping the teacher at the left edge of the frame, while you simultaneously tilt down, keeping the image exquisitely composed throughout.

Wide angle panned images cause less apparent camera motion than zoomed in pans. Fortunately, since our preferred shot is the MOS, you will often already be at a wider focal length when doing a pan. However, if for example you are zoomed on the chalkboard and need to pan over to a student in the back of the room, you should zoom out before panning to make the move less distracting.

Also, slower zooms are less distracting and are more desirable than fast ones. The EVW 300 has a variable speed automatic zoom. We suggest you always zoom with the automatic feature located on top of the right hand grip. The harder you press the zoom button, the faster it will move; the lighter your touch, the slower it will move. If you must make a quick close-up, or quickly zoom out to show something happening in the wider field, you should zoom at full speed so as to avoid missing the event you are trying to record.

Keeping Objects in Focus

It is extremely distracting to the viewer if the objects being taped are out of focus or if blatant readjusting of the focus takes place. In order to avoid this, you can define a field of focus by zooming in and focusing on an object or wall that you wish to be at the far edge of that field. As you zoom out, the increased depth of field from shorter focal lengths will keep your image focused. After this initial zoom in, there will be no need to refocus unless you zoom in on a plane other than your initial point of focus. Remember longer focal lengths have inherently less depth of field.

Chapter 4: Equipment

Canon Optura Digital Camcorder

The Canon Optura is a small, high quality digital camcorder using the mini DV format. It was chosen because of its lightweight, its image quality (500 lines in NTSC) and its ability to progressive scan. However, because the Optura is a consumer camera there are some restrictions that we have had to overcome by using separate hardware. These restrictions are covered under "Microphones and Audio Connections".(See Section 4.2) Please read the Optura instruction manual thoroughly to become familiar with the camera and its functions.

Video Color Systems

There are currently three analog video systems in the world. NTSC, PAL, and SECAM. The United States, Canada, Japan, and a few other countries use NTSC. Europe and the rest of the world use PAL. France invented SECAM and it is used there although France also uses PAL. Because our video data will be digitized onto CD-ROM in Los Angeles, we use NTSC video. NTSC scans at 30 frames per second and uses a different color system than PAL and SECAM (PAL scans at 25 frames per second and uses 50 cycles per second AC power). All of our videographers will shoot with NTSC cameras regardless of their location.

Proscan

The Optura offers a progressive scanning CCD chip. This chip scans every line each 1/60th of a second. In effect it delivers 60 frames per second rather than the 30 frames per second and 60 fields (1/2 frame) per second of an interlaced scan. With this chip we have the option of recording video either as an interlaced signal or a progressive scanned signal. Since our final product is destined to be displayed on a progressive scanning computer monitor, progressive scanning will give us a sharper image (particularly when we sample stills from our video data). See page 33 of the Optura manual.

Note: Because the monitor mounted on top of the Optura is an interlaced video monitor, moving images on this monitor may appear "jerky" when the camera is set to progressive scan.

Video Recording and Still Image Recording

The Optura can be used as a digital still camera. The recording button is located on the upper right hand corner of the camera. Around this red button is a switch that can be turned to "Movie", "Photo" or "Lock". When set to "Movie", the camera records video when the red button is pressed. When set to "Lock", the camera is in standby mode. When set to "Photo", the camera will take single frame digital stills. (See page 12 of the Optura manual).

Be sure you have set this switch to "Movie" mode so that the camera will record video and not stills.

Camera Video Exposure

The Optura has good automatic exposure as well as an automatic video gain switch that works together with the auto exposure. We recommend that you use an automatic exposure mode. The automatic settings are located on “program selector” (the large knob on the left side of the camera). For automatic exposure AND progressive scanning, you must NOT use the "Easy Recording" program. Use the auto recording program "A" in the US,Japan, and NTSC countries. In Europe, Hong Kong, and PAL countries use the “Tv” program mode (shutter priority).

In 95% of our applications these automatic settings will make proper exposures. The major exception is a wide shot in a dark room with a bright projected image (slides, opaque projector, film, etc.). In this case we recommend that you zoom into a close-up of the projected image (so that the auto exposure can adjust to the correct exposure for the projected image) or retain a wide shot and push (once) the exposure wheel. Next, turn the exposure wheel manually to adjust exposure for the projected image by turning the exposure knob. To return to auto exposure, push the exposure knob again.

In Europe, Hong Kong and other PAL countries you must use the “Tv” automatic setting and pre-set the shutter speed to 100 by turning the exposure wheel. If the exposure wheel is pushed in once, the aperture can be set manually while retaining the shutter speed of 100. Push the exposure wheel again to return to automatic aperture exposure while retaining the pre-set shutter speed. Please see the section on the next page.

We suggest that you set up both cameras with the classroom windows behind them. This will avoid backlit subjects that can cause trouble with the automatic exposure control. If this is not possible and you have backlit subjects you will have to set the exposure to manual and to adjust it during recording. Backlit subjects (even if properly exposed) are undesirable because we cannot see everything in the foreground and background.

NOTE: Relying on the small, low resolution LCD monitor for exposure is not desirable and should be done so only if necessary.

Camera Focus

The Optura has good auto focus. We recommend that you use it most of the time. However, it does not "know" what you are aiming at. It is also slow to react in certain situations. There will be rare situations when the auto focus will not focus on what you want and you will have to adjust the focus manually. (Low light and low contrast situations can especially cause problems with auto focus). The focus wheel is located on the lower left side of the camera (next to the exposure wheel). Like the exposure wheel, it will shift into manual focus when pushed once. You can control the focus manually by turning the focusing wheel up or down. Press again to return to auto focus.

Shutter Speed

NTSC Video is scanned at 30 frames per second. This is compatible with the frequency of alternating current in the United States (60 cycles per second). However, when an NTSC camera shoots under artificial light in a PAL country (with alternating current at 50 cycles per second), the image flickers. This is caused by the frequency difference between the scan rate of the camera and the frequency of the lights (ac current). This flicker can be corrected if the camera's shutter (which opens and closes before the scanning chip) is set to a multiple of 50. We recommend that you use a shutter speed of 100 in PAL countries. This means that in PAL countries, you must set the automatic program mode to "Tv" rather than "A". When in the "Tv" mode, adjust the shutter with the Av/Tv control wheel (the exposure wheel). As mentioned above, you can push the exposure wheel once and manually adjust the aperture while retaining a shutter speed of 100. (See page 37 of Optura manual).

In the United States and Japan (NTSC countries), shutter speed is not an issue. We recommend you use the "A" auto exposure program. The shutter speed and aperture will be set automatically. See page 36 of Optura manual.

Optical Image Stabilizer

The Optura is a small camera and it is virtually impossible to hold it steady particularly when the lens is zoomed in. It has a very good optical image stabilizer that will take the shake out of most movement. Keep the image stabilizer set to ON. However, it is still necessary that you handle the camera as smoothly as possible especially when it is off the tripod.

Camera Menu Settings

The camera has a programmable menu for various functions. There are two main menus. Set them as shown below: You may need to use the camera’s remote control to set some of these functions. (See page 25 of the Optura manual.)

Camera Menu: Set the power switch to Camera and the standby lever to “Movie”. Press the “Menu” button.

Digital zoom: ON
Wind screen: OFF
White Balance: AUTO
16:9 : OFF
Movie Mode: Pro Scan
Sensor: ON
Tally: ON
Audio Mode: 16 BIT
Record Mode: SP
Date/time set: Set Date and time
VCR Menu: Set the power switch to VCR. Press the “Menu” button.
Tally Lamp: ON

Sensor: ON
Rec Mode: SP
Mix Select: FIXED
Data Code: CAM
Volume: Medium
Date/time set: Set date and time

Camera Cleaning

It is important to keep the cameras clean on the inside and out. A can of Dust Off and an anti-static cloth are provided to keep the outside clean. Lens tissue is also provided. Breathe on the lens to create a small amount of moisture and clean the lens with one flat piece of lens tissue. Clean the lenses on both cameras before every taping.

Clean each camera's video heads every month using the head-cleaning cassette provided. Insert the cleaning cassette into the camera and press play for 10 seconds. Eject the cassette.

Humidity and Condensation

If the camera is moved from a cold place to a warm place condensation may form on the video heads and other camcorder parts. This can cause damage to the tape and the camera. This is especially true in hot humid climates where air-conditioning is used (in Hong Kong, for instance). But it can also happen if it is cold outside and the camera is brought into a heated building.

IF CONDENSATION IS LIKELY TO BE A PROBLEM, unload the cassette and put the camera in a plastic bag. When the camera reaches room temperature, remove it from the bag. A warning sign will appear in the viewfinder of the camera when condensation is detected and the camera will not operate. You cannot load a cassette when condensation is detected. See page 61 of the Optura manual.

Microphones

The only audio source for the student camera is the ZM-100 zoom microphone. Mount this microphone on top of the camera and plug it into the camera. The teacher camera needs both the teacher's wireless microphone and Sennheiser ME-6 shotgun microphone mounted on top of the camera. Both these sources are mixed and balanced via the XLR Pro mixer mounted at the bottom of the teacher camera. Plug the output of the wireless receiver (XLR male) into the SOURCE 1 XLR (female) input of the mixer. Plug the Sennheiser ME-6 cable into the SOURCE 2 input of the mixer.

Source 1: Teacher’s microphone (wireless receiver output)
Source 2: Student’s microphone (Sennheiser ME-6 shotgun mounted on camera)

Studio Pro XLR Mixer

The mixer is mounted between the camera and the tripod. Mounted below the mixer should be the tripod's quick release plate. The mixer allows two separate grounded audio sources to be mixed though the (mini) stereo input on small camcorders.

Plug the cable from the Sennheiser ME-6 into SOURCE 2 (XLR jack) of the mixer. Plug the XLR cable from the Lectrosonics radio receiver into SOURCE 1 (XLR jack) on the mixer. Plug the output cable of mixer into Mic In plug on teacher camera.

Select "Stereo" from the switch on the front of the mixer. Listening via headphones, switch the ground switch to the best position so there is no hum. Switch both Source 1 and 2 switches to the "mic" (up) position. Finally, adjust the volume of each microphone source on the mixer. SOURCE 1's volume (the wireless teacher's mic) should be set at either 3 or 4. SOURCE 2's volume (the Sennheiser ME-6) should be set at ten. You should hear the teacher's mic coming through one ear of the headphones, and the camera mic coming through the other ear of the headphones. (Remember, the camera mounted mic will pick up any sounds you make).

In field tests a volume level of 3 or 4 for the teacher's mic (SOURCE 1) and 10 for the students' mic (SOURCE 2) seemed right. This will vary depending on the size of the classroom and the teacher's voice.

Note: The instructions for the XLR mixer state the following:

"If you are using two mics and your camera has AGC (Automatic Gain Control) for the audio levels, whichever mic is the loudest will end up setting the level. Use the audio level controls to turn down the loudest mic to match the audio level to the weaker mic."

In other words, if the teacher talks very loudly, this will affect the automatic audio gain on the Optura, bringing the level of both audio channels down which can make the level for the zoom (student's) microphone too low. Should this appear to be the case, you can adjust the volume control for the teacher's mic on the mixer LOWER than 4. This will have the effect of adjusting the zoom mic level higher.

Volume Settings/Ratio on Mixer:
Teacher Mic/Source 1: 3 or 4
Student Mic/Source 2: 10

Lectrosonics Wireless Radio Microphone

There are three parts to this microphone: a transmitter (M187), a lavaliere microphone (M150) that plugs into the transmitter (M187) and a receiver (CR 175).

Lavaliere Microphone:
Plug this into the transmitter. Be sure that the connector locks in. (Disconnect the lavaliere and store it in the case when it is not in use.)

The Transmitter:
Insert a new 9v battery BEFORE each taping. The transmitter has an on/off switch. Be sure to switch it on when it is in use. The power on/off LED should glow brightly.

Turn the power switch to the MUTE position on transmitter. Position the microphone to the appropriate location on the teacher. Keeping the power switch to MUTE ask the teacher to speak as he or she normally would in front of a class. Rotate the MIC LEVEL so that the LEVEL LED flickers or stays lit as you speak. The LIMIT LED should light up on loud peaks. Occasional lighting of the LIMIT LED indicates proper operation and optimum signal-to-noise ratio. Even when limiting is occurring, little or no distortion will occur.

(Be sure to set the transmitter mic levels BEFORE you go to the school. When you wire the teacher with the microphone, do a quick test to see that the levels are set correctly for the location. If the mic level is too high, the LIMIT LED will light frequently or stay lit. If this occurs, lower the mic level. If the mic level is too low, neither LED will light or the LEVEL LED will light dimly. This condition may cause noise in the signal.)

Do not forget to move the power switch to ON when you are ready to tape. Please refer to the Lectrosonics M187 transmitter instructions. Information about this system can also be seen on the internet at www.lectro.com.

The Receiver:
Insert a new 9v battery BEFORE each taping. The receiver has an antenna which must be attached for reception. Before proceeding, make sure the antenna is locked in place. Turn the receiver ON and check to see that the red POWER LED lights up.

Set the OUTPUT control to the 2 o'clock position or 3/4 full. If you hear distortion from the microphone, adjust the OUTPUT control to the left. If you hear a hiss coming from the microphone adjust the OUTPUT control to the right. (Be sure to test and adjust the receiver output BEFORE you go to school. Check the LED levels on location to insure they are set optimally.)

Radio Frequency on Receiver:
This LED lights up when the transmitter is turned on and working properly. Make sure this green light is on.

Power:
This LED lights up when the receiver is properly connected to a power supply and switched on. It indicates proper voltage when the receiver is using a battery.

Modulation:
The "-20" LED lights up when the audio signal from the transmitter is present at an adequate level to produce a good signal to noise ratio. The "0db" LED lights when the audio level is high and the signal is being compressed in the transmitter. It is normal to see and occasional flick of the 0db lamp. An extremely high audio level may cause distortion.

Plug the line out of the receiver into XLR SOURCE 1 of the mixer using the six foot XLR male to XLR female cable provided. Please refer to the Lectrosonics receiver instructions. Information about this system can also be seen on the internet at www.lectro.com.

Frequencies:
The radio frequency of the Lectrosonics microphone is set at the factory and cannot be adjusted. Be sure that the frequency of your transmitter (written on the transmitter) is legal for the country you are operating in. Be sure to communicate with us as to whether your transmitter has the proper frequency.

Canon ZM-100 Zoom Microphone

This microphone is for the student camera. Mount the ZM-100 on the "shoe" on top of the student camera. Plug both microphone cables into the student camera. The audio plug (with two black stripes on the plug) plugs into the "mic in" jack. The microphone needs no battery as it gets its power from the camcorder. The power plug (with one black stripe) plugs into the "DC" jack (next to the mic in jack). Set the ZM-100 stereo/zoom switch to "ZOOM." DO NOT USE "STEREO." Set the zoom knob to 90 degrees.

Sennheiser ME-6 Shotgun Microphone

The ME-6 comes in two parts; the microphone capsule and the power supply module. The microphone capsule screws into the power supply. You should have received this microphone with both parts screwed together. You must unscrew the capsule in order to change the microphone's AA battery. Be sure to insert a fresh AA battery into this microphone before every taping. When you turn the microphone ON, the LED light should blink once if the battery is good.

This microphone inserts into its "shock mount" and the mount attaches to the "shoe" on top of the teacher camera. The one foot microphone cable provided plugs into the microphone at one end and into SOURCE 2 of the XLR pro mixer at the other end.

Adjust the shotgun so that it points at about a 30 degree angle toward the students in the classroom. This mic should favor the students over the teacher.

Bass Roll Off Switch
Located in front of the on/off switch is the bass roll off switch. It has two settings represented by a flat line and a curved line. If set to the bass roll off position (curved line) the microphone will minimize the gain on lower (bass) frequencies. If set to the normal position (flat line) the microphone will deliver all frequencies evenly (20-20,000 Hz at 0 dB). In the classroom you will not ordinarily encounter loud bass frequencies. Accordingly, set this switch to the flat line position.

Digital Watch

Use this watch to record time on both cameras just prior to taping a lesson. This time reference will aid in synchronizing both cameras in playback. Try to get the largest image of the watch as possible in the viewfinder. It may help to angle the watch so that light will better illuminate the time.

Tripods

You are provided two tripods. Use the Matthews fluid head tripod with the teacher's camera and the Pro Master non-fluid head tripod with the student's camera. After it is set, the student's camera does not need to be moved and therefore does not need the smoother fluid head tripod. The Pro Master tripod extends higher than the fluid head tripod. Be sure to extend this tripod to its maximum height after attaching the student camera.

Power/Batteries

Whenever possible, the student camera should be powered by AC current. Insert the "fake" battery (DC-900 DC adapter) into the Optura's battery compartment and connect its cable to the ac adapter/battery charger. Plug this unit into the wall. We have provided a 15 foot extension cord as well as current and plug adapters for your location. The NTSC Optura runs on 110 volts/60 cycles ac power.

Because the teacher camera must be able to move around the classroom it must be battery powered. Provided are two large Bescor 3 hour batteries. Insert the "fake" battery (DC-900 DC adapter) into the Optura's battery compartment and connect its cable to the plug on top of the large Bescor battery. These batteries do not have "memory" and should be charge every night before a taping.

Videographer's Vest

The vest is provided to give you a place to carry the battery and the wireless microphone receiver. From the vest pockets will come cables attaching these things to the camera. We suggest you also carry the second Bescor battery and an additional mini DV videotape in the vest pockets in case a battery or tape runs out before the lesson is over.

Chapter 5: Checklist

Regular Maintenance

- Read the Canon Optura instruction manual thoroughly.
- Read the microphone and mixer instructions thoroughly.
- Set date and time on both cameras. See page 29 of Optura manual.
- Clean cameras and camera lenses regularly.
- Clean video heads every month with cleaning cassette.
- Change camera's CR2025 Lithium battery if its icon flashes in the monitor display. It should last one year. See page 56 of the Optura manual.

Before you go to the School

- Make sure both Bescor batteries and the small Canon battery (BP-914) are charged.
- Put fresh 9v battery in wireless mic transmitter.
- Put fresh 9v battery in wireless mic receiver.
- Put a fresh AA battery in the Sennheiser ME-6 Shotgun.
- Insert "fake" batteries (DC-900 DC adapter) into both cameras for later connections to ac adapter or the large batteries.
- Review and pack directions for school.
- Label tapes now if you wish. (Be sure not to use the wrong tape if a class is canceled.)

On each camera:

- Set camera program mode: "A" Auto. (NTSC Countries)
- Set camera program mode: Tv" and set shutter speed to 100 (PAL countries) (See page 46 in Optura manual.)
- Set Image Stabilizer to "ON" (See page 24 in Optura manual.)
- Set record button switch to "MOVIE"
- Set monitor switch to "EXTERNAL"

On camera menu settings:

(See page 25 of the Optura manual.)

- Digital zoom: ON
- Wind screen: OFF
- White Balance: AUTO
- 16:9 effect: OFF
- Movie Mode: ProScan
- Remote sensor: ON
- Tally lamp: ON
- Audio mode: 16 BIT
- Record mode: SP

- Data /time set: Set Date and time

On VCR Menu Settings:

- Tally lamp: ON
- Sensor: ON
- Rec Mode: SP
- Mix Select: FIXED
- Volume: OFF
- Record Mode: SP
- Data Code: CAM
- Date/time set: Set Date and time

Mixer and Stereo microphone:

- Set switches and controls on mixer and zm-100 in proper position.
- Line/mic: MIC
- Stereo/Mono: STEREO

Other:

- Pack equipment using checklist "equipment to take to school".
- Pack material packets (copies of questionnaires and return envelope) for teachers.

Equipment to Take to School

Video camera hard case

1	Canon Optura "Teacher" Camcorder
1	Sennheiser ME-6 Microphone
1	Shockmount for Sennheiser Microphone
1	Canon Optura “Student” Camcorder
1	Canon ZM-100 zoom mic
1	Studio Pro XLR Mixer
1	Lectrosonic transmitter M187
1	Lectrosonic receiver CR175 with antenna
1	Lavaliere Mic M150
1	extra tie clip for lavaliere
1	Sound Isolating stereo headphones
1	foot XLR to XLR microphone cable for Sennheiser microphone
1	6 foot XLR male-XLR female shielded audio cable (for use between Lectrosonics receiver and XLR mixer)
2	9v batteries for wireless mic system
4	Blank Mini DV tapes (Videographer should always have 4 extra tapes)
1	AA battery for Sennheiser microphone

Gadget bag/ Tamrac 787

1	Canon WL-D66 camera wireless remote
1	STV-250 stereo video cable
1	A/C adapters for camcorders (CA-900)
2	“fake” batteries (DC-900 DC adapter)
2	small Canon camera batteries (BP-914)
6	9v batteries for Lectrosonic receiver and transmitter (2 installed in case)
4	AA Batteries for Sennheiser microphone and WL-D66 wireless remote
2	Bescor batteries (use the DC-900 DC adapter with these batteries)
2	Bescor battery rechargers
1	15’ extension cord
4	Packs of lens tissue
1	Can Dust Off
1	Anti-static cloth
1	Masking tape
1	Current converter and/or adapter (US excluded)
1	Roll gaffer’s tape
2	Canon video/audio proprietary cables for Optura (supplied with camera)
1	Data Collection Manual, Optura camera instruction manual, transmitter/ receiver instruction manual, and zoom mic instruction manual
2	Cleaning cassettes for mini DV
1	Digital wristwatch (to be used as stopwatch)
1	Tamrac photographer’s vest
4	Blank DV tapes
1	Tamrac photographer’s vest

Tripods

1	Matthews THM-20 fluid head tripod (teacher camera)
1	ProMaster 6400 Photography tripod (student camera) (extend this as high as possible)
1	Padded Tripod Case

In the Classroom

- Put ID Labels on video tapes if you have not already done this.
- Load video tapes into cameras if you have not already done this.
- Ask the teacher about the lesson.
- Choose camera positions.
- Move student desks if necessary.
- Close blinds if necessary.
- Set up student camera on Pro Master tripod.
    - Remove lens caps.
    - Set VCR switch to camera/record.
    - Mount zoom microphone on camera.

    - Plug zoom mic into camera.
    - Connect ac adapter or Bescor battery to the camera.
    - Set microphone zoom knob to zoom.
    - Turn camera on.
    - Check audio with headphones.
- Set up teachers camera on Matthews fluid head tripod
    - Remove lens caps.
    - Connect Bescor battery to camera using the cable from the "fake" battery DC-900 DC adapter.
    - Insert Sennheiser microphone into the shock mount.
    - Mount Sennheiser microphone on camera.
    - Turn the Sennheiser microphone ON.
    - Plug the Sennheiser microphone audio cable into mixer CHANNEL 2.
    - Turn Camera ON. (Set the VCR switch to camera/record)
    - Set the mixer stereo/mono switch on mixer to STEREO.
    - Set the mixer line/mic switches on both channels to MIC.
    - Set Channel 1 (Teachers) volume to 3 or 4.
    - Set Channel 2 (Zoom mic) volume to 10.
    - Plug output cable of mixer into camera's "MIC IN" plug.
    - Attach antenna to wireless receiver.
    - Plug Lavaliere mic into transmitter and turn the transmitter to MUTE.
    - Wire the Teacher with the microphone and transmitter and ask for a voice test.
    - Monitor the MIC LEVEL LED on transmitter.
    - Turn the transmitter ON.
    - Plug wireless receiver into mixer CHANNEL 1 using XLR cable.
    - Turn wireless receiver ON.
    - Turn Teacher's Camera ON.
    - Plug headphones into camera's headphone jack.
    - Monitor audio levels from both microphone on teacher camera.
    - If there is audio hum check ground switch on mixer.
    - Temporarily disconnect battery and receiver cables from the teacher's camera.
    - Start Student Camera and make a close-up of the digital watch.
    - Reconnect the battery and receiver cables to the teacher camera.
    - Check that you can remove the camera from the tripod and move about freely.
- Record lesson

After Taping the Lesson

- Remove the teacher's microphone and transmitter
- Turn off transmitter and receiver
- If there is video tape time remaining, collect supplementary video documentation (allow pan of classroom, close-ups of manipulatives, etc.)
- Rewind and remove tapes
- Make sure bar code labels are on all tapes
- Lock record tab on tapes
- Give teacher the questionnaire packet

- Pack equipment using checklist "equipment to take to school"
- Complete log sheet and affix ID label to it

Appendix D.1: TIMSS 1999 Video Study Data Collection Procedures for Videographers

Materials provided to videographers before the shooting

Before going to the school to collect data, videographers will be provided with the following two kinds of materials: (1) lesson information and (2) a material packet.

Lesson information

A document describing where each lesson is to be videotaped will be mailed/faxed to videographers as soon as the lessons are scheduled with the school and teacher. The information will include:

- School name and location
- Contact person and phone number
- Teacher name
- Time, date, and location of lesson to be taped

A material packet

The videographer will be shipped a supply of packets which will be used for each classroom taping session. Each packet contains materials for either a mathematics or a science lesson. They have **not** yet been assigned to a particular school. Each packet includes:

- 1 teacher questionnaire with a bar-code label attached
- 1 set of student questionnaires each with a bar-code label
- 1 teacher instruction sheet
- 1 materials list included and returned by teacher
- 1 sheet of bar code labels for teacher to attach to additional materials being used during the lesson
- 1 sheet of bar code labels to be attached by the videographer to the videotapes and additional classroom materials after the videotaping
- 1 log sheet with a bar code label attached
- 1 FAX sheet for videographer to send tracking information
- 3 FedEx pouches and air bills (two for the teacher; one for the videographer)

Procedures for collecting data

Once videographers receive the above items, they can go to the schools and collect the data. The data collection procedures for videographers to follow are listed below.

Before going to the school

- Verify that you have the correct type of packet.
- If you are taping a mathematics lesson, you should have a mathematics packet.
- If you are taping a science lesson, you should have a science packet.

- Include the packet with all the other necessary video equipment.

<u>After taping the lesson</u>

- Remove the teacher's materials from the packet and instruct the teacher on what to do with them.
- Attach bar code labels to the tapes and to any additional classroom materials handed to you by the teacher.
- Fill out the log sheet and attach a bar code label to the log sheet.
- Send the tapes and the log sheet back to LessonLab.   We strongly encourage you to use Federal Express. If you travel to an area that does not have Federal Express, we suggest you wait until reaching one of their branches at a large city.
- After materials have been shipped, send a completed FAX sheet to LessonLab including the tracking number and a description of the materials. If a FAX is not available, please phone in this information.

Appendix D.2: Videographer's Class Log Sheet

TIMSS
VIDEO STUDIES

BAR CODE

CAMERA OPERATOR: ________________________________

SCHOOL NAME: ________________________________

LESSON: MATH _______ SCIENCE _______

DATE & TIME OF LESSON: ________________________________

MATERIALS COLLECTED AND RETURNED WITH THIS LOG SHEET

	TYPE:	QUANTITY
☐	Videotapes	________
☐	Copies of Textbook pages	________
☐	Copies of Workbook pages	________
☐	Overhead Projections	________
☐	Handouts	________
☐	Other	________

WERE THERE ANY PROBLEMS ENCOUNTERED DURING VIDEOTAPIING?

____

____

____

ANY OTHER COMMENTS THAT MIGHT BE USEFUL FOR UNDERSTANDING THE VIDEOTAPE?

____

____

____

Appendix D.3: Instructions for teachers

TIMSS
VIDEO STUDIES

In order for us to have a more accurate understanding of the lesson just videotaped, it would be helpful if you could provide copies of written documents such as handouts, lesson plans, tests, quizzes, etc.

Please follow the instructions for each item listed below and fill out the second page of this form. Send the form, and all items that apply, back to us in the pre-addressed, pre-paid envelopes. Please affix an ID label to each of these documents.

If you will not have a lesson or unit assessment ready until later, send the rest of the items NOW in the first envelope, and send the assessment later in the second envelope.

Your payment will be processed upon receipt of the materials.

☐ Teacher questionnaire	**Please fill out this questionnaire as soon as possible after the videotaping is completed – preferably on the same day as the videotaping- and send to LessonLab.**
☐ Student questionnaire	**Please ask each student to fill out a questionnaire and collect them as soon as possible.**
☐ Additional materials	**Please include a copy of every written document used during the lesson (e.g., worksheets, copy of textbook pages, overhead transparencies).**
☐ Lesson plan or notes	**Please include a copy of your lesson plan or notes for the videotaped lesson if available.**
☐ Lesson or unit assessment	**Please include a copy of your lesson or unit assessment (e.g., test, quiz, report or portfolio guidelines) with your questionnaire.**

Thank you very much for your cooperation and thoughtfulness!

Appendix D.4: Additional Material List

TIMSS
VIDEO STUDIES

BAR CODE

MATERIALS INCLUDED AND RETURNED WITH THIS SHEET

	ITEM	QUANTITY	PAGES
☐	Teacher questionnaire	________	
☐	Student questionnaires	________	
☐	Handouts	________	
☐	Copies of overhead projections	________	
☐	Copies of Textbook pages	________	________________
☐	Copies of workbook pages	________	________________
☐	Copies of pages from other books	________	________________
☐	Copies of your lesson plan	________	
☐	Copies of lesson assessment	________	
☐	Copies of unit assessment	________	
☐	Other	________	

Appendix E

U.S. Mathematics Teacher Questionnaire

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MATHEMATICS TEACHER
Questionnaire
GRADE 8

VIDEOTAPE I.D. #: ☐☐☐☐☐☐☐☐☐☐☐☐

TIMSS Videotape Study Center

James Stigler- Study Director
LessonLab, Inc.
12436 Santa Monica Blvd.
Los Angeles, CA 90025

DIRECTIONS:

- Please fill out this questionnaire **as soon as possible after the videotaping is completed** – preferably **on the same day as the videotaping**.

- Please include a copy of your lesson plan or notes for the videotaped lesson if available (**see Question 5)**

- Include a copy of your lesson or unit assessment (e. g., test, quiz, report or portfolio guidelines) with your questionnaire (**See Question 20).**

- Mail the completed questionnaire, your lesson plan (or notes), and your unit assessment in one of the envelopes provided as soon as possible.

- If you will not have a lesson or unit assessment ready until later, send the questionnaire NOW in one envelope, and send the assessment later in the second envelope.

- Your payment will be sent upon receipt of the materials.

ORGANIZATION OF THE QUESTIONNAIRE:
This questionnaire is divided into 7 sections, which ask about:

A. **THE VIDEOTAPED LESSON:** The lesson we videotaped and the students in this classroom
B. **THE LARGER UNIT:** How this lesson fits into a larger unit or sequence of lessons
C. **HOW TYPICAL?** How this lesson was typical or not of what usually happens in your classroom
D. **YOUR IDEAS ABOUT TEACHING** asks about the ideas that influence and guide your mathematics teaching
E. **YOUR BACKGROUND:** Your teaching and educational background and teaching load
F. **YOUR SCHOOL:** Demographic data about your school
G. **ATTITUDES:** Your attitudes about mathematics teaching

TIMSS-R

VIDEOTAPE CLASSROOM STUDY

MATHEMATICS TEACHER QUESTIONNAIRE

GRADE 8

Thank you for participating in this study. Both the videotape and the questionnaire will be used only for research purposes, unless you have signed an agreement that states otherwise. All persons with access to this information will be licensed to protect your privacy.

Thank you for your careful attention to this questionnaire. We appreciate the time you are taking to help us better understand mathematics teaching.

Your name: ___________________________________ ☐ Male ☐ Female

School's name: ________________________________ Date: ___________________

Name of videotaped course: _______________________

City/State______________________________________

Number of times videotaped class meets each week _______________

For how long? _______________ minutes per meeting

Grade level(s) of students in videotaped class: ________; # of girls enrolled in class ____
# of boys enrolled in class ____

(Write zero if there are none for that sex)

Phone number where we can reach you should any questions arise (_____)______-________

Best time of day to call you ______________________________AM / PM

E mail address ____

A. THE VIDEOTAPED LESSON

1. Please describe the subject matter content of the videotaped lesson. *Check as many as apply.*

- ☐ 1. Whole number computation
- ☐ 2. Common fraction computation
- ☐ 3. Decimal fraction computation
- ☐ 4. Properties of whole numbers and fractions
- ☐ 5. Integers
- ☐ 6. Percent
- ☐ 7. Estimation and number sense
- ☐ 8. Linear measurement
- ☐ 9. Area
- ☐ 10. Volume
- ☐ 11. Shapes and angles
- ☐ 12. Geometric congruence and similarity--applications
- ☐ 13. Geometric congruence and similarity--proofs
- ☐ 14. Symmetry, translations, rotations
- ☐ 15. Ratios and proportions
- ☐ 16. Functions, relations, and patterns
- ☐ 17. Equations and inequalities
- ☐ 18. Data and statistics
- ☐ 19. Probability
- ☐ 20. Sets and logic
- ☐ 21. Other (please specify

____

2. Which of the following played a role in your decision to teach this content?
Please check one item in each row.

	No Role	**Small Role**	**Major Role**
a. National, State, District, or School curriculum guidelines	☐	☐	☐
b. External examinations or standardized tests	☐	☐	☐
c. Mandated textbook for your grade level	☐	☐	☐
d. Your comfort with or interest in the content	☐	☐	☐
e. Your personal assessment of the students' interests or needs	☐	☐	☐
f. Collaborative work with other teachers or consultants	☐	☐	☐

3. If you marked "Major role" for choice (a) in question 2 above, please list the curriculum guidelines or documents that you use:____

____

4. To what extent did you use the following when planning this lesson, (not necessarily materials you used during the lesson)…

	Not At All	**A Little**	**Some**	**Quite A Lot**	**A Great Deal**
a. a lesson plan that you had prepared and used before	☐	☐	☐	☐	☐
b. lesson or unit plans developed by other educators	☐	☐	☐	☐	☐
c. a lesson you planned in collaboration with other teachers or mathematics specialists	☐	☐	☐	☐	☐
d. student textbook	☐	☐	☐	☐	☐
e. Teacher's Guide version of textbook	☐	☐	☐	☐	☐
f. replacement unit teacher guides (e.g., kits, modules, activity manuals)	☐	☐	☐	☐	☐
g. resource books (e.g., trade books, reference books, other texts)	☐	☐	☐	☐	☐
h. multimedia resources (video, laser disc, TV, etc)	☐	☐	☐	☐	☐
i. the Internet	☐	☐	☐	☐	☐
j. ideas from a workshop	☐	☐	☐	☐	☐
k. knowledge about your students' interests, thinking, or difficultie	☐	☐	☐	☐	☐
l. local curriculum guidelines (e.g., school, district)	☐	☐	☐	☐	☐

m.	state or national curriculum guidelines or standards	☐	☐	☐	☐	☐
n.	external examinations or standardized tests	☐	☐	☐	☐	☐
o.	Other (please describe)____________________	☐	☐	☐	☐	☐

5. For us to understand the videotaped lesson, we need to know which ideas and skills had been previously taught to this class and which were new. For each idea or skill taught in the videotaped lesson, please indicate whether it was:

- mainly review
- mainly new.

If you need more space, continue on the back of the paper. **Please Note:** If you have a written lesson plan or notes for the videotaped lesson, we would like a copy. Please enclose a copy in the envelope provided for return of the questionnaire.

Ideas and skills in videotaped lesson that were mainly review to students:

Ideas and skills in videotaped lesson that were mainly new to students:

6. What was the main thing you wanted students to learn from the videotaped lesson?

7. Are you satisfied that the videotaped lesson achieved that purpose? ☐ YES ☐ NO

Explain why you were or were not satisfied.

8. Think about how you taught the videotaped lesson compared to how you would ideally like to teach this lesson. To what extent did any of the following limit you from reaching your ideal in this lesson?

	Not At All	**A Little**	**Some**	**Quite A Lot**	**Great Deal**	**Does Not Apply**
a. Official curricular guidelines and/or standardized tests	☐	☐	☐	☐	☐	☐
b. Requirements to teach many topics	☐	☐	☐	☐	☐	☐
c. Insufficient student motivation or readiness to learn	☐	☐	☐	☐	☐	☐
d. Class size (If a limitation please describe nature of limitation) ______________________________	☐	☐	☐	☐	☐	☐
e. Insufficient time for lesson planning	☐	☐	☐	☐	☐	☐
f. Insufficient time to work with colleagues on lessons	☐	☐	☐	☐	☐	☐
g. Not enough books (textbooks, trade books, reference books, etc.)	☐	☐	☐	☐	☐	☐
h. Insufficient time to finish what I planned to teach	☐	☐	☐	☐	☐	☐
i. Lack of or obsolete computers	☐	☐	☐	☐	☐	☐
j. Lack of appropriate software for computers	☐	☐	☐	☐	☐	☐
k. Lack of needed instructional equipment (VCR, overhead projection equipment etc.).	☐	☐	☐	☐	☐	☐
l. Lack of needed multimedia materials (videotapes, transparency sets, slides, and laser disks)	☐	☐	☐	☐	☐	☐
m. Insufficient mathematics teaching materials and supplies, (hands-on materials, calculators, etc.)	☐	☐	☐	☐	☐	☐
n. Inadequate physical facilities (room size or layout, furniture, etc.)	☐	☐	☐	☐	☐	☐
o. Insufficient training or support for using new technologies in your classroom	☐	☐	☐	☐	☐	☐
p. Presence of the video-camera and videographer	☐	☐	☐	☐	☐	☐

9. How long did you spend planning for the videotaped lesson? ____________ minutes

9b. How long do you usually spend planning for this type of mathematics lesson? ____ minutes

10. Did your students work in groups for any part of the videotaped lesson?

☐ YES ☐ NO

11. If yes, please describe the basis by which students were assigned to groups (e.g., academic ability level, gender, student choice, other).

12. Think about the availability of the following items at your school. To what extent do you have sufficient access to this items for use in your mathematics classroom?

	Enough	**Too few or too little**	**Not at all**
a. Computers			
b. Computer software			
c. Computers with internet connections			
d. A/V equipment (TV, VCR, overhead projectors			
e. Teaching supplies/materials (e.g. hands-on materials)			
f. Calculators			
g. Reference materials (books, journals, magazines)			

13. Do all students in the school take this course?

☐ YES (skip to 15) ☐ NO

14. If **no**, is curriculum in this course more challenging or less challenging than the typical 8th grade mathematics course in this school? Mark one of the three choices below:

☐ More challenging ☐ A typical 8th grade curriculum ☐ Less challenging

15. Did you previously assign mathematics homework that was due for the day of the videotaped lesson?

☐ YES ☐ NO (skip to 19)

16. Please describe what students were expected to do for this homework.

17. Was the assigned homework related to this lesson or to the prior lesson?

☐ The videotaped lesson ☐ Prior lesson ☐ Both

18. How long would it have taken the typical student in your class to complete this homework?

__________minutes.

19. Will students be formally evaluated on the material they studied in the videotaped lesson (e.g., a quiz, unit test, project, etc.)?

☐ YES ☐ NO

20. If yes, how will they be assessed? (Also, please enclose a copy of the assessment you will use for the lesson or unit. Enclose this assessment in the return envelope).

B. THE LARGER UNIT OR SEQUENCE OF LESSONS

21. Was the videotaped lesson planned as part of a larger **unit** or **sequence of related lessons**, or was it a stand-alone lesson?

☐ stand-alone lesson
(If stand-alone, please explain why & skip to 26)

☐ part of a unit or sequence

22. Describe the unit or sequence of lessons with a short phrase or title:

23. What is the main thing(s) you want students to learn from the whole unit or sequence of lessons?

24. Approximately how many lessons are in the entire sequence or unit? _____________

25. Where did the videotaped lesson fall in the sequence or unit
(e.g., number 3 out of 5)? _______

26. To help us understand what we will see on the videotape, please provide information about the videotaped lesson and about the 2 lessons before and 2 lessons after the videotaped lesson.

- Please describe the main thing you wanted students to learn from the lesson
- Please choose 1 or 2 words that most teachers in you country use to describe each type of lesson. (e.g.., review lesson, introductory lesson, etc.)

	Main thing you wanted students to learn from the lesson	**Type of lesson**
2 lessons Before		
1 lesson Before		
Videotaped Lesson	**DO NOT FILL IN THIS BOX**	
1 lesson After		
2 lessons After		

C. HOW TYPICAL WAS THE VIDEOTAPED LESSON?

27. For this study, we are interested in capturing your typical mathematics teaching. It is important for us to know in what ways the teaching in the videotaped lesson might not have been typical.

How often do you use the teaching methods that are in the videotaped lesson?

- ☐ seldom
- ☐ sometimes
- ☐ often
- ☐ almost always

28. What, if anything, was different in the videotaped lessons from how you normally teach?

29. How would you describe your students' behavior and participation during the videotaped lesson?

- ☐ better than usual
- ☐ about the same as usual
- ☐ worse than usual

30. What, if anything, was different about the nature of the students' behavior and the amount of student participation during the videotaped lesson? Briefly describe any differences.

31. Was the content of the videotaped lesson more difficult for your students than usual, about the same, or less difficult than usual?

- ☐ more difficult for students than most lessons
- ☐ about the same as most lessons
- ☐ less difficult for students than most lessons

32. Do you think that having the camera present caused you to teach a lesson that was better than usual, worse than usual, or about the same as usual?

- ☐ better than usual
- ☐ about the same as usual
- ☐ worse than usual

D. IDEAS THAT GUIDE YOUR TEACHING

33. List the three most important things you would like your students to learn from studying mathematics **this year.**

1. ____

____

2. ____

____

3. ____

____

34. In general, I feel comfortable trying new techniques for teaching mathematics in my classroom.

- ☐ I agree
- ☐ no opinion
- ☐ I disagree

35. In general, I feel I keep up with current ideas in mathematics teaching and learning.

- ☐ I agree
- ☐ no opinion
- ☐ I disagree

36. How do you usually hear about current ideas about the teaching and learning of mathematics?

37. What written materials are you aware of that describe current ideas about the teaching and learning of mathematics? Please list up to three, and indicate whether you personally have read each one.

______________________________ I have read: ☐ all of it ☐ most of it ☐ some of it ☐ none of it

______________________________ I have read: ☐ all of it ☐ most of it ☐ some of it ☐ none of it

______________________________ I have read: ☐ all of it ☐ most of it ☐ some of it ☐ none of it

38. To what extent do you feel that the videotaped lesson is in accord with current ideas about the teaching and learning of mathematics?

- ☐ a lot
- ☐ a fair amount
- ☐ a little
- ☐ not at all (skip to 41)

39. Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics and explain why you think it exemplifies these ideas.

40. As part of professional development activities, how often in the past year has a teacher colleague observed you teaching an entire mathematics lesson? (**do not include observations made in team teaching situations or as part of a formal evaluation).**

Circle a, b, c, or d

a. never
b. once or twice
c. every other month
d. once a month or more

41. As part of professional development activities, how often in the past year have you observed a teacher colleague teaching an entire mathematics lesson? **(do not include observations made in team teaching situations or as part of a formal evaluation)**.

Circle a, b, c, or d

a. never
b. once or twice
c. every other month
d. once a month or more

E. YOUR TEACHING BACKGROUND AND TEACHING LOAD

42. What was the highest level of formal education you have completed?

- ☐ Teacher training without completing high school
- ☐ High school
- ☐ High school with 1 or 2 years of teacher training
- ☐ High school with 3 or 4 years of teacher training
- ☐ BA or equivalent with no teacher training
- ☐ BA or equivalent with teacher training
- ☐ Masters or doctoral degree with no teacher training
- ☐ Masters or doctoral degree with teacher training

43. In what subject areas and grade levels are you certified to teach?

Subjects	Grade level

44. What was your undergraduate major field of study? ____________________________________

45. What was your undergraduate minor field of study (if any)? _____________________________

46. What was your major field of study in graduate school? ________________________________

47. What was your minor field of study in graduate school (if any) ? _________________________

48. Counting this school year, how many years in total have you been teaching? (include part-time teaching, but not substitute teaching)
Please round to the nearest whole number. _____________years

49. Counting this year, how many years in total have you taught mathematics? (include. part-time teaching, but not substitute teaching).
Please round to the nearest whole number _____________years

50. During the last two years, how many college or university courses have you taken in mathematics or mathematics education? (Circle one letter.)

A. none
B. one
C. two
D. three
E. four or more

51. During the last two years, have you participated in professional development activities or taken courses in any of the following? (Circle **all** letters that apply).
A. use of technology, such as computers
B. mathematics instructional techniques
C. cooperative group instruction
D. interdisciplinary instruction
E. teaching higher-order thinking skills
F. teaching students from different cultural backgrounds
G. teaching limited English proficient students
H. teaching students with special needs (e.g. visually impaired, gifted and talented)
I. standards-based teaching
J. classroom management and organization
K. other professional issues
L. none of the above

52. In a typical week, I spend:

a) ______Hours at school teaching mathematics classes. Titles of mathematics classes: __________

____

____

b) ______ Hours at school teaching other classes. Titles of other classes: _____________________

____

____

c) ______ Hours at school meeting with other teachers to work on curriculum and planning issues.

d) ______ Hours at school doing work related to teaching mathematics (e.g., lesson planning, grading papers, etc.).

e) ______ Hours at home doing work related to teaching mathematics (e.g., lesson planning, grading papers, etc.).

f) ______ Hours at home or school doing other school-related activities.

F. QUESTIONS ABOUT YOUR SCHOOL.

53. List the grade levels that are taught in this school:__________________________________

54. What type of school is this?

Identify any special status or purpose of your school: ***Check as many as apply***.

- ☐ Academic accelerated school
- ☐ Vocational school
- ☐ Magnet school (Describe type:_____________________________________)
- ☐ Charter school
- ☐ Partnership with a university
- ☐ Laboratory School
- ☐ School within a school
- ☐ Religious or sectarian school
- ☐ Private (non-religious) school
- ☐ Single sex school
- ☐ Other (Please describe:____)

55. How are students admitted to this school? (e.g., neighborhood residence, entrance test, lottery, all who want to come, other)?

56. Approximately how many mathematics teachers are in this school this year ? _______________

G. ATTITUDES ABOUT TEACHING.

57. Please respond to each statement.

	strongly agree	some-what agree	some-what disagree	strongly disagree
a. I am enthusiastic about teaching mathematics.	☐	☐	☐	☐
b. I enjoy teaching students of this age level.	☐	☐	☐	☐
c. I have adequate materials and facilities to support my teaching of mathematics.	☐	☐	☐	☐
d I actively pursue opportunities to learn how to improve my mathematics teaching.	☐	☐	☐	☐
e. I read journals and books about mathematics teaching.	☐	☐	☐	☐
f. I have adequate opportunities during the school day to collaborate with colleagues about mathematics.	☐	☐	☐	☐
g. I enjoy working with colleagues about mathematics curriculum and teaching, even if it means after-school meetings.	☐	☐	☐	☐
h. I enjoy attending mathematics teacher conferences to learn about new ideas in mathematics teaching.	☐	☐	☐	☐
i. The number of students in my class is appropriate to support good mathematics teaching and learning.	☐	☐	☐	☐
j. I teach in an environment where I feel physically safe.	☐	☐	☐	☐
k. If I had to choose I would become a teacher again.	☐	☐	☐	☐
l. I have a strong mathematics background in the subject areas I teach.	☐	☐	☐	☐
m. I pursue mathematics interests or issues in my personal life.	☐	☐	☐	☐
n. I like to watch TV programs about new developments in mathematics.	☐	☐	☐	☐
o. Teaching mathematics is hard work.	☐	☐	☐	☐
p. Teaching mathematics is rewarding work.	☐	☐	☐	☐
q. I am proud of the quality of my teaching.	☐	☐	☐	☐
r. I enjoy students' questions about mathematics even when I do not know the answer.	☐	☐	☐	☐
s. Girls in this school are encouraged to develop a mathematics interest.	☐	☐	☐	☐
t. I work hard to get girls involved in mathematics.	☐	☐	☐	☐
u. I especially prefer teaching high-ability students.	☐	☐	☐	☐
v I especially prefer teaching low-ability students.	☐	☐	☐	☐
w. I prefer to teach a class that has students of all different ability levels.	☐	☐	☐	☐
x. I am often impressed with the quality of thinking my students can do.	☐	☐	☐	☐
y. My work as a mathematics teacher is appreciated by my students.	☐	☐	☐	☐
z. My work as a mathematics teacher is appreciated by my students' parents.	☐	☐	☐	☐
aa. My work as a mathematics teacher is appreciated by my teacher colleagues.	☐	☐	☐	☐

bb. My work as a mathematics teacher is appreciated by administrators.	☐	☐	☐	☐

58. How knowledgeable are you about the National Council of Teachers of Mathematics (NCTM) *Curriculum and Evaluation Standards for School Mathematics*? (Circle one letter)

    A. Very knowledgeable
    B. Knowledgeable
    C. Somewhat knowledgeable
    D. I have little or no knowledge

59. What type of professional development activities have you participated in that have provided you with strategies for implementing the 1989 NCTM *Curriculum and Evaluation Standards for School Mathematics*? (Circle **all** letters that apply.)

    A. Local workshop
    B. Regional NCTM meeting
    C. National NCTM meeting
    D. Other
    E. None

THANK YOU!!!

for your cooperation and thoughtfulness

Please put this questionnaire, your lesson plan or notes for the videotaped lesson, and your lesson or unit assessment in the mailing envelope and return it as soon as possible.

Appendix F

U.S. Student Questionnaire

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STUDENT QUESTIONNAIRE
GRADE 8

VIDEOTAPE I.D. #: ☐☐☐☐☐☐☐☐☐☐☐☐

TIMSS-R Video Study

James Stigler- Study Director
12436 Santa Monica Blvd.
Los Angeles, CA 90025

According to the paperwork reduction act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number. The valid OMB control number for this information is __________. The time required to complete this information collection is estimated to average 12 minutes per response, including the time to review instructions, search existing data resources, gather the data needed, and complete and review the information collected. If you have any comments concerning the accuracy of the time estimate(s) or suggestions for improving this form, please write to: U.S. Department of Education, Washington, D.C. 20202-4651. If you have comments or concerns regarding the status of your individual submission of this form, write directly to: National Center for Education Statistics, 555 New Jersey Avenue, N.W., Washington, D.C. 20208.

TIMSS-R
Videotape Classroom Study
STUDENT QUESTIONNAIRE

Thank you for participating in this study. Both the videotape and the questionnaire will be used only for research purposes, unless you have signed an agreement that states otherwise. All persons with access to this information will be licensed to protect your privacy.

Thank you for your careful attention to this questionnaire. We appreciate the time you are taking to help us better understand mathematics teaching.

School's Name: ____

1. On what date were you born?
   Write in the month, day, and year

   ___ ___ MONTH ___ ___ DAY ___ ___ ___ ___ YEAR

2. Are you a girl or a boy?
   Circle either A or B.

   Girl………………..A
   Boy………………..B

3. Which best describes you?

   What is your ethnicity?

   Hispanic or Latino ……………………………A
   Not Hispanic or Latino………………………. B

   What is your race?
   (Choose one or more)

   American Indian or Alaska Native…………….C
   Asian…………………………………………. D
   Black or African American……………………E
   Native Hawaiian or Other Pacific Islander……F
   White……………………………………………G

4. Were you born in the United States or its territories (such as Puerto Rico, U.S. Virgin Islands)?

Circle either A or B

Yes……………..A

No………………B

5. If you were not born in United States or its territories (such as Puerto Rico, U.S. Virgin Islands), how old were you when you came to the United States?

Write in your age at the time.

I was __________ years old when I came to the United States.

6. How often do you speak English at home?

Circle one of the following.

Always or almost always…………..A

About half of the time……………...B

Rarely or never ……………………C

7. Altogether, how many people live in your home?

Write in total number of people.

__________ *(Don't forget to include yourself.)*

8. How far in school did your mother and father go?

Circle ONE letter in each column

	Mother	Father
a. Finished elementary school…………………………………………	A	..A
b. Some high school……………………………………………………	B	..B
c. Finished high school………………………………………………	C	..C
d. Some vocational/technical school after high school……………………	D	..D
e. Some community college or university course work…………………...	E	..E
f. Completed a bachelor's degree at college or university……………...	F	..F
g. I don't know………………………………………………………	G	..G

9. How far in school do ***you*** expect to go?

a. Finish elementary school...	A
b. Some high school...	B
c. Finish high school..	C
d. Some vocational/technical school after high school............	D
e. Some community college or university course work...........	E
f. Complete a bachelor's degree at college or university..........	F
g. I don't know...	G

10. Was your mother born in the United States or its territories (such as Puerto Rico, U.S. Virgin Islands)?

Circle either A or B

Yes……………..A

No………………B

11. Was your father born in the United States or its territories (such as Puerto Rico, U.S. Virgin Islands)?

Circle either A or B

Yes……………..A

No………………B

12. About how many books are in your home? (Do not count magazines, newspapers, or your schoolbooks). *Circle only one letter A-E*

None or very few (1-10 books)…………………………………………...A

Enough to fill one shelf (11-25 books)……………………………………B

Enough to fill one bookcase (26-100 books)……………………………....C

Enough to fill two bookcase (101-200 books……………………………...D

Enough to fill three or more bookcases (more than 200 books)…………….E

Thank you!

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Appendix G

TIMSS 1999 Video Study Mathematics Teacher Questionnaire Coding Manual

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LESSONID Alphanumeric lesson identification		
Code	**Example**	**Description or item option**
MAU001	Math, Australia, Lesson 001	Example; column 1 identifies subject, columns 2 and 3 identify country, columns 4 to 6 identify class.

CASEID Numeric lesson identification		
Code	**Example**	**Description or item option**
13001	Math, Australia, Lesson 001	Column 1 identifies subject (1=math; 2=science). Column 2 identifies country (AU=3, CZ=2, HK=6, JP=5, NL=4, SW=7, US=1). Columns 3 to 5 identify class.

CTYALPHA Country identification		
Code	**Country name**	**Description or item option**
10	Australia	
20	Czech Republic	
30	Hong Kong SAR	
40	Japan	
50	The Netherlands	
60	Switzerland	
70	United States	

SUBJECT Lesson subject		
Code	**Country name**	**Description or item option**
1	Mathematics	
2	Science	

LANGUAGE Questionnaire language		
Code	**Country name**	**Description or item option**
1	Cantonese	
2	Czech	
3	Dutch	
4	English	
5	French	
6	German	
7	Italian	
8	Japanese	

TGENDER Teacher gender		
Code	**Response**	**Description or item option**
1	Male	
2	Female	
Blank	Missing, not interpretable, or not applicable	

MEETINGS Number of times videotaped class meets each week ***(Code number of times class meets per week)***		
Code	**Response**	**Description or item option**
1	One	Example
2	Two	Example
Blank	Missing, not interpretable, or not applicable	

HOWLONG For how long? (minutes per meeting) ***(Code number of minutes per meeting)***		
Code	**Response**	**Description or item option**
1	1 minute	Example
2	2 minutes	Example
Blank	Missing, not interpretable, or not applicable	

MEETIME Total amount of time videotaped class meets each week (minutes multiplied by number of meetings per week) ***(Code number of minutes)***		
Code	**Response**	**Description or item option**
Blank	Missing, not interpretable, or not applicable	

GRADE Grade level(s) of students in videotaped class ***(Code Australia, Czech Republic, Hong Kong SAR, Switzerland, and U.S.)***		
Code	**Response**	**Description or item option**
1	Grade 6	
2	Mix – Grades 6 and 7	
3	Grade 7	
4	Mix – Grades 7 and 8	
5	Eighth Grade	
6	Mix – Grades 7, 8, and 9	
7	Mix – Grades 8 and 9	
8	Mix – Grades 8, 9, and 10	
9	Grade 9	
Blank	Missing, not interpretable, or not applicable	

GRADE Grade level(s) of students in videotaped class ***(Code for Netherlands)***		
Code	**Response**	**Description or item option**
1	VWO	Includes VWO, Gymnasium, Atheneum.
2	HAVO	
3	MAVO	
4	VBO	Includes VBO, IVBO, MBO
5	VWO/HAVO	
6	MAVO/VBO	
7	MAVO/HAVO	
8	VBO/MAVO/HAVO	Includes MHV
9	MAVO/HAVO/VWO	
10	VBO/MAVO/HAVO/VWO	
Blank	Missing, not interpretable, or not applicable	

GIRLS Number of girls enrolled in class ***(Code number of girls)***		
Code	**Response**	**Description or item option**
Blank	Missing, not interpretable, or not applicable	

BOYS Number of boys enrolled in class ***(Code number of boys)***		
Code	**Response**	**Description or item option**
Blank	Missing, not interpretable, or not applicable	

GIRLBOY Total number of boys and girls enrolled in class		
Code	**Response**	**Description or item option**
Blank	Missing, not interpretable, or not applicable	

TQ1A Please describe the subject matter content of the videotaped lesson. a. Whole number computation		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1B Please describe the subject matter content of the videotaped lesson. b. Common fraction computation		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1C Please describe the subject matter content of the videotaped lesson. c. Decimal fraction computation		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1D Please describe the subject matter content of the videotaped lesson. d. Properties of whole numbers and fractions		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1E Please describe the subject matter content of the videotaped lesson. e. Integers		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1F Please describe the subject matter content of the videotaped lesson. f. Percent		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1G Please describe the subject matter content of the videotaped lesson. g. Estimation and number sense		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1H Please describe the subject matter content of the videotaped lesson. h. Linear measurement		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1I Please describe the subject matter content of the videotaped lesson. i. Area		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1J Please describe the <u>subject matter content of the videotaped lesson</u>. j. Volume		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1K Please describe the <u>subject matter content of the videotaped lesson</u>. k. Shapes and angles		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1L Please describe the <u>subject matter content of the videotaped lesson</u>. l. Geometric congruence and similarity--applications		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1M Please describe the <u>subject matter content of the videotaped lesson</u>. m. Geometric congruence and similarity--proofs		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1N Please describe the <u>subject matter content of the videotaped lesson</u>. n. Symmetry, translations, rotations		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1O Please describe the subject matter content of the videotaped lesson.
o. Ratios and proportions

Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1P Please describe the subject matter content of the videotaped lesson.
p. Functions, relations, and patterns

Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1Q Please describe the subject matter content of the videotaped lesson.
q. Equations and inequalities

Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1R Please describe the subject matter content of the videotaped lesson.
r. Data and statistics

Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1S Please describe the subject matter content of the videotaped lesson.
s. Probability

Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1T Please describe the subject matter content of the videotaped lesson. t. Sets and logic		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ1U Please describe the subject matter content of the videotaped lesson. u. Other		
Code	**Response**	**Description or item option**
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ2A Which of the following played a role in your decision to teach this content? a. National, State, District, or School curriculum guidelines		
Code	**Response**	**Description or item option**
0	No role	A
1	Small Role	B
2	Major Role	C
Blank	Missing, not interpretable, or not applicable	

TQ2B Which of the following played a role in your decision to teach this content? b. External examinations or standardized tests ***(Code for Czech Republic, Hong Kong SAR, Netherlands, and U.S. versions)*** ***(Code 'Blank' for Australia and Switzerland; item not applicable)***		
Code	**Response**	**Description or item option**
0	No role	A
1	Small role	B
2	Major role	C
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for AU and SW; item not applicable.***

TQ2C Which of the following played a role in your decision to teach this content? c. Mandated textbook for your grade level		
Code	**Response**	**Description or item option**
0	No role	A
1	Small Role	B
2	Major Role	C
Blank	Missing, not interpretable, or not applicable	

TQ2D Which of the following played a role in your decision to teach this content? d. Your comfort with or interest in the content		
Code	**Response**	**Description or item option**
0	No Role	A
1	Small Role	B
2	Major Role	C
Blank	Missing, not interpretable, or not applicable	

TQ2E Which of the following played a role in your decision to teach this content? e. Your personal assessment of the students' interests or needs		
Code	**Response**	**Description or item option**
0	No Role	A
1	Small Role	B
2	Major Role	C
Blank	Missing, not interpretable, or not applicable	

TQ2F Which of the following played a role in your decision to teach this content? f. Collaborative work with other teachers or consultants		
Code	**Response**	**Description or item option**
0	No Role	A
1	Small Role	B
2	Major Role	C
Blank	Missing, not interpretable, or not applicable	

TQ2ARC1 Which of the following played a role in your decision to teach this content? a. National, State, District, or School curriculum guidelines		
Code	**Response**	**Description or item option**
0	No role	A
1	Small or major role	B,C
Blank	Missing, not interpretable, or not applicable	

TQ2BRC1 Which of the following played a role in your decision to teach this content? b. External examinations or standardized tests ***(Code for Czech Republic, Hong Kong SAR, Netherlands, and U.S. versions)*** ***(Code 'Blank' for Australia and Switzerland; item not applicable)***		
Code	**Response**	**Description or item option**
0	No role	A
1	Small or major role	B,C
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for AU and SW; item not applicable.***

TQ2CRC1 Which of the following played a role in your decision to teach this content? c. Mandated textbook for your grade level		
Code	**Response**	**Description or item option**
0	No role	A
1	Small or major role	B,C
Blank	Missing, not interpretable, or not applicable	

TQ2DRC1 Which of the following played a role in your decision to teach this content? d. Your comfort with or interest in the content		
Code	Response	Description or item option
0	**No Role**	**A**
1	Small or major role	B,C
Blank	Missing, not interpretable, or not applicable	

TQ2ERC1 Which of the following played a role in your decision to teach this content? e. Your personal assessment of the students' interests or needs		
Code	**Response**	**Description or item option**
0	No Role	A
1	Small or major role	B,C
Blank	Missing, not interpretable, or not applicable	

TQ2FRC1 Which of the following played a role in your decision to teach this content? f. Collaborative work with other teachers or consultants		
Code	**Response**	**Description or item option**
0	No Role	A
1	Small or major role	B,C
Blank	Missing, not interpretable, or not applicable	

TQ2ARC2 Which of the following played a role in your decision to teach this content? a. National, State, District, or School curriculum guidelines		
Code	**Response**	**Description or item option**
1	None or small role	A,B
2	Major role	C
Blank	Missing, not interpretable, or not applicable	

TQ2BRC2 Which of the following played a role in your decision to teach this content? b. External examinations or standardized tests ***(Code for Czech Republic, Hong Kong SAR, Netherlands, and U.S. versions)*** ***(Code 'Blank' for Australia and Switzerland; item not applicable)***		
Code	**Response**	**Description or item option**
1	None or small role	A,B
2	Major role	C
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for AU and SW; item not applicable.***

TQ2CRC2 Which of the following played a role in your decision to teach this content?
c. Mandated textbook for your grade level

Code	Response	Description or item option
1	None or small role	A,B
2	Major role	C
Blank	Missing, not interpretable, or not applicable	

TQ2DRC2 Which of the following played a role in your decision to teach this content?
d. Your comfort with or interest in the content

Code	Response	Description or item option
1	None or small role	A,B
2	Major role	C
Blank	Missing, not interpretable, or not applicable	

TQ2ERC2 Which of the following played a role in your decision to teach this content?
e. Your personal assessment of the students' interests or needs

Code	Response	Description or item option
1	None or small role	A,B
2	Major role	C
Blank	Missing, not interpretable, or not applicable	

TQ2FRC2 Which of the following played a role in your decision to teach this content?
f. Collaborative work with other teachers or consultants

Code	Response	Description or item option
1	None or small role	A,B
2	Major role	C
Blank	Missing, not interpretable, or not applicable	

TQ4A To what extent did you use the following when planning this lesson,
a. A lesson plan that you had prepared and used before

Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4B To what extent did you use the following when planning this lesson, b. Lesson or unit plans developed by other educators		
Code	**Response**	**Description or item option**
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4C To what extent did you use the following when planning this lesson, c. A lesson you planned in collaboration with other teachers or mathematics specialists		
Code	**Response**	**Description or item option**
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4D To what extent did you use the following when planning this lesson, d. Student textbook		
Code	**Response**	**Description or item option**
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4E To what extent did you use the following when planning this lesson, e. Teacher's Guide version of textbook		
Code	**Response**	**Description or item option**
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4F To what extent did you use the following when planning this lesson, f. Replacement unit teacher guides (e.g., kits, modules, activity manuals) ***(Code 'Blank' for Netherlands; item not applicable)***		
Code	**Response**	**Description or item option**
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for Netherlands*; *item not applicable.***

TQ4G To what extent did you use the following when planning this lesson, g. Resource books (e.g., trade books, reference books, other texts)		
Code	**Response**	**Description or item option**
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4H To what extent did you use the following when planning <u>this lesson</u>,
h. Multimedia resources (video, laser disc, TV, etc)

Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4I To what extent did you use the following when planning <u>this lesson</u>,
i. The Internet

Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4J To what extent did you use the following when planning <u>this lesson</u>,
j. Ideas from a workshop

Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4K To what extent did you use the following when planning <u>this lesson</u>, k. Knowledge about your students' interests, thinking, or difficulties		
Code	**Response**	**Description or item option**
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4L To what extent did you use the following when planning <u>this lesson</u> l. Local curriculum guidelines (e.g., school, district) l. School curriculum guidelines ***(Hong Kong SAR version)*** l. Your own school's curriculum guidelines ***(Australia version)*** ***(Code 'Blank' for Switzerland-Italian speaking area; item not applicable)***		
Code	**Response**	**Description or item option**
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for Switzerland-Italian speaking area; item not applicable.***

TQ4M To what extent did you use the following when planning <u>this lesson</u>, m. State or national curriculum guidelines or standards ***(Czech Republic, Netherlands, U.S. versions)*** m. Curriculum guidelines or standards issued by the education authorities ***(Hong Kong SAR version)*** m. Your state's version of the *National Profiles* ***(Australia version)***		
Code	**Response**	**Description or item option**
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

TQ4N To what extent did you use the following when planning <u>this lesson</u>, m. External examinations or standardized test ***(Code 'Blank' for Australia or Switzerland German-speaking area; item not applicable)***		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for Australia and Switzerland-German speaking area; item not applicable.***

TQ4O1 To what extent did you use the following when planning <u>this lesson</u>, o. Other		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***review*** to students.
TQ5AC *Review content goal*

Code	Response	Description or item option
0	New ideas or skills	No ideas or skills were review.
1	Numbers	Whole numbers, Number Theory, patterns.
2	Fractions	Fractions and decimals, irrrational numbers.
3	Ratio	Ratio, proportion, percent
4	Integers	Integers, powers.
5	Geometry-angles	Geometry: Angles
6	Geometry-lines, triangles	Geometry: Triangles and lines in two-dimensional plane, similarity, Pythagorean Theorem, and quads
7	Geometry-two-dimensions	Geometry: Perimeter/circumference/area two-dimensional figures and volume
8	Geometry-three-dimensions	Geometry: Descriptions - three-dimensional figures
9	Geometry-transformations	Geometry: Geometric transformations
10	Geometry-constructions	Geometry: Constructions
11	Statistics-data	Probability and statistics: Organizing and displaying data
12	Statistics-statistics	Probability and statistics: Statistics
13	Statistics-probability	Probability and statistics: Probability
14	Linear algebra-equations	Algebra: Linear functions: simplifying expressions and solving equations, formulas, functions, polynomials, multinomials
15	Linear algebra-graphs	Algebra: Linear functions: graphing
16	Linear algebra-functions	Algebra: Quadratic and other linearortrigonometric functions including formulae
17	Non-linear algebra	Algebra: Graphing non-linear (non-trigonometric) functions
18	Miscellaneous	Miscellaneous topics
19	Technology	
20	No content goal identified	Teacher indicated review in TQ5A or TQ5B, but did not identify specific content being reviewed, e.g., basic mathematics content
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***review*** to students. **TQ5AP *Review process goal***		
Code	Response	Description or item option
0	New ideas or skills	No ideas or skills were review.
1	Knowing	Familiarity with mathematical content listed or general familiarity with mathematics; contents listed without process listed.
2	Operations or calculations	Students are capable of using operations in routine procedures such as addition, subtraction, multiplication, and division. The code implies that teachers identified common tasks without noting that students are problem solving or working on real world applications.
3	Review	Teacher specifically identified review of particular content area or general "review for a test".
4	Application to real world	Students are able to apply mathematical knowledge to real world application.
5	External influence	Teacher notes that “goals” or knowledge gained is deemed by an external source such as “getting through the book", “complete subject matter", “pass math", "curriculum standards", or "end of grade test".
6	Mathematical thinking	Students participate in the “logical” thinking of mathematics, but not problem solving.
7	Problem solving	Teacher notes problem solving skills as a performance.
8	Technology	Students learn to use technology to solve mathematics problems.
9	No process goal identified	Teacher indicated review in TQ5A or TQ5B, but did not list process goal.
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***review*** to students. **TQ5AA *Review perspective goal***		
Code	Response	Description or item option
0	New ideas or skills	No ideas or skills were review.
1	Interest	Students become interested in or enjoy mathematics, and increase understanding.
2	Mathematical study habits	Teacher identifies "how to study" mathematics or references work ethics, encourages ways of mathematics thinking, e.g., openness, objectivity, tolerance of uncertainty, inventiveness, curiosity.
3	Awareness	Recognition of the need for mathematics in life.
4	Confidence	Students gain confidence in their abilities to succeed in mathematics.
5	Positive attitude	Decrease the mathematics anxiety of students and/or increase appreciation for mathematics; encourage positive attitudes towards mathematics.
6	Atmosphere	Create a positive learning environment.
7	Multiple Solutions	Students learn different solution methods.
8	Future requirements	Help students prepare for future, e.g., academic requirements or career requirements.
9	Work in groups	Students work in groups, collaborate and help each other.
10	No perspective goal identified	Teacher indicated review in TQ5A or TQ5B, but did not list a perspective goal that was reviewed.
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***review*** to students. **TQ5ACRC *Review content goal - recoded***		
Code	Response	Description or item option
0	No review content goal	
1	Review content goal	
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***review*** to students. **TQ5APRC *Review process goal - recoded***		
Code	Response	Description or item option
0	No review process goal	
1	Review process goal	
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***review*** to students. **TQ5AARC *Review perspective goal - recoded***		
Code	Response	Description or item option
0	No review perspective goal	
1	Review perspective goal	
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***new*** to students. **TQ5BC** ***New content goal***		
Code	Response	Description or item option
0	Review ideas or skills	No ideas or skills were new.
1	Numbers	Whole numbers, Number Theory, patterns.
2	Fractions	Fractions and decimals, irrrational numbers.
3	Ratio	Ratio, proportion, percent
4	Integers	Integers, powers.
5	Geometry-angles	Geometry: Angles
6	Geometry-lines, triangles	Geometry: Triangles and lines in two-dimensional plane, similarity, Pythagorean Theorem, and quads
7	Geometry-two-dimensions	Geometry: Perimeter/circumference/area two-dimensional figures and volume
8	Geometry-three-dimensions	Geometry: Descriptions - three-dimensional figures
9	Geometry-transformations	Geometry: Geometric transformations
10	Geometry-constructions	Geometry: Constructions
11	Statistics-data	Probability and statistics: Organizing and displaying data
12	Statistics-statistics	Probability and statistics: Statistics
13	Statistics-probability	Probability and statistics: Probability
14	Linear algebra-equations	Algebra: Linear functions: simplifying expressions and solving equations, formulas, functions, polynomials, multinomials
15	Linear algebra-graphs	Algebra: Linear functions: graphing
16	Linear algebra-functions	Algebra: Quadratic and other linear or trigonometric functions including formulae
17	Non-linear algebra	Algebra: Graphing non-linear (non-trigonometric) functions
18	Miscellaneous	Miscellaneous topics
19	Technology	
20	No content goal identified	Teacher indicated new ideas or skills in TQ5A or TQ5B, but did not identify specific content being presented, e.g., basic mathematics content
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***new*** to students. **TQ5BP** ***New process goal***		
Code	Response	Description or item option
0	Review ideas or skills	No new ideas or skills were presented.
1	Knowing	Familiarity with mathematical content listed or general familiarity with mathematics; content listed without any process listed.
2	Operations or calculations	Students are capable of using operations in routine procedures such as addition, subtraction, multiplication, and division. The code implies that teachers identified common tasks without noting that students are problem solving or working on real world applications.
0	Review	Teacher specifically identified review of particular content area or general "review for a test".
4	Application to real world	Students are able to apply mathematical knowledge to real world application.
5	External influence	Teacher notes that "goals" or knowledge gained is required by an external source, e.g., "getting through the book", "complete subject matter", "pass math", "curriculum standards", or "end of grade test".
6	Mathematical thinking	Students participate in the "logical" thinking of mathematics, but not problem solving.
7	Problem solving	Teacher notes problem solving skills as a performance.
8	Technology	Students learn to use technology to solve mathematics problems.
9	No process goal identified	Teacher indicated new ideas or skills in TQ5A or TQ5B, but did not list a process goal.
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***new*** to students. **TQ5BA** ***New perspective goal***		
Code	Response	Description or item option
0	Review ideas or skills	Teacher did not list any new performance area associated with this process.
1	Interest	Students become interested in or enjoy mathematics, and increase understanding.
2	Mathematical study habits	Teacher identifies “how to study” mathematics or references work ethics; teacher encourages ways of mathematics thinking, e.g., openness, objectivity, tolerance of uncertainty, inventiveness, curiosity.
3	Awareness	Recognition of the need for mathematics in life.
4	Confidence	Students gain confidence in their abilities to succeed in mathematics.
5	Positive attitude	Decrease the mathematics anxiety of students and/or increase appreciation for mathematics; encourage positive attitudes towards mathematics.
6	Atmosphere	Create a positive learning environment.
7	Multiple solutions	Student learn different solution methods.
8	Future requirements	Help students prepare for future, e.g., academic requirements or career requirements.
9	Work in groups	Students work in groups, collaborate and help each other.
10	No perspective goal identified	Teacher indicated new ideas or skills in TQ5A or TQ5B, but did not list specific ideas or skills.
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***new*** to students. **TQ5BCRC** ***New content goal - recoded***		
Code	Response	Description or item option
0	No new content goal	
1	New content goal	
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***new*** to students. **TQ5BPRC** ***New process goal - recoded***		
Code	Response	Description or item option
0	No new process goal	
1	New process goal	
Blank	Missing, not interpretable, or not applicable	

Ideas and skills in videotaped lesson that were mainly ***new*** to students. **TQ5BARC *New perspective goal - recoded***		
Code	Response	Description or item option
0	No new perspective goal	
1	New perspective goal	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6C *Content goal***		
Code	Response	Description or item option
0	No specific content topic mentioned	No specific content topic mentioned.
1	Numbers	Whole numbers, Number Theory, patterns.
2	Fractions	Fractions and decimals, irrrational numbers.
3	Ratio	Ratio, proportion, percent
4	Integers	Integers, powers.
5	Geometry-angles	Geometry: Angles
6	Geometry-lines, triangles	Geometry: Triangles and lines in two-dimensional plane, similarity, Pythagorean Theorem, and quads
7	Geometry-two-dimensions	Geometry: Perimeter/circumference/area two-dimensional figures and volume
8	Geometry-three-dimensions	Geometry: Descriptions - three-dimensional figures
9	Geometry-transformations	Geometry: Geometric transformations
10	Geometry-constructions	Geometry: Constructions
11	Statistics-data	Probability and statistics: Organizing and displaying data
12	Statistics-statistics	Probability and statistics: Statistics
13	Statistics-probability	Probability and statistics: Probability
14	Linear algebra-equations	Algebra: Linear functions: simplifying expressions and solving equations, formulas, functions, polynomials, multinomials
15	Linear algebra-graphs	Algebra: Linear functions: graphing
16	Linear algebra-functions	Algebra: Quadratic and other linear or trigonometric functions including formulae
17	Non-linear algebra	Algebra: Graphing non-linear (non-trigonometric) functions
18	Miscellaneous	Miscellaneous topics
19	Technology	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6CRC** ***Content goal - recoded***		
Code	Response	Description or item option
0	No specific content topic mentioned	No specific content topic mentioned.
10	Numbers	Whole numbers, Number Theory, patterns.
10	Fractions	Fractions and decimals, irrational numbers.
10	Ratio	Ratio, proportion, percent
10	Integers	Integers, powers.
20	Geometry-angles	Geometry: Angles
20	Geometry-lines, triangles	Geometry: Triangles and lines in two-dimensional plane, similarity, Pythagorean Theorem, and quads
20	Geometry-two-dimensions	Geometry: Perimeter/circumference/area two-dimensional figures and volume
20	Geometry-three-dimensions	Geometry: Descriptions - three-dimensional figures
20	Geometry-transformations	Geometry: Geometric transformations
20	Geometry-constructions	Geometry: Constructions
30	Statistics-data	Probability and statistics: Organizing and displaying data
30	Statistics-statistics	Probability and statistics: Statistics
30	Statistics-probability	Probability and statistics: Probability
40	Linear algebra-equations	Algebra: Linear functions: simplifying expressions and solving equations, formulas, functions, polynomials, multinomials
40	Linear algebra-graphs	Algebra: Linear functions: graphing
40	Linear algebra-functions	Algebra: Quadratic and other linear or trigonometric functions including formulae
40	Non-linear algebra	Algebra: Graphing non-linear (non-trigonometric) functions
0	Miscellaneous	Miscellaneous topics
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6P *Process goal***		
Code	Response	Description or item option
0	No process mentioned	No process goal mentioned.
1	Knowing	Familiarity with mathematical content listed or general familiarity with mathematics; contents listed without any process listed.
2	Operations or calculations	Students are capable of using operations in routine procedures such as addition, subtraction, multiplication, and division. The code implies that teachers identified common tasks without noting that students are problem solving or working on real world applications.
3	Review	Teacher specifically identified review of particular content area or general "review for a test"
4	Application to real world	Students are able to apply mathematical knowledge to real world application.
5	External influence	Teacher notes that “goals” or knowledge gained is required by an external source such as “getting through the book", “complete subject matter", “pass math", "curriculum standards", or "end of grade test".
6	Mathematical thinking	Students participate in the “logical” thinking of mathematics, but not problem solving.
7	Problem solving	Teacher notes problem solving skills as a performance.
8	Technology	Students learn to use technology to solve mathematics problems.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6A** ***Perspective goal***		
Code	Response	Description or item option
0	No perspective goal mentioned	No perspective goal mentioned.
1	Interest	Students become interested in or enjoy mathematics, and increase understanding
2	Mathematical study habits	Teacher identifies "how to study" mathematics or references work ethics; teacher encourages ways of mathematics thinking, e.g., openness, objectivity, tolerance of uncertainty, inventiveness, curiosity.
3	Awareness	Recognition of the need for mathematics in life.
4	Confidence	Students gain confidence in their abilities to succeed in mathematics.
5	Positive attitude	Decrease the mathematics anxiety of students and/or increase appreciation for mathematics; encourage positive attitudes towards mathematics.
6	Atmosphere	Create a positive learning environment.
7	Multiple solutions	Student learn different solution methods.
8	Future requirements	Help students prepare for future, e.g., academic requirements or career requirements.
9	Work in groups	Students work in groups, collaborate and help each other.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6CC0** ***No content goals***		
Code	Response	Description or item option
0	Content goal identified	
1	No content goal identified	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PC0** ***No process goals***		
Code	Response	Description or item option
0	Process goal identified	
1	No process goal identified	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6AC0** ***No perspective goals***		
Code	Response	Description or item option
0	Perspective goal identified	
1	No perspective goal identified	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6CCRC** ***Content goals - recoded***		
Code	Response	Description or item option
0	No content goal identified	
1	Content goal identified	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PCRC** ***Process goals - recoded***		
Code	Response	Description or item option
0	No process goal identified	
1	Process goal identified	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6ACRC** ***Perspective goals - recoded***		
Code	Response	Description or item option
0	No perspective goal identified	
1	Perspective goal identified	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6CPDF** ***Difference between content and process goals identified***		
Code	Response	Description or item option
-1	Process but not content goal identified	
0	No difference between content and process goals identified	
1	Content but not process goal identified	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6CADF** ***Difference between content and perspective goals identified***		
Code	Response	Description or item option
-1	Perspective but not content goal identified	
0	No difference between content and perspective goals identified	
1	Content but not perspective goal identified	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PADF** ***Difference between process and perspective goals identified***		
Code	Response	Description or item option
-1	Perspective but not process goal identified	
0	No difference between process and perspective goals identified	
1	Process but not perspective goal identified	
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6NUMB** ***Content goal identified - Numbers***		
Code	Response	Description or item option
0	No numbers content goal identified	
1	Numbers content goal identified	Includes whole numbers, number theory, patterns, fractions, decimals, irrational numbers, ratio, proportion, percent, integers, and powers.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6GEOM** ***Content goal identified - Geometry***		
Code	Response	Description or item option
0	No geometry content goal identified	
1	Geometry content goal identified	Includes angles, triangles and lines in two-dimensional plane, similarity, Pythagorean Theorem, quads, perimeter, circumference, area, volume, three-dimensional figures, geometry transformations, and constructions.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6STAT** ***Content goal identified - Statistics***		
Code	Response	Description or item option
0	No statistics content goal identified	
1	Statistics content goal identified	Includes organizing and displaying data, statistics, and probability.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6ALG** ***Content goal identified - Algebra***		
Code	Response	Description or item option
0	No algebra content goal identified	
1	Algebra content goal identified	Includes algebra linear functions (simplifying expressions and solving equations, formulas, functions, polynomials, multinomials, and graphing), quadratic and other linear or trigonometric functions, and graphing non-linear, non-trigonometric functions.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6OTH** ***Content goal identified - Other***		
Code	Response	Description or item option
0	No other content goal identified	Excludes numbers, geometry, statistics, and algebra content goals.
1	Other content goal identified	Includes miscellaneous goals.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PC1** ***Process goal identified – Knowing mathematical content***		
Code	Response	Description or item option
0	No process goal identified as knowing	
1	Process goal identified as knowing	Includes familiarity with mathematical content listed or general familiarity with mathematics.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PC2** ***Process goal identified – Using routine operations or calculations***		
Code	Response	Description or item option
0	No process goal identified as operations or calculations	
1	Process goal identified as operations or calculations	Includes using operations in routine procedures such as addition, subtraction, multiplication, and division.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PC3** ***Process goal identified – Reviewing***		
Code	Response	Description or item option
0	No process goal identified as review	
1	Process goal identified as review	Includes review of a particular content area or general "review for a test".
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PC4** ***Process goal identified – Applying mathematics to real world problems***		
Code	Response	Description or item option
0	No process goal identified as application to real world	
1	Process goal identified as application to real world	Includes applying mathematical knowledge to real world application.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PC5** ***Process goal identified – Fulfilling external requirements***		
Code	Response	Description or item option
0	No process goal identified as external influence	
1	Process goal identified as external influence	Includes goal required by an external source such as "getting through the book", "complete subject matter", "curriculum standards", or "end of grade test".
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PC6** ***Process goal identified –Thinking mathematically***		
Code	Response	Description or item option
0	No process goal identified as mathematical thinking	
1	Process goal identified as mathematical thinking	Includes engaging in the "logical" thinking of mathematics.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PC7** ***Process goal identified – Developing problem solving skills***		
Code	Response	Description or item option
0	No process goal identified as problem solving	
1	Process goal identified as problem solving	Includes problem solving skills.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6PC8** ***Process goal identified – Using technology***		
Code	Response	Description or item option
0	No process goal identified as technology	
1	Process goal identified as technology	Includes learning to use technology to solve mathematics problems.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6POTH** ***Process goal identified – Other***		
Code	Response	Description or item option
0	No other process goal	Excludes knowing mathematical content, using routine operations, applying mathematics to real world problems, and reasoning mathematically.
1	Other process goal identified	Includes reviewing, developing problem solving skills, using technology, and fulfilling external requirements.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6AC1** ***Perspective goal identified – Increasing interest in mathematics***		
Code	Response	Description or item option
0	No perspective goal identified as interest	
1	Perspective goal identified as interest	Includes increasing students' interest in or enjoyment of mathematics.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6AC2** ***Perspective goal identified – Developing mathematical dispositions***		
Code	Response	Description or item option
0	No perspective goal identified as developing mathematical dispositions	
1	Perspective goal identified as developing mathematical dispositions	Includes developing "how to study" mathematics or work ethics, encourages ways of mathematics thinking, e.g., openness, objectivity, tolerance of uncertainty, inventiveness, curiosity.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6AC3** ***Perspective goal identified – Increasing awareness of mathematics in life***		
Code	Response	Description or item option
0	No perspective goal identified as awareness	
1	Perspective goal identified as awareness	Includes increasing students' awareness of the use of mathematics in life.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6AC4** ***Perspective goal identified – Increasing confidence***		
Code	Response	Description or item option
0	No perspective goal identified as confidence	
1	Perspective goal identified as confidence	Includes increasing students' confidence in their abilities to succeed in mathematics.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6AC5** ***Perspective goal identified – Encouraging positive attitude toward mathematics***		
Code	Response	Description or item option
0	No perspective goal identified as positive attitude	
1	Perspective goal identified as positive attitude	Includes decreasing students' mathematics anxiety and/or increasing their appreciation for mathematics; encouraging a positive attitude toward mathematics.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6AC6** ***Perspective goal identified – Creating a positive learning environment***		
Code	Response	Description or item option
0	No perspective goal identified as positive learning environment	
1	Perspective goal identified as positive learning environment	Includes creating a positive learning environment.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6AC7** ***Perspective goal identified – Learning multiple solutions***		
Code	Response	Description or item option
0	No perspective goal identified as multiple solutions	
1	Perspective goal identified as multiple solutions	Includes encouraging students to appreciate different solutions methods.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6AC8** ***Perspective goal identified – Fulfilling future requirements***		
Code	Response	Description or item option
0	No perspective goal identified as fulfilling future requirements	
1	Perspective goal identified as fulfilling future requirements	Includes helping students fulfill future academic or career requirements.
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ6AC9** ***Perspective goal identified – Working in groups***		
Code	Response	Description or item option
0	No perspective goal identified as groupwork	
1	Perspective goal identified as groupwork	Includes students learning to work in groups, collaborate with and help each other.
Blank	Missing, not interpretable, or not applicable	

TQ7A Are you satisfied that the videotaped lesson achieved that purpose?		
Code	Response	Description or item option
0	No	B
1	Yes	A
2	Yes and No	A,B
Blank	Missing, not interpretable, or not applicable	

TQ7ARC Are you satisfied that the videotaped lesson achieved that purpose?		
Code	Response	Description or item option
0	No	B
1	Yes, or mixed	A, or A and B
Blank	Missing, not interpretable, or not applicable	

TQ8A To what extent did any of the following limit you from reaching your ideal in this lesson? a. Official curricular guidelines and/or standardized tests ***(Czech Republic, Hong Kong SAR, Netherlands, and U.S. versions)*** a. Your state's version of the *National Profiles* ***(Australia version)***		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8B To what extent did any of the following limit you from reaching your ideal in this lesson? b. Requirements to teach many topics		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8C To what extent did any of the following limit you from reaching your ideal in this lesson? c. Insufficient student motivation or readiness to learn		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8D1 To what extent did any of the following limit you from reaching your ideal in this lesson? d. Class size		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8E To what extent did any of the following limit you from reaching your ideal in this lesson? e. Insufficient time for lesson planning		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8F To what extent did any of the following limit you from reaching your ideal in this lesson? Insufficient time to work with colleagues on lessons Insufficient time to collaborate with colleagues on lessons *(Australia version)*		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8G To what extent did any of the following limit you from reaching your ideal in this lesson? g. Not enough books (textbooks, trade books, reference books, etc.)		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8H To what extent did any of the following limit you from reaching your ideal in this lesson? h. Insufficient time to finish what I planned to teach		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8I To what extent did any of the following limit you from reaching your ideal in this lesson?
i. Lack of or obsolete computers
i. Lack of computers or obsolete computers ***(Australia version)***

Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8J To what extent did any of the following limit you from reaching your ideal in this lesson?
j. Lack of appropriate software for computers

Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8K To what extent did any of the following limit you from reaching your ideal in this lesson?
k. Lack of needed instructional equipment (VCR, overhead projection equipment, etc.)

Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8L To what extent did any of the following limit you from reaching your ideal in this lesson? l. Lack of needed multimedia materials (videotapes, transparency sets, slides, and laser disks)		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8M To what extent did any of the following limit you from reaching your ideal in this lesson? m. Insufficient mathematics teaching materials and supplies (hands-on materials, calculators, etc.)		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8N To what extent did any of the following limit you from reaching your ideal in this lesson? n. Inadequate physical facilities (room size or layout, furniture, etc.)		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8O To what extent did any of the following limit you from reaching your ideal in this lesson? o. Insufficient training or support for using new technologies in your classroom		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8P To what extent did any of the following limit you from reaching your ideal in this lesson? p. Presence of the video-camera or videographer		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot	D
4	A great deal	E
98	Not applicable	F Item noted by teacher as not applicable.
Blank	Missing or not interpretable	

TQ8ARC To what extent did any of the following limit you from reaching your ideal in this lesson? ***a.*** Official curricular guidelines and/or standardized tests ***(Czech Republic, Hong Kong SAR, Netherlands, and U.S. versions)*** a. Your state's version of the *National Profiles* ***(Australia version)***		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8BRC To what extent did any of the following <u>limit you</u> from reaching your ideal in this lesson? b. Requirements to teach many topics		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8CRC To what extent did any of the following <u>limit you</u> from reaching your ideal in this lesson? c. Insufficient student motivation or readiness to learn		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8DRC To what extent did any of the following <u>limit you</u> from reaching your ideal in this lesson? d. Class size		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8ERC To what extent did any of the following limit you from reaching your ideal in this lesson? e. Insufficient time for lesson planning		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8FRC To what extent did any of the following limit you from reaching your ideal in this lesson? f. Insufficient time to work with colleagues on lessons f. Insufficient time to collaborate with colleagues on lessons ***(Australia version)***		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8GRC To what extent did any of the following limit you from reaching your ideal in this lesson? g. Not enough books (textbooks, trade books, reference books, etc.)		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8HRC To what extent did any of the following <u>limit you</u> from reaching your ideal in this lesson? h. Insufficient time to finish what I planned to teach		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8IRC To what extent did any of the following <u>limit you</u> from reaching your ideal in this lesson? ii. Lack of or obsolete computers ii. Lack of computers or obsolete computers ***(Australia version)***		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8JRC To what extent did any of the following <u>limit you</u> from reaching your ideal in this lesson? j. Lack of appropriate software for computers		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8KRC To what extent did any of the following limit you from reaching your ideal in this lesson?
k. Lack of needed instructional equipment (VCR, overhead projection equipment, etc.)

Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8LRC To what extent did any of the following limit you from reaching your ideal in this lesson?
l. Lack of needed multimedia materials (videotapes, transparency sets, slides, and laser disks)

Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8MRC To what extent did any of the following limit you from reaching your ideal in this lesson?
m. Insufficient mathematics teaching materials and supplies (hands-on materials, calculators, etc.)

Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8NRC To what extent did any of the following limit you from reaching your ideal in this lesson? n. Inadequate physical facilities (room size or layout, furniture, etc.)		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F.

TQ8ORC To what extent did any of the following limit you from reaching your ideal in this lesson? o. Insufficient training or support for using new technologies in your classroom		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ8PRC To what extent did any of the following limit you from reaching your ideal in this lesson? p. Presence of the video-camera or videographer		
Code	Response	Description or item option
0	Not at all	A
1	A little	B
2	Some	C
3	Quite a lot or a great deal	D,E
Blank	Missing, not interpretable, or not applicable	F

TQ9A How long did you spend planning the videotaped lesson? (Code number of minutes)		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ9B How long do you usually spend planning for this type of mathematics lesson? (Code number of minutes)		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ9A9BDF Difference in time teacher spent planning for this type of mathematics lesson from time spent planning for the videotaped lesson (Code number of minutes in TQ9A minus number of minutes in TQ9B)		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ10 Did your students work in groups for any part of the videotaped lesson?		
Code	Response	Description or item option
0	No	
1	Yes	
2	Yes and No	
Blank	Missing, not interpretable, or not applicable	

TQ10RC Did your students work in groups for any part of the videotaped lesson?		
Code	Response	Description or item option
0	No	
1	Yes, or mixed	
Blank	Missing, not interpretable, or not applicable	

TQ12A To what extent do you have sufficient access to this item for use in your mathematics classroom? a. Computers		
Code	Response	Description or item option
0	Not at all	C
1	Too few or little	B
2	Enough	A
Blank	Missing, not interpretable, or not applicable	

TQ12B To what extent do you have sufficient access to this item for use in your mathematics classroom? b. Computer software		
Code	Response	Description or item option
0	Not at all	C
1	Too few or little	B
2	Enough	A
Blank	Missing, not interpretable, or not applicable	

TQ12C To what extent do you have sufficient access to this item for use in your mathematics classroom? c. Computers with Internet connections		
Code	Response	Description or item option
0	Not at all	C
1	Too few or little	B
2	Enough	A
Blank	Missing, not interpretable, or not applicable	

TQ12D To what extent do you have sufficient access to this item for use in your mathematics classroom? d. A/V equipment (TV, VCR, overhead projectors)		
Code	Response	Description or item option
0	Not at all	C
1	Too few or little	B
2	Enough	A
Blank	Missing, not interpretable, or not applicable	

TQ12E To what extent do you have sufficient access to this item for use in your mathematics classroom? e. Teaching supplies/materials (e.g. hands-on materials) ***(Item was not included in 40% of the Cantonese versions of the teacher questionnaire.)***		
Code	Response	Description or item option
0	Not at all	C
1	Too few or little	B
2	Enough	A
3	Not at all and Enough	A,C
Blank	Missing, not interpretable, or not applicable	

TQ12F To what extent do you have sufficient access to this item for use in your mathematics classroom? f. Calculators		
Code	Response	Description or item option
0	Not at all	C
1	Too few or little	B
2	Enough	A
3	Not at all and Enough	A,C (e.g., NL teacher marked not at all and enough, and wrote “these belong to students”).
Blank	Missing, not interpretable, or not applicable	

TQ12G To what extent do you have sufficient access to this item for use in your mathematics classroom? g. Reference book materials (books, journals, magazines)		
Code	Response	Description or item option
0	Not at all	C
1	Too few or little	B
2	Enough	A
Blank	Missing, not interpretable, or not applicable	

TQ13 Do all students in the school take this course? ***(Czech Republic, Hong Kong SAR, U.S. versions)*** Do all students at the year 8 level take this course of study/pathway? ***(Australia version)*** ***(Code ‘1’ for Netherlands and Switzerland)***		
Code	Response	Description or item option
0	No	B
1	Yes	A ***Code ‘1’ for all NL and SW; all students must take this course.***
Blank	Missing, not interpretable, or not applicable	

TQ14
If **no**, is curriculum in this course more challenging or less challenging than the typical eighth grade mathematics course in this school? Mark one of the three choices below ***(Australia, Hong Kong SAR, U.S. versions)***
If **no**, is the curriculum on the same level as in other 8th-grade courses? ***(CZ version)***
(Code '2' for Netherlands and for Switzerland German-speaking and Italian-Speaking areas)

Code	Response	Description or item option
1	Less challenging	C
2	A typical 8th grade curriculum	B 'Yes' on Question 13; all students take this course. ***Code '2' for NL and SW; all students must take this course.***
3	More challenging	A
4	Mixed level of difficulty	A and C; A, B, and C
Blank	Missing, not interpretable, or not applicable	

TQ14RC
If **no**, is curriculum in this course more challenging or less challenging than the typical eighth grade mathematics course in this school? Mark one of the three choices below ***(Australia, Hong Kong SAR, U.S. versions)***
If **no**, is the curriculum on the same level as in other 8th-grade courses? ***(CZ version)***
(Code '2' for Netherlands and for Switzerland German-speaking and Italian-Speaking areas)

Code	Response	Description or item option
1	Less challenging	C
2	A typical 8th grade curriculum, or mixed level of difficulty	B; A and C; A, B, and C 'Yes' on Question 13; all students take this course. ***Code '2' for all NL and SW; all students must take this course.***
3	More challenging	A
Blank	Missing, not interpretable, or not applicable	

TQ14NO13 If **no**, is curriculum in this course more challenging or less challenging than the typical eighth grade mathematics course in this school? Mark one of the three choices below ***(Australia, Hong Kong SAR, U.S. versions)*** If **no**, is the curriculum on the same level as in other 8th-grade courses? ***(CZ version)*** ***(Code 'Blank' for Netherlands, Switzerland German-speaking and Italian-speaking areas***)		
Code	Response	Description or item option
1	Less challenging	C
2	A typical 8th grade curriculum	B
3	More challenging	A
4	Mixed level of difficulty	A and C; A, B, and C.
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for all 'Yes' responses on Question 13; Code 'Blank' for NL, SW-German and SW-Italian speaking areas; all students take this course.***

TQ15 Did you previously assign mathematics homework that was due for the day of the videotaped lesson?		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ17 Was the assigned homework related to this lesson or the prior lesson?		
Code	Response	Description or item option
0	No homework assigned	No homework assigned; or homework not from prior or videotaped lesson. ***Code '0' for all TQ15 = '0' responses.***
1	Prior lesson	B
2	Videotaped lesson	A
3	Both	C
Blank	Missing, not interpretable, or not applicable	

TQ18 How long would it have taken the typical student in your class to complete this homework? ***(Code actual number of minutes)***		
Code	Response	Description or item option
1	1 minute	Example
2	2 minutes	Example
Blank	Missing, not interpretable, or not applicable	

TQ19 Will students be formally evaluated on the material they studied in the videotaped lesson (e.g., a quiz, unit test, project, etc.)?		
Code	Response	Description or item option
0	No	B
1	Yes	A
2	Yes and No	A,B
Blank	Missing, not interpretable, or not applicable	

TQ19RC Will students be formally evaluated on the material they studied in the videotaped lesson (e.g., a quiz, unit test, project, etc.)?		
Code	Response	Description or item option
0	No	B
1	Yes, or mixed	A, or A and B
Blank	Missing, not interpretable, or not applicable	

TQ21 Was the videotaped lesson part of a unit or sequence of related lessons, or was it standalone?		
Code	Response	Description or item option
1	Stand-alone lesson	A
2	Part of a larger unit or sequence of related lessons	B
Blank	Missing, not interpretable, or not applicable	

TQ24 Approximately how many lessons are in the entire sequence or unit? ***(Code number of lessons in unit)***		
Code	Response	Description or item option
1	1 lesson	First lesson, or stand-alone lesson.
2	2 lessons	Example
Blank	Missing, not interpretable, or not applicable	

TQ25 Where did the videotaped lesson fall in the sequence or unit? ***(Code number of videotaped lesson in unit)***		
Code	Response	Description or item option
1	First lesson in unit	First lesson in unit, teacher notes lesson is not stand alone but only one lesson in unit, or stand-alone lesson.
2	Second lesson in unit	Example
Blank	Missing, not interpretable, or not applicable	

TQ27 For this study, we are interested in capturing your typical mathematics teaching. It is important for us to know in what ways the teaching in the videotaped lesson might not have been typical. How often do you use the teaching methods that are in the videotaped lesson?		
Code	Response	Description or item option
1	Seldom	A
2	Sometimes	B
3	Often	C
4	Almost always	D
Blank	Missing, not interpretable, or not applicable	

TQ27C12 For this study, we are interested in capturing your typical mathematics teaching. It is important for us to know in what ways the teaching in the videotaped lesson might not have been typical. How often do you use the teaching methods that are in the videotaped lesson?		
Code	Response	Description or item option
0	Almost always or Often	C,D
1	Seldom or Sometimes	A,B
Blank	Missing, not interpretable, or not applicable	

TQ27C3 For this study, we are interested in capturing your typical mathematics teaching. It is important for us to know in what ways the teaching in the videotaped lesson might not have been typical. How often do you use the teaching methods that are in the videotaped lesson?		
Code	Response	Description or item option
0	Seldom, Sometimes, or Almost always	A,B,D
1	Often	C
Blank	Missing, not interpretable, or not applicable	

TQ27C4 For this study, we are interested in capturing your typical mathematics teaching. It is important for us to know in what ways the teaching in the videotaped lesson might not have been typical. How often do you use the teaching methods that are in the videotaped lesson?		
Code	Response	Description or item option
0	Seldom, Sometimes, or Often	A,B,C
1	Almost always	D
Blank	Missing, not interpretable, or not applicable	

TQ29 How would you describe your students' behavior and participation during the videotaped lesson?		
Code	Response	Description or item option
1	Worse than usual	C
2	About the same as usual	B
3	Better than usual	A
4	Better and Worse than usual	A,C or A,B,C
Blank	Missing, not interpretable, or not applicable	

TQ29RC How would you describe your students' behavior and participation during the videotaped lesson?		
Code	Response	Description or item option
1	Worse than usual	C
2	About the same as usual, or mixed	B, A and C, or A and B and C
3	Better than usual	A
Blank	Missing, not interpretable, or not applicable	

TQ29C1 How would you describe your students' behavior and participation during the videotaped lesson?		
Code	Response	Description or item option
0	About the same as usual, or Better than usual	A,B
1	Worse than usual	C
Blank	Missing, not interpretable, or not applicable	

TQ29C2 How would you describe your students' behavior and participation during the videotaped lesson?		
Code	Response	Description or item option
0	Worse than usual, or Better than usual	A,C
1	About the same as usual, or mixed	B
Blank	Missing, not interpretable, or not applicable	

TQ29C3 How would you describe your students' behavior and participation during the videotaped lesson?		
Code	Response	Description or item option
0	Worse than usual, or About the same as usual	B,C
1	Better than usual	A
Blank	Missing, not interpretable, or not applicable	

What, if anything, was different about the nature of the students' behavior and the amount of student participation during the videotaped lesson? **TQ30C11 CZ student behavior less active** **Code CZ only for responses describing student behavior as worse.**		
Code	Response	Description or item option
0	Student behavior same as usual, or better	**Code CZ only for responses describing student behavior as worse, specifically, insecure, shy, or less focused.**
1	Student behavior worse: less active	**Code CZ only for responses describing student behavior as worse, specifically, less active.**
Blank	Missing, not interpretable, or not applicable	**Code 'Blank' for all other countries.**

What, if anything, was different about the nature of the students' behavior and the amount of student participation during the videotaped lesson? **TQ30C12 CZ student behavior insecure or shy** **Code CZ only for responses describing student behavior as worse.**		
Code	Response	Description or item option
0	Student behavior same as usual, or better	**Code CZ only for responses describing student behavior as worse, specifically, less active or less focused.**
1	Student behavior worse: insecure or shy	**Code CZ only for responses describing student behavior as worse, specifically, insecure or shy.**
Blank	Missing, not interpretable, or not applicable	**Code 'Blank' for all other countries.**

What, if anything, was different about the nature of the students' behavior and the amount of student participation during the videotaped lesson? **TQ30C13 CZ student behavior less focused** **Code CZ only for responses describing student behavior as worse.**		
Code	Response	Description or item option
0	Student behavior same as usual, or better	**Code CZ only for responses describing student behavior as worse, specifically, less active, insecure, or shy.**
1	Student behavior worse: less focused	**Code CZ only for responses describing student behavior as worse, specifically, less focused.**
Blank	Missing, not interpretable, or not applicable	**Code 'Blank' for all other countries.**

TQ31 Was the content of the videotaped lesson more difficult for your students than usual, about the same, or less difficult than usual?		
Code	Response	Description or item option
1	Less difficult for students than most lessons	C
2	About the same as most lessons	B
3	More difficult for students than most lessons	A
4	Mixed level of difficulty	A and C, or A, B, and C.
Blank	Missing, not interpretable, or not applicable	

TQ31RC Was the content of the videotaped lesson more difficult for your students than usual, about the same, or less difficult than usual?		
Code	Response	Description or item option
1	Less difficult for students than most lessons	C
2	About the same as most lessons, or mixed level of difficulty	B, or A and C, or A and B and C
3	More difficult for students than most lessons	A
Blank	Missing, not interpretable, or not applicable	

TQ31C1 Was the content of the videotaped lesson more difficult for your students than usual, about the same, or less difficult than usual?		
Code	Response	Description or item option
0	About the same, or More difficult for students than most lessons	A,B
1	Less difficult for students than most lessons	C
Blank	Missing, not interpretable, or not applicable	

TQ31C2 Was the content of the videotaped lesson more difficult for your students than usual, about the same, or less difficult than usual?		
Code	Response	Description or item option
0	Less difficult, or More difficult for students than most lessons	A,C
1	About the same as most lessons	B
Blank	Missing, not interpretable, or not applicable	

TQ31C3 Was the content of the videotaped lesson more difficult for your students than usual, about the same, or less difficult than usual?		
Code	Response	Description or item option
0	Less difficult, or About the same as most lessons	B,C
1	More difficult for students than most lessons	A
Blank	Missing, not interpretable, or not applicable	

TQ32 Do you think that having the camera present caused you to teach a lesson that was better than usual, worse than usual, or about the same as usual?		
Code	Response	Description or item option
1	Worse than usual	C
2	About the same as usual	B
3	Better than usual	A
4	Mixed – Better and Worse	A and C, or A, B, and C
Blank	Missing, not interpretable, or not applicable	

TQ32RC Do you think that having the camera present caused you to teach a lesson that was better than usual, worse than usual, or about the same as usual?		
Code	Response	Description or item option
1	Worse than usual	C
2	About the same as usual, or Mixed	B, or A and C, or A and B and C
3	Better than usual	A
Blank	Missing, not interpretable, or not applicable	

TQ32C1 Do you think that having the camera present caused you to teach a lesson that was better than usual, worse than usual, or about the same as usual?		
Code	Response	Description or item option
0	About the same, or Better than usual	A,B
1	Worse than usual	C
Blank	Missing, not interpretable, or not applicable	

TQ32C2 Do you think that having the camera present caused you to teach a lesson that was better than usual, worse than usual, or about the same as usual?		
Code	Response	Description or item option
0	Worse, or Better than usual	A,C
1	About the same as usual	B
Blank	Missing, not interpretable, or not applicable	

TQ32C3 Do you think that having the camera present caused you to teach a lesson that was better than usual, worse than usual, or about the same as usual?		
Code	Response	Description or item option
0	Worse, or About the same as usual	B,C
1	Better than usual	A
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33C1** ***Content goal - First mentioned*** **TQ33C2** ***Content goal - Second mentioned*** **TQ33C3** ***Content goal - Third mentioned***		
Code	Response	Description or item option
0	No specific content topics mentioned	No specific content topics mentioned.
1	Numbers	Whole numbers, Number Theory, patterns.
2	Fractions	Fractions and decimals, irrrational numbers.
3	Ratio	Ratio, proportion, percent
4	Integers	Integers, powers.
5	Geometry-angles	Geometry: Angles
6	Geometry-lines, triangles	Geometry: Triangles and lines in two-dimensional plane, similarity, Pythagorean Theorem, and quads
7	Geometry-two-dimensions	Geometry: Perimeter/circumference/area two-dimensional figures and volume
8	Geometry-three-dimensions	Geometry: Descriptions - three-dimensional figures
9	Geometry-transformations	Geometry: Geometric transformations
10	Geometry-constructions	Geometry: Constructions
11	Statistics-data	Probability and statistics: Organizing and displaying data
12	Statistics-statistics	Probability and statistics: Statistics
13	Statistics-probability	Probability and statistics: Probability
14	Linear algebra-equations	Algebra: Linear functions: simplifying expressions and solving equations, formulas, functions, polynomials, multinomials
15	Linear algebra-graphs	Algebra: Linear functions: graphing
16	Linear algebra-functions	Algebra: Quadratic and other linear or trigonometric functions including formulae
17	Non-linear algebra	Algebra: Graphing non-linear (non-trigonometric) functions
18	Miscellaneous	Miscellaneous topics
19	Technology	
20	Unspecified geometry content	Geometry content, but no detailed topic identified
21	Unspecified algebra content	Algebra content, but no detailed topic identified
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33CSUM Number of *content goals identified***		
Code	Response	Description or item option
0	No goals	No content goals identified
1	One goal	One content goal identified
2	Two goals	Two content goals identified
3	Three goals	Three content goals identified
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ33P1** ***Process goal - First mentioned*** **TQ33P2** ***Process goal - Second mentioned*** **TQ33P3** ***Process goal - Third mentioned***		
Code	Response	Description or item option
0	No processes mentioned	No processes mentioned.
1	Knowing	Familiarity with mathematical content listed or general familiarity with mathematics; contents simply listed without process listed.
2	Operations or calculations	Students are capable of using operations in routine procedures such as addition, subtraction, multiplication, and division. The code implies that teachers identified common tasks without noting that students are problem solving or working on real world applications.
3	Review	Teacher specifically identified review of particular content area or general "review for a test".
4	Application to real world	Students are able to apply mathematical knowledge to real world application.
5	External influence	Teacher notes that “goals” or knowledge gained is required by an external source such as “getting through the book", “complete subject matter", “pass math", "curriculum standards", or "end of grade test".
6	Mathematical thinking	Students participate in the “logical” thinking of mathematics, but not problem solving.
7	Problem solving	Teacher notes problem solving skills as a performance.
8	Technology	Students learn to use technology to solve mathematics problems.
9	Communicate	Students learn to communicate mathematically.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PSUM Number of *process goals identified***		
Code	Response	Description or item option
0	No goals	No process goals identified
1	One goals	One process goal identified
2	Two goals	Two process goals identified
3	Three goals	Three process goals identified
Blank	Missing, not interpretable, or not applicable	

What was the main thing you wanted students to learn from the videotaped lesson? **TQ33A1** ***Perspective goal - First mentioned*** **TQ33A2** ***Perspective goal - Second mentioned*** **TQ33A3** ***Perspective goal - Third mentioned***		
Code	Response	Description or item option
0	No perspective goals mentioned	No perspective or attitude goals mentioned.
1	Interest	Students become interested in or enjoy mathematics, and increase understanding
2	Mathematical study habits	Teacher identifies "how to study" mathematics or references work ethics; teacher encourages ways of mathematics thinking, e.g., openness, objectivity, tolerance of uncertainty, inventiveness, curiosity.
3	Awareness	Recognition of the need for mathematics in life.
4	Confidence	Students gain confidence in their abilities to succeed in mathematics.
5	Positive attitude	Decrease the mathematics anxiety of students and/or increase appreciation for mathematics; encourage positive attitudes towards mathematics.
6	Atmosphere	Create a positive learning environment.
7	Multiple solutions	Student learn different solution methods, e.g., "There are more than one methods to solve a problem".
8	Future requirements	Help students prepare for future, e.g., academic requirements or career requirements.
9	Work in groups	Students work in groups, collaborate and help each other.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33ASUM Number of *perspective goals identified***		
Code	Response	Description or item option
0	No goals	No perspective goals identified
1	One goals	One perspective goal identified
2	Two goals	Two perspective goals identified
3	Three goals	Three perspective goals identified
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33NUMB *Content goals - Numbers*** **(Code number of mentions)**		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33GEOM *Content goals - Geometry*** **(Code number of mentions)**		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33STAT *Content goals - Statistics*** **(Code number of mentions)**		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33ALG *Content goals - Algebra*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33OTH** ***Content goals - Other*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC1** ***Process goals – Knowing mathematical content*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC2** ***Process goals – Using routine operations or calculations*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC3** ***Process goals - Reviewing*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC4** ***Process goals – Applying mathematics to real world problems*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC5** ***Process goals – Fulfilling external requirements*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC6** ***Process goals – Thinking mathematically*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC7** ***Process goals - Developing problem solving skills*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC8** ***Process goals – Using technology*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC9** ***Process goals – Other process goal*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC1** ***Perspective goals - Increasing interest in mathematics*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC2** ***Perspective goals – Developing mathematical dispositions*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC3** ***Perspective goals - Increasing awareness of mathematics in life*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC4** ***Perspective goals – Increasing confidence*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC5** ***Perspective goals - Encouraging positive attitude toward mathematics*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC6** ***Perspective goals – Creating a positive learning environment*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC7** ***Perspective goals - Learning multiple solutions*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC8** ***Perspective goals – Fulfilling future requirements*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC9** ***Perspective goals – Working in groups*** ***(Code number of mentions)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33NURC** ***Content goal identified - Numbers***		
Code	Response	Description or item option
0	No numbers content goal identified	
1	Numbers content goal identified	Includes whole numbers, number theory, patterns, fractions, decimals, irrational numbers, ratio, proportion, percent, integers, and powers.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33GERC** ***Content goal identified - Geometry***		
Code	Response	Description or item option
0	No geometry content goal identified	
1	Geometry content goal identified	Includes angles, triangles and lines in two-dimensional plane, similarity, Pythagorean Theorem, quads, perimeter, circumference, area, volume, three-dimensional figures, geometry transformations, and constructions.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33STRC** ***Content goal identified - Statistics***		
Code	Response	Description or item option
0	No statistics content goal identified	
1	Statistics content goal identified	Includes organizing and displaying data, statistics, and probability.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33ALRC** ***Content goal identified - Algebra***		
Code	Response	Description or item option
0	No algebra content goal identified	
1	Algebra content goal identified	Includes algebra linear functions (simplifying expressions and solving equations, formulas, functions, polynomials, multinomials, and graphing), quadratic and other linear or trigonometric functions, and graphing non-linear, non-trigonometric functions.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33OTRC** ***Content goal identified - Other***		
Code	Response	Description or item option
0	No other content goal identified	Excludes numbers, geometry, statistics, and algebra content goals.
1	Other content goal identified	Includes miscellaneous goals.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC1** ***Process goal identified – Knowing mathematical content***		
Code	Response	Description or item option
0	No process goal identified as knowing	
1	Process goal identified as knowing	Includes familiarity with mathematical content listed or general familiarity with mathematics.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC2** ***Process goal identified – Using routine operations or calculations***		
Code	Response	Description or item option
0	No process goal identified as operations or calculations	
1	Process goal identified as operations or calculations	Includes using operations in routine procedures such as addition, subtraction, multiplication, and division.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC3** ***Process goal identified – Reviewing***		
Code	Response	Description or item option
0	No process goal identified as review	
1	Process goal identified as review	Includes review of a particular content area or general "review for a test".
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC4** ***Process goal identified – Applying mathematics to real world problems***		
Code	Response	Description or item option
0	No process goal identified as application to real world	
1	Process goal identified as application to real world	Includes applying mathematical knowledge to real world application.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC5** ***Process goal identified – Fulfilling external requirements***		
Code	Response	Description or item option
0	No process goal identified as external influence	
1	Process goal identified as external influence	Includes goal established by an external source such as "getting through the book", "complete subject matter", "curriculum standards", or "end of grade test".
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC6** ***Process goal identified –Thinking mathematically***		
Code	Response	Description or item option
0	No process goal identified as mathematical thinking	
1	Process goal identified as mathematical thinking	Includes engaging in the "logical" thinking of mathematics.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC7** ***Process goal identified – Developing problem solving skills***		
Code	Response	Description or item option
0	No process goal identified as problem solving	
1	Process goal identified as problem solving	Includes problem solving skills.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PC8** ***Process goal identified – Using technology***		
Code	Response	Description or item option
0	No process goal identified as technology	
1	Process goal identified as technology	Includes learning to use technology to solve mathematics problems.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33P9RC** ***Process goal identified – Communicating mathematically***		
Code	Response	Description or item option
0	No process goal identified as technology	Excludes knowing mathematical content, using routine operations, applying mathematics to real world problems, and reasoning mathematically.
1	Process goal identified as technology	Includes reviewing, developing problem solving skills, using technology, and fulfilling external requirements.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC1** ***Perspective goal identified – Increasing interest in mathematics***		
Code	Response	Description or item option
0	No perspective goal identified as interest	
1	Perspective goal identified as interest	Includes increasing students’ interest in or enjoyment of mathematics.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC2** ***Perspective goal identified – Developing mathematical dispositions***		
Code	Response	Description or item option
0	No perspective goal identified as developing mathematical dispositions	
1	Perspective goal identified as developing mathematical dispositions	Includes developing "how to study" mathematics or work ethics, encouraging ways of mathematics thinking, e.g., openness, objectivity, tolerance of uncertainty, inventiveness, curiosity.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC3** ***Perspective goal identified – Increasing awareness of mathematics in life***		
Code	Response	Description or item option
0	No perspective goal identified as awareness	
1	Perspective goal identified as awareness	Includes increasing students' awareness of the use of mathematics in life.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC4** ***Perspective goal identified – Increasing confidence***		
Code	Response	Description or item option
0	No perspective goal identified as confidence	
1	Perspective goal identified as confidence	Includes increasing students' confidence in their abilities to succeed in mathematics.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC5** ***Perspective goal identified – Encouraging positive attitude toward mathematics***		
Code	Response	Description or item option
0	No perspective goal identified as positive attitude	
1	Perspective goal identified as positive attitude	Includes decreasing students' mathematics anxiety and/or increasing their appreciation for mathematics; encouraging a positive attitude toward mathematics.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC6** ***Perspective goal identified – Creating a positive learning environment***		
Code	Response	Description or item option
0	No perspective goal identified as positive learning environment	
1	Perspective goal identified as positive learning environment	Includes creating a positive learning environment.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC7** ***Perspective goal identified – Learning multiple solutions***		
Code	Response	Description or item option
0	No perspective goal identified as multiple solutions	
1	Perspective goal identified as multiple solutions	Includes encouraging students to appreciate different solutions methods.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC8** ***Perspective goal identified – Fulfilling future requirements***		
Code	Response	Description or item option
0	No perspective goal identified as fulfilling future requirements	
1	Perspective goal identified as fulfilling future requirements	Includes helping students fulfill future academic or career requirements.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33AC9** ***Perspective goal identified – Working in groups***		
Code	Response	Description or item option
0	No perspective goal identified as groupwork	
1	Perspective goal identified as groupwork	Includes students learning to work in groups, collaborate with and help each other.
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33CPDF** ***Difference between content and process goals identified***		
Code	Response	Description or item option
-1	Process but not content goal identified	
0	No difference between content and process goals identified	
1	Content but not process goal identified	
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33CADF** ***Difference between content and perspective goals identified***		
Code	Response	Description or item option
-1	Perspective but not content goal identified	
0	No difference between content and perspective goals identified	
1	Content but not perspective goal identified	
Blank	Missing, not interpretable, or not applicable	

Most important thing you would like your students to learn from studying mathematics this year. **TQ33PADF** ***Difference between process and perspective goals identified***		
Code	Response	Description or item option
-1	Perspective but not process goal identified	
0	No difference between process and perspective goals identified	
1	Process but not perspective goal identified	
Blank	Missing, not interpretable, or not applicable	

TQ34 In general, I feel comfortable trying new techniques for teaching mathematics in my classroom		
Code	Response	Description or item option
1	I disagree	C
2	No opinion	B
3	I agree	A
Blank	Missing, not interpretable, or not applicable	

TQ35 In general, I feel I keep up with current ideas in mathematics teaching and learning		
Code	Response	Description or item option
1	I disagree	C
2	No opinion	B
3	I agree	A
Blank	Missing, not interpretable, or not applicable	

TQ35C1 In general, I feel I keep up with current ideas in mathematics teaching and learning		
Code	Response	Description or item option
0	No opinion, or I agree	A,B
1	I disagree	C
Blank	Missing, not interpretable, or not applicable	

TQ35C2 In general, I feel I keep up with current ideas in mathematics teaching and learning		
Code	Response	Description or item option
0	I disagree, or I agree	A,C
1	No opinion	B
Blank	Missing, not interpretable, or not applicable	

TQ35C3 In general, I feel I keep up with current ideas in mathematics teaching and learning		
Code	Response	Description or item option
0	I disagree, or No opinion	B,C
1	I agree	A
Blank	Missing, not interpretable, or not applicable	

TQ37A What written materials are you aware of that describe current ideas about the teaching and learning of mathematics? (Code number of written materials)		
Code	Response	Description or item option
0	None	No written materials identified
1	One material	Teacher identified one written material
2	Two materials	Teacher identified two written materials
3	Three materials	Teacher identified three written materials
Blank	Missing, not interpretable, or not applicable	

What written materials are you aware of that describe current ideas about the teaching and learning mathematics? Please list up to three, and indicate whether you have personally read each one. **TQ37B1** ***First mentioned written material*** **TQ37B2** ***Second mentioned written material*** **TQ37B3** ***Third mentioned written material***		
Code	Response	Description or item option
0	None of it	D
1	Some of it	C
2	Most of it	B
3	All of it	A
Blank	Missing, not interpretable, or not applicable	

TQ38 To what extent do you feel that the videotaped lesson is in accord with current ideas about the teaching and learning of mathematics?		
Code	Response	Description or item option
0	Not at all	D
1	A little	C
2	A fair amount	B
3	A lot	A
Blank	Missing, not interpretable, or not applicable	

TQ38RC To what extent do you feel that the videotaped lesson is in accord with current ideas about the teaching and learning of mathematics?		
Code	Response	Description or item option
0	Not at all	D
1	A little	C
2	A fair amount or A lot	A,B
Blank	Missing, not interpretable, or not applicable	

TQ38C0 To what extent do you feel that the videotaped lesson is in accord with current ideas about the teaching and learning of mathematics?		
Code	Response	Description or item option
0	A little, A fair amount, or A lot	A,B,C
1	Not at all	D
Blank	Missing, not interpretable, or not applicable	

TQ38C1 To what extent do you feel that the videotaped lesson is in accord with current ideas about the teaching and learning of mathematics?		
Code	Response	Description or item option
0	Not at all, A fair amount, or A lot	A,B,D
1	A little	C
Blank	Missing, not interpretable, or not applicable	

TQ38C23 To what extent do you feel that the videotaped lesson is in accord with current ideas about the teaching and learning of mathematics?		
Code	Response	Description or item option
0	Not at all, or A little	C,D
1	A fair amount, or A lot	A,B
Blank	Missing, not interpretable, or not applicable	

TQ39A Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics.		
Code	Response	Description or item option
0	Lesson does not exemplify current ideas	'No' on TQ38
1	Student actively involved	Students involved in hands-on activities, students apply knowledge to practical problems or tasks, students actively participate in lesson, or students use manipulatives.
2	Classroom discussion	Classroom discussion used to 'motivate or stimulate' students.
3	Students construct their own knowledge	Teacher facilitates students learning on their own, e.g., "I try to lead them to their own conclusions"; students construct their own knowledge; students pose questions; students design investigations to answer questions; students develop or invent concept or procedure; teacher does not tell students what to do.
4	Students working together	Students go over work together; students help each other; students collaborate; students build a community of inquiry-group collaboration.
5	External source	Teacher implements department, school, textbook guidelines or requirements in lesson.
6	Teacher as facilitator	Teacher identifies role of the teacher as facilitator.
7	Students work independent of teacher	Teacher implements discovery learning, self-motivation, learning by way of doing the task with teacher feedback.
8	Student motivation or interest	Teacher increases student motivation or interest, e.g., "students were having fun and … improving thinking skills".
9	Method of introduction - student focused	Teacher's introduction of the topic is consistent with current ideas of teaching and learning, e.g., "I moved from the general to the specific," "used problems to develop ideas," "students led to independent work".
10	Multiple ability class	Class is composed of students with different levels of ability.
11	Linking new concepts to prior knowledge	Teacher links new concepts to prior knowledge; checking for students' prior ideas and misconceptions, then helping them address and change these ideas, e.g., "Learning only takes place with understanding, the new concept was strongly linked to established numerical concepts".
12	Types of problems used	Teacher identifies the types of problems, but not how students work on these problems, as reflecting current reform, e.g., "use of competition problems," "practical

		examples".
13	Teach critical thinking or problem solving skills	Instruction focused on teaching critical thinking or problem solving skills.
14	Use of real world problems	Teacher uses practical or real world problems.
15	Instruction level responsive to student	Instruction responsive to student needs including student knowledge and/or abilities.
16	Use of technology	Instruction includes using computers, calculators, or other technology.
17	Other	Instruction implements other current ideas including assessing student performance, e.g., "students successes are assessed not their failures", building student confidence, using competition.
18	No current area identified	Teacher indicated implementation of current ideas in TQ38 but did not identify a specific current idea.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics.
TQ39AC1 ***Active involvement of students***

Code	Response	Description or item option
0	None identified, or current idea not identified as students actively involved	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as students actively involved.
1	Students actively involved	Students involved in hands-on activities, students apply knowledge to practical problems or tasks, students actively participate in lesson, or students use manipulatives.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics.
TQ39AC2 ***Classroom discussion***

Code	Response	Description or item option
0	None identified, or current idea not identified as classroom discussion	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as classroom discussion.
1	Classroom discussion	Classroom discussion used to 'motivate or stimulate' students.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC3** ***Student construction of their own knowledge***		
Code	Response	Description or item option
0	None identified, or current idea not identified as students constructing knowledge	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as students constructing knowledge.
1	Students constructing knowledge	Teacher facilitates students learning on their own; students construct their own knowledge; students pose questions; students design investigations to answer questions; students develop or invent concept or procedure; teacher does not tell students what to do.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC4** ***Student groupwork***		
Code	Response	Description or item option
0	None identified, or current idea not identified as groupwork	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as groupwork.
1	Students work together	Students go over work together; students help each other; students collaborate; students build a community of inquiry-group collaboration.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC5** ***Instruction derived from external source of current ideas***		
Code	Response	Description or item option
0	None identified, or current idea not identified as external source	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as external source.
1	External source of current ideas	Teacher implements department, school, textbook guidelines or requirements in lesson.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC6** ***Teacher role as facilitator***		
Code	Response	Description or item option
0	None identified, or current idea not identified as teacher as facilitator	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as teacher as facilitator.
1	Teacher facilitates student learning	Teacher identifies role of the teacher as facilitator.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC7** ***Independent student work***		
Code	Response	Description or item option
0	None identified, or current idea not identified as independent student work	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as independent student work.
1	Students work independently	Teacher implements discovery learning, self-motivation, learning by way of doing the task with teacher feedback.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC8** ***Increased student interest***		
Code	Response	Description or item option
0	None identified, or current idea not identified as student interest	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as student interest.
1	Increase student interest	Teacher increases student motivation or interest, e.g., "students were having fun and…improving thinking skills".
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC9** ***Student focused instruction***		
Code	Response	Description or item option
0	None identified, or current idea not identified as student focused	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as student focused.
1	Student focused instruction	Teacher's introduction of the topic is consistent with current ideas of teaching and learning, e.g., "I moved from the general to the specific," "used problems to develop ideas," "students led to independent work".
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC10** ***Multiple ability class***		
Code	Response	Description or item option
0	None identified, or current idea not identified as multiple ability class	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as multiple ability class.
1	Multiple ability class	Class is composed of students with different levels of ability.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC11** ***New concepts linked to prior knowledge***		
Code	Response	Description or item option
0	None identified, or current idea not identified as new concepts linked to prior knowledge	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as new concepts linked to prior knowledge.
1	New concepts linked to prior knowledge	Teacher links new concepts to students' prior knowledge.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC12** ***Types of problems used***		
Code	Response	Description or item option
0	None identified, or current idea not identified as types of problems	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as types of problems.
1	Types of problems used	Teacher identifies the types of problems, but not how students work on these problems, as reflecting current reform, e.g., "use of competition problems," "practical examples".
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC13** ***Problem solving skills***		
Code	Response	Description or item option
0	None identified, or current idea not identified as problem solving	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as problem solving.
1	Problem solving skills	Instruction focused on teaching problem solving skills or critical thinking.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC14** ***Use of real world problems***		
Code	Response	Description or item option
0	None identified, or current idea not identified as real world problems	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as real world problems.
1	Use of real world problems	Teacher uses practical or real world problems.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC15** ***Instruction level responsive to student needs***		
Code	Response	Description or item option
0	None identified, or current idea not identified as instruction responsive to student needs	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as instruction responsive to student needs.
1	Instruction responsive to student needs	Instruction responsive to student needs including student knowledge and/or abilities.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC16** ***Use of technology***		
Code	Response	Description or item option
0	None identified, or current idea not identified as use of technology	Lesson does not exemplify current ideas ('No' on TQ38), or current idea not identified as use of technology.
1	Use of technology	Instruction includes use of computers, calculators, or other technology.
Blank	Missing, not interpretable, or not applicable	

Please describe one part of the videotaped lesson that you feel exemplifies current ideas about the teaching and learning of mathematics. **TQ39AC17** ***Other current idea***		
Code	Response	Description or item option
0	None identified, or other current idea identified	Lesson does not exemplify current ideas ('No' on TQ38), or other current idea identified.
1	Other current idea	Lesson exemplifies other current idea.
Blank	Missing, not interpretable, or not applicable	

TQ39B Please describe why you feel this exemplifies current ideas about the teaching and learning of mathematics.		
Code	Response	Description or item option
0	Lesson does not exemplify current ideas	'No' on TQ 38; teacher did not feel lesson exemplified current ideas about teaching and learning
1	Informal communication	Teacher read this is better, other professional told teacher this worked better – no indication of personal experience, e.g., "current idea in the teaching of math", "current trends".
2	Confidence	
3	External guidelines or requirements	State or national mathematics standards; Department, school, principal, etc. expectations of method – no indication of teachers' personal ideas
4	Promotes groups work skills	Current practice promotes opportunities for students to learn how to work productively or solve problems as a group.
5	Builds independence	The current practice enables students to work on their own, e.g., "students can work at own pace," "it puts the problem in the hands of the student".
6	Incorporates how children learn	Practice is employed because it reflects how the teacher believes students learn, e.g., "students learn better by independent thinking," "better retention".
7	Develops thinking skills	Teacher indicates that current practice promotes mathematical thinking, e.g., "promotes thinking skills," "gets students to do self-assessment".
8	Motivates students; increases student interest	Current practice is used because it is what the teacher believes students will or do find most interesting, e.g., "it grabs their attention."
9	Student preparation for future	Help prepare student for future, e.g., next grade level requirements, future job requirements.
10	Teach critical thinking or problem solving skills	
11	Real world applications	Instruction incorporates real world applications
12	Teacher experience	
13	Other	Includes helping teacher assess student abilities; useful; improves mathematics study habits.
14	No reason given	Teacher identified current idea in TQ39, but did not provide a reason.
Blank	Missing, not interpretable, or not applicable	

TQ40 As part of professional development activities, how often in the past year has a teacher colleague observed you teaching an entire mathematics lesson?		
Code	Response	Description or item option
0	Never	A
1	Once or twice	B
2	Every other month	C
3	Once a month or more	D
Blank	Missing, not interpretable, or not applicable	

TQ40RC As part of professional development activities, how often in the past year has a teacher colleague observed you teaching an entire mathematics lesson?		
Code	Response	Description or item option
0	Never	A
1	One or more times	B,C,D
Blank	Missing, not interpretable, or not applicable	

TQ41 As part of professional development activities, how often in the past year have you observed a teacher colleague teaching an entire mathematics lesson?		
Code	Response	Description or item option
0	Never	A
1	Once or twice	B
2	Every other month	C
3	Once a month or more	D
Blank	Missing, not interpretable, or not applicable	

TQ41RC As part of professional development activities, how often in the past year have you observed a teacher colleague teaching an entire mathematics lesson?		
Code	Response	Description or item option
0	Never	A
1	One or more times	B,C,D
Blank	Missing, not interpretable, or not applicable	

TQ42 What was the highest level of formal education you have completed? ***(Codes for U.S. version only)***			
Code TQ42RC4	Code TQ42RC4B	Response	Description or item option
1	2	Teacher training without completing high school	A
2	2	High school	B
2	2	High school with one or two years of teacher training	C
2	2	High school with 3 or 4 years of teacher training	D
3	3	BA or equivalent with no teacher training	E
3	3	BA or equivalent with teacher training	F
4	4	Masters or Doctoral degree with no teacher training	G
4	4	Masters or Doctoral degree with teacher training	H
Blank	Blank	Missing, not interpretable, or not applicable	

TQ42 What was the highest level of formal education you have completed? ***(Codes for Australia only)***			
Code TQ42RC4	Code TQ42RC4B	Response	Description or item option
1	2	Teacher training without completing secondary school	A
2	3	Secondary school	B
2	3	High school with one or two years of teacher training	C
2	3	High school with 3 or 4 years of teacher training	D
3	4	BA or equivalent with no teacher training	E
3	4	BA or equivalent with teacher training	F
4	4	Masters or Doctoral degree with no teacher training	G
4	4	Masters or Doctoral degree with teacher training	H
Blank	Blank	Missing, not interpretable, or not applicable	

TQ42 What was the highest level of formal education you have completed? ***(Codes for Czech Republic only)***			
Code TQ42RC4	Code TQ42RC4B	Response	Description or item option
2	2	High school	A
3	2	BA or equivalent with no teacher training	B
3	3	BA or equivalent with teacher training	C
4	4	Masters or Doctoral degree with no teacher training	D
4	4	Masters or Doctoral degree with teacher training	E
Blank	Blank	Missing, not interpretable, or not applicable	

TQ42 What was the highest level of formal education you have completed? ***(Codes for Hong Kong only)***			
Code TQ42RC4	Code TQ42RC4B	Response	Description or item option
1	2	Teacher training without completing high school	A
2	2	High school	B
2	2	High school with one or two years of teacher training	C
2	2	High school with 3 or 4 years of teacher training	D
2	2	Matriculation	E ***Additional option in HK version only!***
2	2	Matriculation with 1 or 2 years of teacher training	F ***Additional option in HK version only!***
2	2	Matriculation with 3 or 4 years of teacher training	G ***Additional option in HK version only!***
3	3	BA or equivalent with no teacher training	H
3	3	BA or equivalent with teacher training	I
4	4	Masters or Doctoral degree with no teacher training	J
4	4	Masters or Doctoral degree with teacher training	K
Blank	Blank	Missing, not interpretable, or not applicable	

TQ42 What was the highest level of formal education you have completed? *(Codes for Netherlands only)*			
Code TQ42RC4	Code TQ42RC4B	Response	Description or item option
1	2	Teacher training without completing high school	A
2	2	High school	B
2	2	High school with one or two years of teacher training	C
2	2	High school with 3 or 4 years of teacher training	D
3	3	BA or equivalent without teacher training	E
3	3	BA or equivalent with teacher training	Teacher marked option 'D' plus teacher reported at least two years of teaching experience (see TQ48 and TQ49)
4	4	Masters or Doctoral degree with no teacher training	F
4	4	Masters or Doctoral degree with teacher training	G
Blank	Blank	Not interpretable response	

TQ42 What was the highest level of formal education you have completed? *(Codes for Switzerland–German language area only)*			
Code TQ42RC4	Code TQ42RC4B	Response	Description or item option
1	2	Lehrerseminar 4-6, Jahr	A
2	2	Matura mit 1-2 Jahren Lehrerausbildung	B
3	3	Matura mit 2-3 Jahren Studium zum Sekundarlehrer	C
4	4	Lizentiat (Studium von mindestens 5 Jahren)	D
4	4	Lizentiat mit Lehrdiplom (z.B, Hoheres Lehramt)	E
4	4	Doktorat ohne Lehrdiplom	F
4	4	Doktorat mit zusatzlichem Lehrdiplom	G
4	4	Habilitierter Professor	H,I
Blank	Blank	Missing, not interpretable, or not applicable	

TQ42 What was the highest level of formal education you have completed? *(Codes for Switzerland–Italian language area only)*			
Code TQ42RC4	Code TQ42RC4B	Response	Description or item option
2	2	Scuola magistrale con abilitazione all'insegnamento medio	A
3	3	Mezza licenza universitaria	B
4	4	Licenza universitaria	C
4	4	Licenza universitaria con abilitazione	D
4	4	Dottorato	E
4	4	Dottorato con abilitazione	F
Blank	Blank	Missing, not interpretable, or not applicable	

TQ42 What was the highest level of formal education you have completed? *(Codes for Switzerland–French language only)*			
Code TQ42RC4	Code TQ42RC4B	Response	Description or item option
1	2	Formation pedagogique sans baccalaureat	A
2	2	Le baccalaureat	B
2	2	Le baccalaureat, plus 1 ou 2 ans de formation pedagogique	C
3	3	Le baccalaureat, plus 3 ou 4 ans de formation pedagogique	D
4	4	Diplome universitaire ou equivalent sans formation pedagogique	E
4	4	Diplome universitaire ou equivalent avec formation pedagogique	F
4	4	Diplome d'etudes superieures sans formation pedagogique	G
4	4	Diplome d'etudes superieures avec formation pedagogique	H
Blank	Blank	Missing, not interpretable, or not applicable	

TQ42HS What was the highest level of formal education you have completed?		
Code	Response	Description or item option
0	College or university degree	TQ42RC4 codes ‘3’ or ‘4’
1	High school diploma or less, with or without teacher training	TQ42RC4 codes ‘1’ or ‘2’
Blank	Missing, not interpretable, or not applicable	

TQ42BABS What was the highest level of formal education you have completed?		
Code	Response	Description or item option
1	Less than high school, high school diploma, or graduate degree, with or without teacher training	TQ42RC4 codes ‘1’, ‘2’, or ‘4’
1	College or university degree, with or without teacher training	TQ42RC4 code ‘3’
Blank	Missing, not interpretable, or not applicable	

TQ42HS What was the highest level of formal education you have completed?		
Code	Response	Description or item option
0	College or university degree or less, with or without teacher training	TQ42RC4 codes ‘1’, ‘2’, or ‘3’
1	Graduate degree, with or without teacher training	TQ42RC4 code ‘4’
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43MATH – Mathematics**		
Code	Response	Description or item option
0	Not certified in mathematics	
1	Certified below Grade 8	Certification includes Grades K through 7
2	Certified including Grade 8	Certification includes Grade 8, e.g., Grades K-8, K-9, K-12, 7 – 8, 7 – 9, or 7 - 10
3	Certified above Grade 8	Certification includes grades above Grade 8
4	Certified but grade unspecified	
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43MED - Mathematics Education**		
Code	Response	Description or item option
0	Not certified in mathematics education	
1	Certified below Grade 8	Certification includes Grades K through 7
2	Certified including Grade 8	Certification includes Grade 8, e.g., Grades K-8, K-9, K-12, 7 – 8, 7 – 9, or 7 - 10
3	Certified above Grade 8	Certification includes grades above Grade 8
4	Certified but grade unspecified	
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43SCI – Science or Science Education**		
Code	Response	Description or item option
0	Not certified in science or science education	
1	Certified below Grade 8	Certification includes Grades K through 7
2	Certified including Grade 8	Certification includes Grade 8, e.g., Grades K-8, K-9, K-12, 7 – 8, 7 – 9, or 7 - 10
3	Certified above Grade 8	Certification includes grades above Grade 8
4	Certified but grade unspecified	
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43EDU - Education**		
Code	Response	Description or item option
0	Not certified in education	
1	Certified below Grade 8	Certification includes Grades K through 7
2	Certified including Grade 8	Certification includes Grade 8, e.g., Grades K-8, K-9, K-12, 7 – 8, 7 – 9, or 7 - 10
3	Certified above Grade 8	Certification includes grades above Grade 8
4	Certified but grade unspecified	
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43OTHR - Other area**		
Code	Response	Description or item option
0	Not certified in other area	
1	Certified below Grade 8	Certification includes Grades K through 7
2	Certified including Grade 8	Certification includes Grade 8, e.g., Grades K-8, K-9, K-12, 7 – 8, 7 – 9, or 7 - 10
3	Certified above Grade 8	Certification includes grades above Grade 8
4	Certified but grade unspecified	
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43MARC – Mathematics – Recode 1**		
Code	Response	Description or item option
0	Not certified in Grade 8 mathematics	Not certified in mathematics
1	Certified excluding Grade 8	Certification excludes Grade 8 mathematics
2	Certified including Grade 8	Certification includes Grade 8 mathematics
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43MERC - Mathematics Education – Recode 1**		
Code	Response	Description or item option
0	Not certified in Grade 8 mathematics education	Not certified in mathematics education
1	Certified excluding Grade 8	Certification excludes Grade 8 mathematics education
2	Certified including Grade 8	Certification includes Grade 8 mathematics education
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43MAME – Mathematics or Mathematics Education – Recode 1**		
Code	Response	Description or item option
0	Not certified in Grade 8 mathematics or mathematics education	Not certified in mathematics or mathematics education
1	Certified excluding Grade 8	Certification excludes Grade 8 mathematics or mathematics education
2	Certified including Grade 8	Certification includes Grade 8 mathematics or mathematics education
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43SCRC – Science or Science Education – Recode 1**		
Code	Response	Description or item option
0	Not certified in Grade 8 science or science education	Not certified in science or science education
1	Certified excluding Grade 8	Certification excludes Grade 8 science or science education
2	Certified including Grade 8	Certification includes Grade 8 science or science education
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43EDRC - Education – Recode 1**		
Code	Response	Description or item option
0	Not certified in Grade 8 education	Not certified in education
1	Certified excluding Grade 8	Certification excludes Grade 8 education
2	Certified including Grade 8	Certification includes Grade 8 education
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43OTRC - Other area – Recode 1**		
Code	Response	Description or item option
0	Not certified in Grade 8 other area	Not certified in other area
1	Certified excluding Grade 8	Certification excludes Grade 8 other area
2	Certified including Grade 8	Certification includes Grade 8 other area
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43MRC2 – Mathematics or Mathematics Education – Recode 2**		
Code	Response	Description or item option
1	Certified in mathematics or mathematics education excluding Grade 8	Certified in mathematics or mathematics education for grades other than Grade 8 or grade unspecified
2	Certified including Grade 8	Certification includes Grades 8
Blank	Missing, not interpretable, or not applicable	Not certified in mathematics or mathematics education, missing, not interpretable, or not applicable

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43SRC2 – Science or Science Education– Recode 2**		
Code	Response	Description or item option
1	Certified in science or science education excluding Grade 8	Certified in science or science education for grades other than Grade 8 or grade unspecified
2	Certified including Grade 8	Certification includes Grades 8
Blank	Missing, not interpretable, or not applicable	Not certified in science or science education, missing, not interpretable, or not applicable

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43ERC2 - Education– Recode 2**		
Code	Response	Description or item option
1	Certified in education excluding Grade 8	Certified in education for grades other than Grade 8 or grade unspecified
2	Certified including Grade 8	Certification includes Grades 8
Blank	Missing, not interpretable, or not applicable	Not certified in education, missing, not interpretable, or not applicable

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43ORC2 - Other area– Recode 2**		
Code	Response	Description or item option
1	Certified in other area excluding Grade 8	Certified in other area for grades other than Grade 8 or grade unspecified
2	Certified including Grade 8	Certification includes Grades 8
Blank	Missing, not interpretable, or not applicable	Not certified in other area, missing, not interpretable, or not applicable

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43CERT – Certified to teach in at least one subject area**		
Code	Response	Description or item option
0	No subject area identified	
1	Certified to teach in at least one subject area	
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43M8 – Mathematics or Mathematics Education – Recode 3**		
Code	Response	Description or item option
0	Not certified in Grade 8 mathematics or mathematics education	Not certified in mathematics or mathematics education, or certified in mathematics or mathematics education excluding Grade 8
1	Certified including Grade 8	Certification includes Grades 8
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43MNO8 – Mathematics or Mathematics Education – Recode 3**		
Code	Response	Description or item option
0	Not certified in mathematics or mathematics education for grades other than Grade 8	Not certified in mathematics or mathematics education, or certified in mathematics or mathematics education Grade 8
1	Certified in mathematics or mathematics education excluding Grade 8	Certified in mathematics or mathematics education, or certified in mathematics or mathematics education for grades other than Grade 8
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43S8 – Science or Science Education– Recode 3**		
Code	Response	Description or item option
0	Not certified in Grade 8 science or science education	Not certified in science or science education, or certified in science or science education excluding Grade 8
1	Certified including Grade 8	Certification includes Grades 8
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43SNO8 – Science or Science Education– Recode 3**		
Code	Response	Description or item option
0	Not certified in science or science education for grades other than Grade 8	Not certified in science or science education, or certified in science or science education Grade 8
1	Certified in science or science education excluding Grade 8	Certified in science or science education, or certified in science or science education for grades other than Grade 8
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? ***(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)*** **TQ43E8 - Education– Recode 3**		
Code	Response	Description or item option
0	Not certified in Grade 8 education	Not certified in education, or certified in education excluding Grade 8
1	Certified including Grade 8	Certification includes Grades 8
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? *(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)* **TQ43ENO8 –Education– Recode 3**		
Code	Response	Description or item option
0	Not certified in education for grades other than Grade 8	Not certified in education, or certified in education Grade 8
1	Certified in education excluding Grade 8	Certified in education, or certified in education for grades other than Grade 8
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? *(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)* **TQ43O8 - Other area– Recode 3**		
Code	Response	Description or item option
0	Not certified in Grade 8 other area	Not certified in other area, or certified in other area excluding Grade 8
1	Certified including Grade 8	Certification includes Grades 8
Blank	Missing, not interpretable, or not applicable	

In what subject are you certified to teach? In what grade level are you certified to teach? *(Australia, Czech Republic, Hong Kong, Netherlands, and US versions)* **TQ43ONO8 –Other area – Recode 3**		
Code	Response	Description or item option
0	Not certified in other area for grades other than Grade 8	Not certified in other area, or certified in other area Grade 8
1	Certified in other area excluding Grade 8	Certified in other area, or certified in other area for grades other than Grade 8
Blank	Missing, not interpretable, or not applicable	

TQ44A What was your undergraduate major? Mathematics *(Australia, Czech Republic, Hong Kong, Netherlands, US versions)* What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	No undergraduate courses taken in mathematics	
1	Mathematics undergraduate major	Mathematics or a specific field of mathematics
Blank	Missing, not interpretable, or not applicable	

TQ44B What was your undergraduate major? Mathematics Education
(Australia, Czech Republic, Hong Kong, Netherlands, US versions)
What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***

Code	Response	Description or item option
0	No undergraduate courses taken in mathematics education	
1	Mathematics education undergraduate major	Education degree specific to mathematics
Blank	Missing, not interpretable, or not applicable	

TQ44C What was your undergraduate major? Science/Science Education
(Australia, Czech Republic, Hong Kong, Netherlands, US versions)
What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***

Code	Response	Description or item option
0	No undergraduate courses taken in science or science education	
1	Science or science education undergraduate major	Science or a specific field of science or applied science, e.g., biology, physics, engineering, environmental, or education degree specific to science.
Blank	Missing, not interpretable, or not applicable	

TQ44D What was your undergraduate major? Education
(Australia, Czech Republic, Hong Kong, Netherlands, US versions)
What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***

Code	Response	Description or item option
0	No undergraduate courses taken in education	
1	Education undergraduate major	Grade level education, e.g., elementary education, education, pedagogy.
Blank	Missing, not interpretable, or not applicable	

TQ44E What was your undergraduate major? Other ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	No undergraduate courses taken in other discipline	
1	Other undergraduate major	Undergraduate major in field other than mathematics, mathematics education, science or science education, or education.
Blank	Missing, not interpretable, or not applicable	

TQ45A What was your undergraduate minor? Mathematics ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** ***HEG: Check SW TQ*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	No undergraduate courses taken in mathematics	
1	Mathematics undergraduate minor	Mathematics or a specific field of mathematics
Blank	Missing, not interpretable, or not applicable	

TQ45B What was your undergraduate minor? Mathematics Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)***		
Code	Response	Description or item option
0	No undergraduate courses taken in mathematics education	
1	Mathematics education undergraduate minor	Education degree specific to mathematics
Blank	Missing, not interpretable, or not applicable	

TQ45C What was your undergraduate minor? Science/Science Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)***		
Code	Response	Description or item option
0	No undergraduate courses taken in science or science education	
1	Science or science education undergraduate minor	Science or a specific field of science or applied science, e.g., biology, physics, engineering, environmental, or education degree specific to science.
Blank	Missing, not interpretable, or not applicable	

TQ45D What was your undergraduate minor? Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)***		
Code	Response	Description or item option
0	No undergraduate courses taken in education	
1	Education undergraduate minor	Grade level education, e.g., elementary education, education, pedagogy.
Blank	Missing, not interpretable, or not applicable	

TQ45E What was your undergraduate minor? Other area ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)***		
Code	Response	Description or item option
0	No undergraduate courses taken in other discipline	
1	Other undergraduate minor	Undergraduate minor in field other than mathematics, mathematics education, science or science education, or education.
Blank	Missing, not interpretable, or not applicable	

TQ46A What was your major field of study in graduate school? Mathematics ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	No graduate courses taken in mathematics	
1	Mathematics graduate major	Mathematics or a specific field of mathematics
Blank	Missing, not interpretable, or not applicable	

TQ46B What was your graduate major? Mathematics Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	No graduate courses taken in mathematics education	
1	Mathematics education graduate major	Education degree specific to mathematics
Blank	Missing, not interpretable, or not applicable	

TQ46C What was your graduate major? Science/Science Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	No graduate courses taken in science or science education	
1	Science or science education graduate major	Science or a specific field of science or applied science, e.g., biology, physics, engineering, environmental, or education degree specific to science.
Blank	Missing, not interpretable, or not applicable	

TQ46D What was your graduate major? Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	No graduate courses taken in education	
1	Education graduate major	Grade level education, e.g., elementary education, education, pedagogy.
Blank	Missing, not interpretable, or not applicable	

TQ46E What was your graduate major? Other area ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	No graduate courses taken in other discipline	
1	Other graduate major	Graduate major in field other than mathematics, mathematics education, science or science education, or education.
Blank	Missing, not interpretable, or not applicable	

TQ47A What was your graduate minor? Mathematics ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** ***HEG: Check SW TQ*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	No graduate courses taken in mathematics	
1	Mathematics graduate minor	Mathematics or a specific field of mathematics
Blank	Missing, not interpretable, or not applicable	

TQ47B What was your graduate minor? Mathematics Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)***		
Code	Response	Description or item option
0	No graduate courses taken in mathematics education	
1	Mathematics education graduate minor	Education degree specific to mathematics
Blank	Missing, not interpretable, or not applicable	

TQ47C What was your graduate minor? Science/Science Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)***		
Code	Response	Description or item option
0	No graduate courses taken in science or science education	
1	Science or science education graduate minor	Science or a specific field of science or applied science, e.g., biology, physics, engineering, environmental, or education degree specific to science.
Blank	Missing, not interpretable, or not applicable	

TQ47D What was your graduate minor? Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)***		
Code	Response	Description or item option
0	No graduate courses taken in education	
1	Education graduate minor	Grade level education, e.g., elementary education, education, pedagogy.
Blank	Missing, not interpretable, or not applicable	

TQ47E What was your graduate minor? Other area ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)***		
Code	Response	Description or item option
0	No graduate courses taken in other discipline	
1	Other graduate minor	Graduate minor in field other than mathematics, mathematics education, science or science education, or education.
Blank	Missing, not interpretable, or not applicable	

MAJORMTH Main area of study - Mathematics ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	Area other than mathematics	Area other than mathematics or no area identified
1	Mathematics	Main area of study in mathematics or a specific field of mathematics

MAJORMED Main area of study – Mathematics Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	Area other than mathematics education	Area other than mathematics education or no area identified
1	Mathematics education	Main area of study is mathematics education degree specific to mathematics

MAJORSCI Main area of study – Science or Science Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	Area other than science or science education	Area other than science or science education or no area identified
1	Science or science education	Main area of study is science or science education

MAJOREDU Main area of study - Education ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	Area other than education	Area other than education or no area identified
1	Education	Main area of study in education or a specific field of mathematics, including courses taken or certification

MAJOROTH Main area of study – Other area ***(Australia, Czech Republic, Hong Kong, Netherlands, US versions)*** What was your course of study in your main discipline - Less than three years of study? ***(Swiss version)***		
Code	Response	Description or item option
0	Mathematics, or mathematics education, science or science education, education, or no other area described by teacher	
1	Other area	Main area of study in mathematics or a specific field of mathematics, including courses taken or certification

TQ48 Counting this school year, how many years have you been teaching? ***(Code number of years)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ49 Counting this school year, how many years have you been teaching mathematics? ***(Code number of years)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ50 During the last two years, how many college or university courses have you taken in mathematics or mathematics education? ***(Czech Republic, Hong Kong SAR, Netherlands, U.S. versions)*** During the last two years, how many university courses have you taken in mathematics or mathematics education? ***(Australia version)*** During the last two years, how many Education Center courses have you taken in mathematics or mathematics education? ***(Japan version)***		
Code	Response	Description or item option
0	None	A
1	One course	B
2	Two courses	C
3	Three courses	D
4	Four or more courses	E
Blank	Missing, not interpretable, or not applicable	

TQ50RC During the last two years, how many college or university courses have you taken in mathematics or mathematics education? ***(Czech Republic, Hong Kong SAR, Netherlands, U.S. versions)***
During the last two years, how many university courses have you taken in mathematics or mathematics education? ***(Australia version)***
During the last two years, how many Education Center courses have you taken in mathematics or mathematics education? ***(Japan version)***

Code	Response	Description or item option
0	None	A
1	One or more courses	B,C,D,E
Blank	Missing, not interpretable, or not applicable	

During the last two years, have you participated in professional development activities or taken courses in any of the following?
TQ51A Use of technology, such as computers

Code	Response	Description or item option
0	No	
1	Yes	A
Blank	Missing, not interpretable, or not applicable	

During the last two years, have you participated in professional development activities or taken courses in any of the following?
TQ51B Mathematics instructional techniques

Code	Response	Description or item option
0	No	
1	Yes	B
Blank	Missing, not interpretable, or not applicable	

During the last two years, have you participated in professional development activities or taken courses in any of the following?
TQ51C Cooperative group instruction

Code	Response	Description or item option
0	No	
1	Yes	C
Blank	Missing, not interpretable, or not applicable	

During the last two years, have you participated in professional development activities or taken courses in any of the following? **TQ51D** Interdisciplinary instruction		
Code	Response	Description or item option
0	No	
1	Yes	D
Blank	Missing, not interpretable, or not applicable	

During the last two years, have you participated in professional development activities or taken courses in any of the following? **TQ51E** Teaching higher-order thinking skills		
Code	Response	Description or item option
0	No	
1	Yes	E
Blank	Missing, not interpretable, or not applicable	

During the last two years, have you participated in professional development activities or taken courses in any of the following? **TQ51F** Teaching students from different cultural backgrounds		
Code	Response	Description or item option
0	No	
1	Yes	F
Blank	Missing, not interpretable, or not applicable	

During the last two years, have you participated in professional development activities or taken courses in any of the following? **TQ51G** Teaching limited English proficient students		
Code	Response	Description or item option
0	No	
1	Yes	G
Blank	Missing, not interpretable, or not applicable	

During the last two years, have you participated in professional development activities or taken courses in any of the following? **TQ51H** Teaching students with special needs		
Code	Response	Description or item option
0	No	
1	Yes	H
Blank	Missing, not interpretable, or not applicable	

During the last two years, have you participated in professional development activities or taken courses in any of the following? **TQ51I** Standards-based teaching ***(Hong Kong SAR, Japan, Netherlands, U.S. versions)*** Outcomes based teaching ***(Australia version)*** ***(Code 'Blank' for Czech Republic and Switzerland; item not applicable)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	*Code 'Blank' for Czech Republic and Switzerland; item not applicable.*

During the last two years, have you participated in professional development activities or taken courses in any of the following? **TQ51J** Classroom-management and organization		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

During the last two years, have you participated in professional development activities or taken courses in any of the following? **TQ51K** Other professional issues		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ51L Number of professional development activities ***(Code number of activities)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ52A1 How many hours a week do you teach mathematics? ***(Code number of hours per week)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ52B1 How many hours a week do you teach classes other than mathematics? ***(Code number of hours per week)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ52C How many hours a week do you meet with other teachers to work on curriculum and planning lessons? ***(Code number of hours per week)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ52D How many hours a week do you do work at school related to teaching mathematics (e.g. lesson planning, grading papers, etc.)? ***(Code number of hours per week)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ52E How many hours a week do you do work at home related to teaching mathematics (e.g. lesson planning, grading papers, etc.)? ***(Code number of hours per week)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ52F How many hours a week do you spend at home or at school doing other school related activities? ***(Code number of hours per week)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ52A1MD How many hours a week do you teach mathematics? ***(Code number of hours per week; substitute '0' for missing data)***		
Code	Response	Description or item option
0	No hours, or substitute '0' hours for missing data	
Blank	Not interpretable, or not applicable	

TQ52B1MD How many hours a week do you teach classes other than mathematics? ***(Code number of hours per week; substitute '0' for missing data)***		
Code	Response	Description or item option
0	No hours, or substitute '0' hours for missing data	
Blank	Not interpretable, or not applicable	

TQ52CMD How many hours a week do you meet with other teachers to work on curriculum and planning lessons? ***(Code number of hours per week; substitute '0' for missing data)***		
Code	Response	Description or item option
0	No hours, or substitute '0' hours for missing data	
Blank	Not interpretable, or not applicable	

TQ52DMD How many hours a week do you do work at school related to teaching mathematics (e.g. lesson planning, grading papers, etc.)? ***(Code number of hours per week; substitute '0' for missing data)***		
Code	Response	Description or item option
0	No hours, or substitute '0' hours for missing data	
Blank	Not interpretable, or not applicable	

TQ52EMD How many hours a week do you do work at home related to teaching mathematics (e.g. lesson planning, grading papers, etc.)? ***(Code number of hours per week; substitute '0' for missing data)***		
Code	Response	Description or item option
0	No hours, or substitute '0' hours for missing data	
Blank	Not interpretable, or not applicable	

TQ52FMD How many hours a week do you spend at home or at school doing other school related activities? ***(Code number of hours per week; substitute '0' for missing data)***		
Code	Response	Description or item option
0	No hours, or substitute '0' hours for missing data	
Blank	Not interpretable, or not applicable	

TQ52TOT Total hours a week teacher spends on activities (Sum of TQ52A1MD through TQ52FMD) ***(Code total number of hours per week)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ53 List the grade levels taught in this school. ***(Codes for Australia, Czech Republic, Hong Kong SAR, Switzerland, and U.S.)***		
Code	Response	Description or item option
1	4-9 or intervals included	Entire interval must be within this interval; includes 4-8, 5-8, 6-8, 6 to 9, 7-8, 7-9, 8-9 (7-10 is not included in this code).
2	6 -13 or intervals included	For Australia, code includes 5-12, 8-12. For the Czech Republic, code includes 6-12, 7-10, 7-12, 7-13. In Hong Kong SAR, Secondary 1-Secondary 7 and Form 1-Form 7 are equivalent to Grades 7-13, and Secondary 1-Secondary 5 or Form 1-Form 5 are equivalent to Grades 7 to 11.
3	K-9 or intervals included	Includes K-7, K-8, K-9, 1-8, and 1-9.
4	K-13 or intervals included	In the Czech Republic, code includes K-10, K-12, and K-13.
Blank	Missing, not interpretable, or not applicable	

TQ53 List the grade levels taught in this school. ***(Codes for Netherlands)***		
Code	Response	Description or item option
1	VWO	D
2	HAVO	C
3	MAVO	B
4	VBO	A
5	VWO/HAVO	C,D
6	MAVO/VBO	A,B
7	MAVO/HAVO	B,C
8	VBO/MAVO/HAVO	A,B,C
9	MAVO/HAVO/VWO	B,C,D
10	VBO/MAVO/HAVO/VWO	A,B,C,D
Blank	Missing, not interpretable, or not applicable	

TQ54A1 What type of school is this? a. Academic accelerated school (***AU, HK SAR, U.S. versions)*** a. State school ***(CZ version)*** a. Openbaar ***(NL version)*** a. Oberschule ***(SW-German version)*** a. Corso attitudinale ***(SW-Italian version)*** a. Public school - Cycle d'orientation ***(SW-French version)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A2 What type of school is this? b. Vocational school ***(AU, HK SAR, U.S. versions)*** b. State school with specialization **(CZ version)** b. Roman Catholic ***(NL version)*** b. Realschule ***(SW-German version)*** b.Corso di base ***(SW-Italian version)*** b.Public school - Ecole secondaire ***(SW-French version)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A3 What type of school is this? c. Magnet school ***(HK SAR and U.S. versions)*** c. School with a special program ***(AU version)*** c. Private school ***(CZ version)*** c. Protestant or Christian ***(NL version)*** c. Sekundarschule ***(SW-German version)*** c. Public school ***(SW-French version)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A4 What type of school is this? d. Charter school ***(U.S. version)*** d. Private school with specialization ***(CZ version)*** d. Experimental secondary school ***(HK SAR version)*** d. General school ***(NL version)*** d, Kantonsschule oder Untergymnasium (Progymnasium) ***(SW-German version)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A5 What type of school is this? e. Partnership with a university (***AU, HK SAR, U.S. versions)*** e. Religious or Christian school ***(CZ version)*** e. Other ***(SW-German version)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A6 What type of school is this? f.. Laboratory school ***(Codes for U.S. version)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A7 What type of school is this? g. School within a school ***(Codes for AU and U.S. versions)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A8 What type of school is this? h. Religious or sectarian school ***(Codes for AU, HK SAR, U.S. versions)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A9 What type of school is this? i. Private (non-religious) school ***(Codes for AU, HK SAR, U.S. versions)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A10 What type of school is this? j. Single sex school ***(Codes for AU, HK SAR, U.S. versions)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A11 What type of school is this? k. Other ***(Codes for AU, HK SAR, U.S. versions)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54A12 What type of school is this? l. Public school ***(Codes for AU, HK SAR, U.S. version only)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54B1 What type of school is this? Philosophy categories ***(Netherlands version)*** ***(Code Netherlands version)***		
Code	Response	Description or item option
1	Montessori-onderwijs	A
2	Vrije School	B
3	Dalton- onderwijs	C
4	Freinet - onderwijs	D
5	Other	E
Blank	Missing, not interpretable, or not applicable	Code 'Blank' for all countries except Netherlands!

TQ54B1 What type of school is this? a. Oberschule ***(Codes for Switzerland only)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54B2 What type of school is this? b. Realschule ***(Codes for Switzerland only)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54B3 What type of school is this? c. Sekundarschule ***(Codes for Switzerland only)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54B4 What type of school is this? d. Bezirksschule ***(Codes for Switzerland only)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54B5 What type of school is this? e. Kantonsschule oder Untergymnasium (Progymnasium) ***(Codes for Switzerland only)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ54B6 What type of school is this? f. Other ***(Codes for Switzerland only)***		
Code	Response	Description or item option
0	No	
1	Yes	
Blank	Missing, not interpretable, or not applicable	

TQ56 Approximately how many mathematics teachers are in this school this year? ***(Code number of teachers)***		
Code	Response	Description or item option
Blank	Missing, not interpretable, or not applicable	

TQ57A Attitudes about teaching. a. I have adequate materials and facilities to support my teaching of mathematics		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57B Attitudes about teaching. b. I actively pursue opportunities to learn how to improve my mathematics teaching		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57C Attitudes about teaching. c. I especially prefer teaching low-ability students.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57D Attitudes about teaching. d. My work as a mathematics teacher is appreciated by my teacher colleagues.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57E Attitudes about teaching. e. Girls in this school are not encouraged to develop a mathematics interest.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57F Attitudes about teaching. f. If I had to choose I would become a teacher again.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57G Attitudes about teaching. g. I have a strong mathematics background in the subject areas I teach.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57H Attitudes about teaching. h. I am often impressed with the quality of thinking my students can do.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57I Attitudes about teaching. I. I prefer to teach a class that has students of all different ability levels.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57J Attitudes about teaching. j. I am enthusiastic about teaching mathematics.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57K Attitudes about teaching. k. I do not like to watch TV programs about new developments in mathematics.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57L Attitudes about teaching. l. I enjoy students' questions about mathematics even when I do not know the answer.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57M Attitudes about teaching. m. My work as a mathematics teacher is appreciated by my students' parents.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57N Attitudes about teaching. n. I read journals and books about mathematics teaching.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57O Attitudes about teaching. o. I enjoy teaching students of this age level.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57P Attitudes about teaching. p. I do not pursue mathematics interests or issues in my personal life.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57Q Attitudes about teaching. q. I especially prefer teaching high-ability students.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57R Attitudes about teaching. r. Teaching mathematics is rewarding work.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57S Attitudes about teaching. s. The number of students in my class is not appropriate to support good mathematics teaching and learning.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57T Attitudes about teaching. t. I do not have adequate opportunities during the school day to collaborate with colleagues about mathematics.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57U Attitudes about teaching. u. I am proud of the quality of my teaching.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57V Attitudes about teaching. v. I enjoy working with colleagues about mathematics curriculum and teaching, even if it means after-school meetings.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57W Attitudes about teaching. w. Teaching mathematics is hard work.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57X Attitudes about teaching. x. I teach in an environment where I do not feel physically safe.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57Y Attitudes about teaching. y. I enjoy attending mathematics teacher conferences to learn about new ideas in mathematics teaching.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57Z Attitudes about teaching. z. My work as a mathematics teacher is appreciated by my students.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57AA Attitudes about teaching. aa. My work as a mathematics teacher is not appreciated by administrators.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57BB Attitudes about teaching. bb. I work hard to get girls involved in mathematics.		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	

TQ57CC Attitudes about teaching. bb. I work hard to get boys involved in mathematics. (Item included in Australia version only)		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for CZ, HK SAR, NL, SW, and U.S.***

TQ57DD Attitudes about teaching. dd. I think that I am an effective teacher, I am confidant that my students learn nearly all of what I teach. ***(Item included in Australia version only)***		
Code	Response	Description or item option
1	Strongly disagree	D
2	Somewhat disagree	C
3	Somewhat agree	B
4	Strongly agree	A
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for CZ, HK SAR, NL, SW, and U.S.***

TQ58 How knowledgeable are you about the National Council of Teachers of Mathematics (NCTM) Curriculum and Evaluation Standards for School Mathematics? ***(HK SAR and U.S. versions)*** How knowledgeable are you about your state's version of the Mathematics National Profiles for Australian Schools? ***(Australia version)*** ***(Item included in Australia HK SAR, and U.S. versions only)***		
Code	Response	Description or item option
1	I have little or no knowledge	D
2	Somewhat knowledgeable	C
3	Knowledgeable	B
4	Very knowledgeable	A
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for CZ, NL, and SW***

TQ59A What type of professional development activities have you participated in that have provided you with strategies for implementing the 1989 NCTM Curriculum and Evaluation Standards for School Mathematics? ***(U.S. version)*** In what type of professional development activities have you participated which have provided you with strategies for implementing about your state's version of the Mathematics National Profiles for Australian Schools? ***(Australia version)*** a. Local workshop ***(Item included in U.S. and Australia versions only)***		
Code	Response	Description or item option
0	No	
1	Yes	A
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for CZ, HK SAR, NL, and SW***

TQ59B
What type of professional development activities have you participated in that have provided you with strategies for implementing the 1989 NCTM Curriculum and Evaluation Standards for School Mathematics? ***(U.S. version)***
In what type of professional development activities have you participated which have provided you with strategies for implementing about your state's version of the Mathematics National Profiles for Australian Schools? ***(Australia version)***
b. Regional NCTM meeting
(Item included in U.S. and Australia versions only)

Code	Response	Description or item option
0	No	
1	Yes	B
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for CZ, HK SAR, NL, and SW***

TQ59C
What type of professional development activities have you participated in that have provided you with strategies for implementing the 1989 NCTM Curriculum and Evaluation Standards for School Mathematics? ***(U.S. version)***
In what type of professional development activities have you participated which have provided you with strategies for implementing about your state's version of the Mathematics National Profiles for Australian Schools? ***(Australia version)***
c. National NCTM meeting
(Item included in U.S. and Australia versions only)

Code	Response	Description or item option
0	No	
1	Yes	C
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for CZ, HK SAR, NL, and SW***

TQ59D
What type of professional development activities have you participated in that have provided you with strategies for implementing the 1989 NCTM Curriculum and Evaluation Standards for School Mathematics? ***(U.S. version)***
In what type of professional development activities have you participated which have provided you with strategies for implementing about your state's version of the Mathematics National Profiles for Australian Schools? ***(Australia version)***
d. Other
(Item included in U.S. and Australia versions only)

Code	Response	Description or item option
0	No	
1	Yes	D
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for CZ, HK SAR, NL, and SW***

TQ59E In what type of professional development activities have you participated which have provided you with strategies for implementing about your state's version of the Mathematics National Profiles for Australian Schools? ***(Australia version)*** d. None ***(Item included in Australia version only)***		
Code	Response	Description or item option
0	Not checked	
1	Checked – no participation in activities	E
Blank	Missing, not interpretable, or not applicable	***Code 'Blank' for CZ, HK SAR, NL, and SW***

CTYNOSW Country identification excluding Switzerland		
Code	Country name	Description or item option
10	Australia	
20	Czech Republic	
30	Hong Kong SAR	
40	Japan	
50	Netherlands	
70	United States	

CTYNOJP Country identification excluding Japan		
Code	Country name	Description or item option
10	Australia	
20	Czech Republic	
30	Hong Kong SAR	
50	Netherlands	
60	Switzerland	
70	United States	

CTYNONL Country identification excluding NL		
Code	Country name	Description or item option
10	Australia	
20	Czech Republic	
30	Hong Kong SAR	
40	Japan	
60	Switzerland	
70	United States	

CTAUSWUS Country identification		
Code	Country name	Description or item option
10	Australia	
60	Switzerland	
70	United States	

CTYAUUS Country identification		
Code	Country name	Description or item option
10	Australia	
70	United States	

CTNOAUJP Country identification excluding Switzerland		
Code	Country name	Description or item option
20	Czech Republic	
30	Hong Kong SAR	
50	Netherlands	
60	Switzerland	
70	United States	

CTNOJPNL Country identification		
Code	Country name	Description or item option
10	Australia	
20	Czech Republic	
30	Hong Kong SAR	
60	Switzerland	
70	United States	

CTNOCZJP Country identification		
Code	Country name	Description or item option
10	Australia	
30	Hong Kong SAR	
50	Netherlands	
60	Switzerland	
70	United States	

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Appendix H

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Appendix I

TIMSS 1999 Video Study Mathematics Video Coding Manual

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Third International Mathematics and Science Study

TIMSS 1999 Video Study

MATHEMATICS VIDEO CODING MANUAL

Important Note:

We decided not to make any changes to the coding manual to codes after their reliability had been established. However, as a result of ongoing quality control checks it became necessary to clarify some existing codes.

These additions or clarifications to existing codes have been placed in the coding manual at the relevant places. For easy identification they are marked by a box and contain the actual date of the addition. Within the box the changes are bolded.

INTRODUCTION: CODING SYSTEM OVERVIEW

Code Types

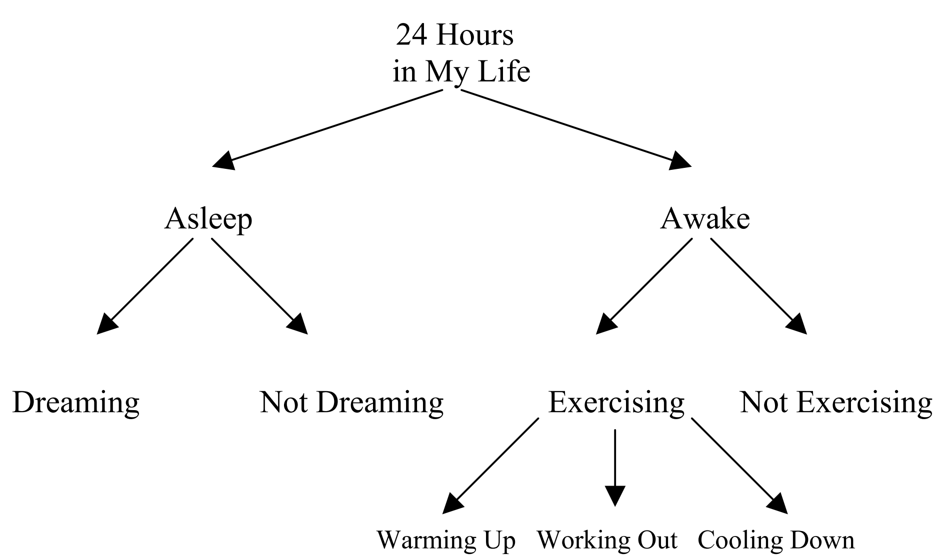
We use two types of codes: coverage and occurrence codes.

<u>Coverage codes</u> are used to code a lesson, or a defined portion of a lesson, in its entirety. All coverage codes have at least 2 mutually exclusive and exhaustive options. Only one of these options can be applied to any defined period of time. The option will always have an in-point and an out-point.

<u>Occurrence codes</u> are codes that are marked anytime they occur (i.e., their definition is met) within a lesson. An occurrence code may be found several times within one lesson, or it may never occur within a particular lesson. We want to know: 1) how many times the code occurred within a particular lesson, and 2) where the code occurred within a particular lesson.

Examples of Coverage Codes

If you wanted to code a 24-hour period of your life in its entirety, you could do so with coverage codes. At the broadest level, you might choose to code whether you were asleep or awake. These are mutually exclusive and exhaustive codes. You *have* to be *either* one or the other. You could subdivide the “asleep” and “awake” segments with other, mutually exclusive and exhaustive codes. See the following illustration:



Some Observations:

◆ It may have occurred to you that the distinction between "asleep" and "awake" isn't always clear. How do you code the period of time during which you doze off? How do you code the period of time spent between hitting the snooze button and being wide awake? In order to ensure that you (and other coders) code these instances consistently (or reliably), you would need to come up with rules for deciding what makes a case fall into one category versus another. These rules can be arbitrary. For instance, you may decide that when your eyes have been open for 10 consecutive seconds, you are awake. Your "awake" segment would start when your eyes opened at the beginning of the 10 seconds. Much of this manual will provide you with rules for making coding decisions.

◆ You may have also noticed that the hierarchy of coverage codes is heavily influenced by the topic that interests you. If you created the illustration above and showed it to someone who knew nothing about what you wanted to study, that person could deduce several things:

1. You feel that a 24-hour period is an important unit of analysis.

2. You feel that wakefulness is an important distinction; it differentiates, in some important way, the manner in which you spend your time. It might also mean that the period of time in which you're interested doesn't include time spent sleeping. Creating the "asleep-awake" distinction will help you to later focus on segments of wakefulness.

3. You're interested in exercising. You also see the time you spend exercising or not exercising as an important distinction.

Examples of Occurrence Codes

There may be things that happen in your day that cannot be coded with "coverage codes," but are interesting to capture nonetheless. They may be brief happenings – or occurrences. For instance, you might be interested in the moments that you wipe the sweat from your brow or reach for your water bottle. You might have particular hypotheses about when these events are likely to occur. (For example, you might expect these particular occurrences to be more frequent while "awake" than while "asleep" and more frequent during "working out" than during "warming up.") To code these occurrences, you would need to identify the event (e.g., "wipe brow" or WB), the numerical order of the event that day (e.g., WB#3), and the times at which the event started and stopped.

Chapter 1. PASS 1: BEGINNING & END OF LESSON + CLASSROOM INTERACTION

The first pass is designed to provide the coder with an overview of the lesson. The lesson features to be marked are at the most general level.

1.1 Time of the Lesson (LES)

1.1.1 Marking the Beginning of the Lesson

The code "time of lesson" is to be coded as an occurrence code. The in-point is the beginning of the lesson and the out-point is the end of the lesson.

The **beginning of lesson** is marked by the first "public talk" of the teacher that requires all students' attention, e.g. the teacher saying," OK, now we will begin …,"Good morning …,"Today we will study …", Please be quiet, so we can begin …", or "Take out your homework …". <u>At this point, a good student in class would recognize the lesson as beginning and would pay attention.</u>

"Public talk" is intended for the *entire class*. (The talk may or may not be related to mathematics.) This implies that all (or most) of the students should be in the classroom when the class begins.

Notes:
If materials belonging to the mathematics class are passed out more than one minute prior to any public statement by the teacher, then the lesson begins at the start of this activity.

If students start working independently without any public statement from the teacher, the lesson begins when the bell rings or, if there is no bell, when the majority of students are working.

If it seems obvious that the lesson began prior to the start of the video footage, check the student tape to find the exact time. If the exact time cannot be found on the student tape then mark the first in-time of the video footage as the beginning of the lesson.

Examples:

FT-CZ-021	00:16
M-HK-096	00:19
Z-FT-NL-0047	00:57

1.1.2 Marking the End of the Lesson

The **end of lesson** is marked by the last public talk of the teacher that requires all students' attention, e.g. "That's it for today …", "We'll take a break now …", "Have a good day …".
At this point a good student in class would recognize the lesson as ending.

"Public talk" is intended for the *entire class*. (The talk may or may not be related to mathematics.) This implies that all (or most) of the students should be in the classroom when the class ends.

Note:
If students are working independently and the teacher doesn't close the lesson with a public statement, the lesson ends when the bell rings or, if there is no bell, when the majority of students pack up their mathematics materials or leave the classroom.

Examples:

FT-CZ-020	45:10
M-HK-096	33:08
Z-FT-NL-0047	43:32

1.2 Patterns of Public/Private Classroom Interaction (CI)

Patterns of Public/Private Classroom Interaction (CI) is a coverage code. That is, all points in the lesson must be coded as one of the following five, mutually exclusive categories. Mark a change in public/private interaction regardless of any change in any other dimension. *(Note: The classroom talk needn't be math-relevant.)*

In general, there are three categories of Classroom Interaction (CI) patterns:
- Entirely Public Interaction (1.2.1)
- Mixed (Public and Private) Interaction (1.2.2)
- Entirely Private Interaction (1.2.3)

Within the "mixed" category, there are 3 types of interaction patterns:
- Public Information Provided by Teacher, *Optional* for Student Use (1.2.2.1)
- Public Information Provided by Student, *Optional* for Student Use (1.2.2.2)
- Mixed Private and Public Work, *Not Optional* (1.2.2.3)

Code a shift in CI patterns only if another pattern lasts for ***more than one minute.***

However at the opening and closing of a lesson there is no minimum time requirement. That is, at the beginning or end of a lesson there may be a CI pattern that lasts less than one minute. These segments should be coded without regard to their length.

Some General Tips: Sometimes you may not be sure whether a CI pattern really lasts for 1 full minute based solely on the time codes from the lesson transcript. In these close cases, it will be necessary to refer the video and take note of the exact in and out points of the segment.

Sometimes it is difficult to decide which of the public/private patterns should be coded. If this is the case, check first if a teacher's announcement can help to make a decision. If not, revert to the student tape for clarification.

1.2.1 Entirely Public Interaction

1.2.1.1 Type 1: Public Interaction (CI 1)

There is public dialog directed by the teacher or one or more students. Students' participation may, however, be minimal. Dialog may or may not be accompanied by written information. (When public written information is evident, it is usually provided by the teacher and is in the form of explanations on the chalkboard or overhead projector. When private written information is evident, it is usually in the form of students' notes.) The intent is that all students participate or listen (i.e., not optional). There may be *brief* periods (i.e., ***less than 1 minute***) of private work during this time, as when the teacher asks Ss to complete a small task. If the private work time lasts for ***more than one minute***, then code the private work time as CI 5 (Private Work) or CI 2 (Public Information Provided by Teacher, *Optional* for Student Use – to be described in 1.2.3.1). Otherwise, continue to code the segment as public.

Examples:

FT-CZ-021 00:16-01:35
FT-CZ-021 34:36-36:36
M-HK-029 3:03-4:22
M-US-001 8:03-9:49 (no public, written information (15 minute)
M-SW-065 25:16-27:34

1.2.2 Mixed (Public and Private) Interaction

1.2.2.1 Type 2: Public Information Provided by Teacher,* Optional *for Student Use (CI 2)

The teacher presents information publicly, in either verbal or written form. Students may choose whether to attend to it. If students choose not to attend, they instead work on an assignment privately. (That assignment may be the same as or different from the one presented publicly.)

Note:
The teacher must *clearly signal* that student attention is *optional*.

Examples:
M-NL-011 00:42, 01:10
Z-FT-NL-0049 38:50-40:05-40:37 (assistance to an individual, given on BB)
Z-FT-NL-0049 35:08-37:04 (verbal instructions @ 35:26, 36:45, 36:48)

1.2.2.2 Type 3: Public Information Provided by Student, **Optional** ***for Student Use (CI 3)***

A student presents information publicly in written form. There may be a verbal interaction between the student and the teacher about the written work (and there may even be input from the seated students). Other students may choose whether to attend to the written information. This pattern normally occurs when all students (both at the board and at their seats) are working on the same assignment and the teacher is assessing the understanding of the student at the board.

Note:

If a student is working *behind* the board and their work is not "publicly available" to the class, code as Type 5.

Examples:
M-CZ-007 8:29-9:11
FT-CZ-021 1:32-3:06

Addition/Clarification to the coding manual: 1.2.2.2 CI Pattern TYPE 3: Public Information Provided by Student, Optional for Student.

03/01/2000

A student or a small group of students presents information publicly, in written form. The seated students may choose whether to attend to the written information provided. **When the student(s) at the board is/are no longer actively presenting information in written form (i.e., when the students return to their seats), it is no longer CI3.**

CI3 can appear in (at least) two ways. (1) There may be verbal interaction between the student(s) at the board and the teacher about the written work and there may even be input from the seated students. **(2) Students might present written information in silence without the teacher commenting, as when the teacher asks some students to write their solutions on the board while other students continue to work on the assignment.**

Example of CI3 → CI5: M-HK-049 (CI3: 25:52 - 29:15; CI5: 29:15 - 31:11)

1.2.2.3 Type 4: Mixed Private and Public Work*, Not Optional *(CI 4)

The teacher divides the class into groups. Some students are assigned to work privately on problems, while the rest of the class works publicly with the teacher.

Note:
This pattern is rare.

1.2.3 Entirely Private Interaction

1.2.3.1 Type 5: Private Work (CI 5)

All students work at their seats. Students may discuss problems with one another. The teacher may assist individual students or small groups of students, either verbally or both verbally and in writing. The teacher may also speak publicly to the class. If the public talk lasts for ***more than one minute***, then code it as either CI 1 (Public Interaction Between the Teacher and Student(s)) or CI 2 (Public Information Provided by Teacher, *Optional* for Student Use). Otherwise, continue to code as private work.

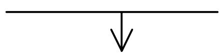
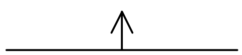
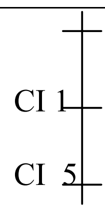
Examples:
M-US-002 28:33-34:15
M-US-001 00:17-00:45
M-NL-012 38:05 – 38:40 (public announcement during private work)
FT-SW-065 34:48-36:18

1.3 Pass 1 Coder Protocol

- Print the lesson transcript
- Watch the lesson to get a general feel
- Code the in- and out-points of the Lesson [LES]
- Code the Classroom Interaction [CI] patterns

1.4 Pass 1 Transcript Marking

- Draw all LINES in the first column (left of the time codes)
- Use the following symbols for marking pass 1
- Write in or circle the exact time of each shift in the text

	Draw a line with an arrow pointing down at the beginning of the lesson
	Draw a line with an arrow pointing up at the end of the lesson
	Draw a line during the time of the segment and indicate the type of Classroom Interaction next to the line. Draw a small line on the line to mark a shift in types. Also put a double slash // at the exact point in the text.

- The line in column one should have no gap from beginning to end, and all time marks should be at least one minute apart .
- The label uses for each segment must be either CI 1, CI 2, CI 3, CI 4, or CI 5
- The codes to be applied in Pass 1 are:

LES	Lesson	Length of the entire lesson
CI	Classroom Interaction	Public and private classroom interaction types 1 = Public 2 = Public by Teacher, Optional 3 = Public by Student, Optional 4 = Mix, Not Optional 5 = Private

1.5 How to print the lesson transcript

- Open the Lesson
- Select PRINT from the FILE menu
- Choose Transcript Report 1 in the REPORT NAME window.
- Highlight the unit's transcript (the lesson number) to be printed , and click PRINT
- Click OK in the *Laser writer 8 page set up*
- In the next window, under GENERAL ➔ select LAYOUT ➔ 2 pages per paper (select the setting with page 1 on the left and page 2 on the right)
- To staple the transcript, go back to the LAYOUT ➔ choose PRINTER SPECIFIC OPTIONS ➔ stapler➔ click PRINT

1.6 Where to find the Additional Materials for a lesson

(Additional materials include: textbook pages, worksheets, overheads used in the lesson, etc.)

36. Make sure you are connected to the Lesson Lab Drive (Chooser - Apple Share - Main Server - Lesson Lab Drive)
37. Select LLI Directory
38. Select Public Documents
39. Select Scanned Materials
40. Select Add_Mats
41. Select Math_AM
42. Double click on the lesson
43. Click OK on the screen saying the lesson is locked
44. Chose Acrobat Exchange to open the lesson

Chapter 2. PASS 2: CONTENT ACTIVITY CODES

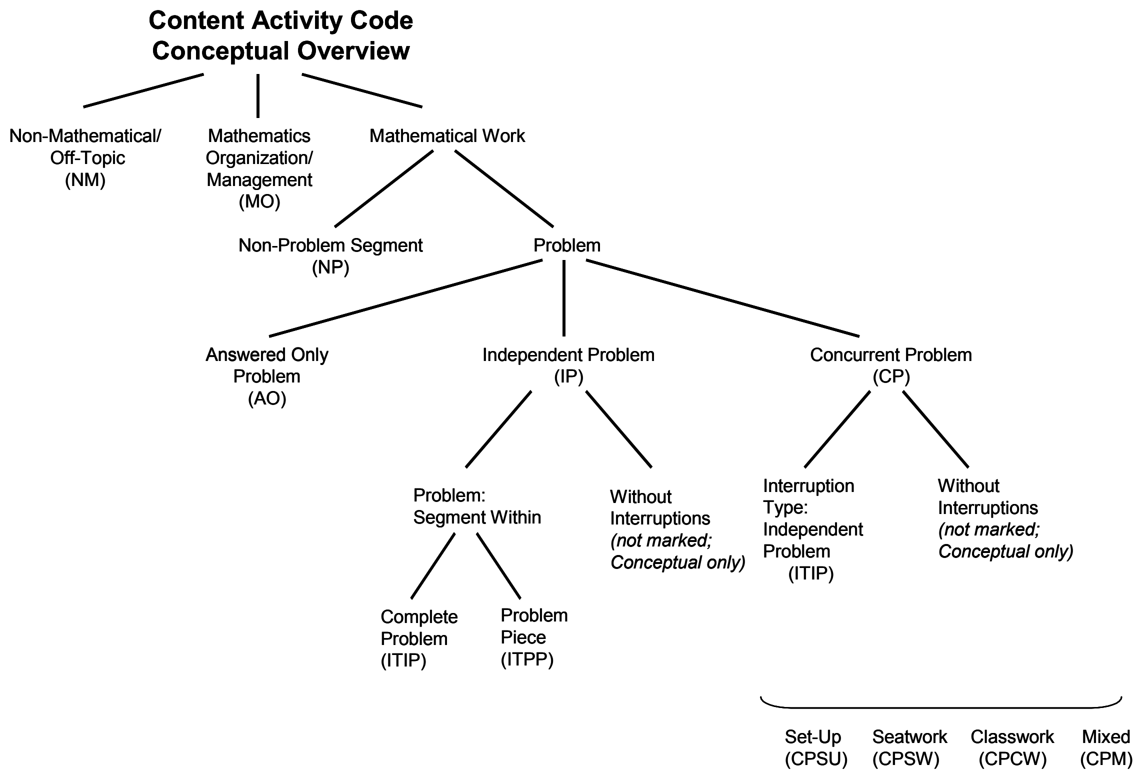
During the second pass we will code the Content Activity in the lesson. This coverage code will segment the lesson exhaustively.

The 13 content activity categories are:

Non-mathematical/Off Topic (NM)
Mathematics Organization/Management (MO)
Independent Problem (IP)
Answered Only Problem (AO)
Concurrent Problem Set-Up (CPSU)
Concurrent Problem Seat Work (CPSW)
Concurrent Problem Class Work (CPCW)
Concurrent Problem Mixed Activity (CPM)
Interruption Type: Independent Problem (ITIP)
Interruption Type: Problem Piece (ITPP)
Non-Problem (NP)
Break (BK)
Technical Problem (TP)

Everything you need to know about these categories you will find on the following pages.

This diagram displays the conceptual links between the content activity categories:



2.1 What Are Non-Mathematical/Off-Topic Segments? (NM)

Definition:
Non-mathematical/Off-Topic Segments (NM) contain no mathematical content. They offer no opportunities for students to learn mathematics. Non-mathematics segments must last ***at least 30 seconds*** in order to be coded as such.

Examples:

- Announcements by the teacher about school activities (e.g., field trips, vacation days).
- Interruptions by someone outside of the class requesting the teacher's attention (e.g., a student entering the room to collect the lunch count, a question of the teacher over the public address system).
- Following the bell at the beginning of the lesson, interactions between Ss or T/Ss that precede any mathematical work or organization. For example, the teacher taking roll.

- Discussions by the teacher of non-mathematical events (e.g., the music concert the night before).

- Disciplinary actions by the teacher in response to students' misbehavior.

- At the beginning and end of lessons, the appropriate content activity category should be applied, without any time constraints. However, where a NM segment is less than 30 seconds it should be merged with the following segment in the case of the beginning of the lesson, or the preceding segment at the end of the lesson. For example, the lesson may begin: "*Good morning class. Let's start.* First we will solve the following problem together". The NM (in italics) is less than 30 seconds, so it would be merged with the next segment (in this case a problem segment).

M-HK-030	43:23-47:19
FT-AU-04	2:43-4:32
Z-FT-NL-0048	1:11-1:40
M-CZ-026	2:10-3:37

2.2 What Are Mathematics Organization/Management Segments? (MO)

Definition:
Mathematics organization/management segments (MO) include references to mathematics (e.g., mathematics tools, resources, homework, tests), but do *not* contain mathematical content. As soon as any content is presented or the teacher begins to assign problems, it will NOT be coded as MO.
MO segments must last ***at least 30 seconds*** in order to be coded as such.

Note: MO segments that form the opening and closing of a lesson (the first or last segments coded) needn't meet the minimum time requirement. Code them no matter how short the segments are.

Examples of segments to be coded as MO:

- General organizational description of a future test or a quiz (e.g., "The test you are taking tomorrow will take the full class period….").

- Description of the grading policy on the test or quiz recently completed (e.g., "90% and higher was an A"). The comments are limited to general issues regarding testing and grading, not issues specific to a problem.

- The teacher and/or students passing out a worksheet that is not the next activity.

M-HK-050	30:12-32:00
M-US-002	16:16-17:56
M-US-011	2:39-3:34

Exception: (Segment not to be coded as MO)

- If the teacher discusses a lesson agenda/goal that includes mathematical content, this will not be coded as MO. (Instead code this as a Non-Problem segment (NP); see Section 2.16). An example would be the teacher describing the organization of the lesson in mathematical terms: "Today we will be studying systems of linear equations, but first we will review solving individual equations and then we will…"

2.3 General Definition of a Problem

Definition:
Problems contain an explicit or implicit Problem Statement (PS, Section 2.4.1) that includes an unknown aspect, something that must be determined by applying a mathematical operation (Section 2.5), and they contain a Target Result (TR, Section 2.4.2). When a solution is checked, this is considered part of the problem (Section 2.8).

2.4 Finding Problem Statements (PS) and Target Results (TR)

Mathematical problems have implicit or explicit Problem Statements (PS) as well as Target Results (TR). In order to code a problem, we first need to identify the PS and the TR.

2.4.1 What is a Problem Statement (PS)?

The **Problem Statement (PS)** describes the task to be completed. It may be verbal or written. The answer to the PS is the Target Result (TR).

Sometimes the PS is incomplete but clearly implied. In these cases the intention to solve a particular problem must appear to be known to students. For example, the students may have just worked on several very similar problems in the lesson (see M-US-004 example below).

The teacher may indicate a problem by referring to a particular textbook page and number (e.g., "Please solve problem #2 on page 18.") or indicate a problem on a worksheet (e.g., "Do the fifth problem."). In this case the announcement counts as the PS. Furthermore, a spoken PS can be an abbreviated, less specific, or incomplete version of a written problem.

Examples of some Problem Statements:

- "Solve the linear equation"
- "Which of the following numbers is bigger?"

- "We're gonna shingle the roof" (implied: How much will it cost, including tax?) [M-US-004]

Note:
General goal statements or topic announcements do not have TRs. PSs have particular TRs.

2.4.2 What is a Target Result (TR)?

The **Target Result (TR)** is the answer or solution to the Problem Statement (PS) obtained by applying the relevant operations. Mark the first complete and accurate public presentation of the solution.

The TR may be a number, an algebraic expression, a geometric object, a strategy for solving problems, and even the creation of a new problem. The teacher, the students, or both, may work out the solution to the problem.

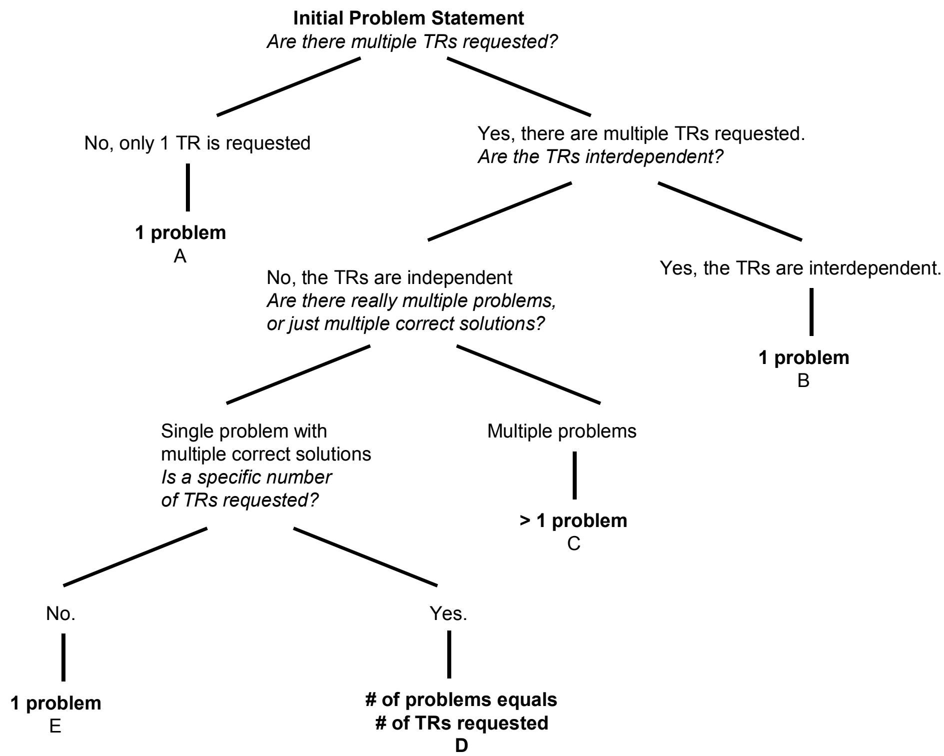
The TR may be explained, corrected, further elaborated, or checked. This type of continued discussion about the TR will be included as part of the problem.

Not all problems in a lesson will be worked through to their TRs.

2.4.3 Determining How Many Problems to Code

A Problem Statement (PS) may ask for one Target Result (TR) (e.g., solve the equation for x) or it may ask for several TRs (e.g., using the two given points create an equation, fill in a value table and graph the function). Because the number of TRs is generally used to determine the number of problems coded, sometimes it might be difficult to reliably decide how many problems there actually are.

The decision tree below is designed to help you make reliable decisions about how many problems to code. "**Interdependent**" means that one of the requested TRs **MIGHT BE USED** to get to a second TR.

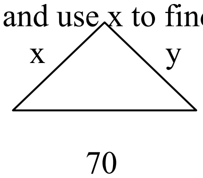


A. Examples of Problem Statements with a ***single Target Result*** (ONE problem):

- Find x in the equation 3x –5 = 10
- Find the area of the parallelogram with a base of 8 cm and a height of 4 cm.

B. Examples of Problem Statements asking for ***multiple, interdependent Target Results*** *(ONE problem):*

- In the triangle below, find x and use x to find y:



- Make a value table and graph the equation: 3x = 2y – 1

C. Example of a Problem Statement asking for ***multiple, independent Target Result****s* *(MULTIPLE problems):*

- Solve the following equations:
  - a) 3x + 1 = 8
  - b) x – 7 = 42 (= 2 problems)

- Given the following equation: $3x = 2y - 1$

  a. Make a table using the format

x	0	1	2	3
y				

  b. Graph (= 2 problems)

D. Examples of single problems with ***multiple correct solutions*** *and a* ***specific number of Target Results*** *requested (# of problems = # of independent TRs requested):*

- Name two triangles that can be used to tessellate triangle QRS, give the lengths of their sides and explain why they can be used to tessellate (2 independent TRs, therefore 2 problems -- each with 3 interdependent TRs).
- Name 3 decimal numbers between 11.8 and 11.9 (= 3 problems)

E. Examples of single problems with ***multiple correct solutions*** *and the* ***number of Target Results unspecified*** *(ONE problem):*

- Name a triangle that can be used to tessellate triangle QRS, and give its perimeter.
- Name some decimal numbers between 11.8 and 11.9

Note:

- For problems on worksheets, the above decision tree will also be applied. Worksheet problems often contain "subproblems" -- such as #1a,b,c. Each subproblem is considered a new "initial problem statement."

  Example:

  A wall in the city has two advertising posters on it. A tax of 75 guilders must be paid to the city per dm^2. Therefore, we must know the surface area of the posters.

- Calculate the surface area of the two posters.
- What is the tax due to the city on the first poster?
- What is the tax due to the city on the second poster?

  (a = 2 problems; b = 1 problem; c = 1 problem)

2.5 What is a mathematical operation?

Mathematical problems must have at least one mathematical operation.

A mathematical operation could be:

1) a procedure applied to:

- numbers
- variables
- algebraic expressions
- geometric objects
- a geometric construction
- a graph or map

2) a method of mathematizing a real-world situation:

- measuring objects
- manipulating symbols

<u>Addition to the coding manual: 2.5 What is a Mathematical Operation?</u>

3/2/00

A mathematical operation could be:

2) a method of mathematizing a real-world situation:

- measuring objects
- manipulating symbols
- **applying statistical concepts**

Types of operations include:

- adding, subtracting, multiplying, dividing, squaring, etc.
- combining like terms
- combining exponents
- factoring
- simplifying
- expanding
- manipulating equations
- changing representation form (e.g., writing a story problem as an equation)
- solving equations
- substituting numbers for variables
- plotting graphs
- reading graphs
- applying formulas, rules or theorems
- applying tools for measuring angles
- estimating measurements
- rounding off numbers
- rotating, reflecting, constructing angles, lines and curves
- drawing charts
- proving identities
- comparing solution strategies
- identifying real life applications of a formula
- interpreting a complex mathematical figure

Note: Labeling a figure is *not* an operation, however manipulating a label or symbol to generate a new result *is* an operation.

Mathematical problems require **mathematical thought.** Although the amount or depth of thought may be relatively small, the problem must make some demands on students' thought by requiring that students recognize the mathematical objects that must be acted on and then apply the mathematical operation(s) to obtain the result.

Example:
FT-AU-04 18:32-22:05

2.6 Distinguishing Problems from Steps

Many mathematical problems require one or more "steps" to reach the solution. Steps, by themselves WITHIN a problem, do NOT count as separate mathematical problems. A step is a mathematical operation that occurs between the Problem Statement (PS) and the Target Result (TR). A step is used to reach the TR.

Sometimes it may be difficult to determine if an operation (or set of operations) qualifies as a step or as a new problem. Look to see if there is a larger Problem Statement (said or clearly implied). If so, then the operation(s) are steps.

Example of steps:

We are going to graph the following function -- 3X+Y=12 (Problem Statement)
First we need to make a table to determine some coordinates (Steps)
Now let's plot the points and make the graph (Target Result)

2.7 Examples and Special Cases

Examples of problems include:

- Adding simple whole numbers (e.g., 3 + 5) is NOT a problem, but adding simple fractions is a problem (because, for some eighth graders, fractions are mathematical objects that require some recognition/analysis but small whole numbers are, by this time, routine).
- Counting how many of five circles are shaded is NOT a problem, but counting the number of terms in an algebraic expression is a problem (because, for some eighth graders, algebraic terms require recognition/analysis but shaded circles do not).
- Recalling the convention for labeling a single angle is NOT a problem, but manipulating labels to generate new ways of naming an angle is a problem.
  Example:
  FT-AU-04 8:47-14:45

Special Cases To Be Coded as Problems:

- Teaching how to translate a mathematics operation onto a calculator/computer counts as a problem, regardless of the difficulty level.

Examples:
Use your calculator to find the square root of 100.

Use your calculator to add 3 and 5.

However, where a calculator/computer is clearly being used as a tool to complete a step towards the solution of a problem (e.g., to determine the value of cosine θ, or to convert a decimal number into degrees with seconds, as in HK 044) then this "step" is not a problem.

- If the TR is a formula, rule, definition, etc., it will ONLY be coded as a problem IF it is worked on for ***at least 2 minutes*** (from the Problem Statement to the Target Result) ***and at least 2 operations*** are applied. If the same operation is repeated, it is counted as a separate mathematical operation. (We include these extra conditions here to exclude those cases where the teacher asks students simply to recall a rule or formula from memory.)

Special Cases NOT To Be Coded as Problems:

Simple questions by the teacher that ask students to "fill in the blank" with information that one could expect all eighth-grade students to have over-learned or know by common sense, or that is suggested so strongly by the question itself that no other answers seem reasonable, are not problems.

Examples:
- "So what is two and five?"
- "Here are two halves; how many of them are shaded?"
- "Remember, first you combine the x's and then you combine the...?"

2.8 Checking

Checking will always be coded as part of the problem, even if the check itself meets the definition of a problem.

Checking means:
- making sure the Target Result (TR) is correct, often by "plugging" the answer into the original question.
- making sure an alternative solution is incorrect.
- making sure that one solution method yields the same TR as a different solution method.

In the last case, the teacher/textbook must clearly state (before the problem is worked on) that the goal of using these 2 solution methods is to check that they yield the same result. If the goal of checking is not clearly indicated, then use the rule below.

If the teacher explicitly asks students to work the problem using another strategy than they have used the first time (and does NOT refer to this as checking), it is coded as a new problem; if the teacher asks students to report alternative strategies (or solutions) that they have already found, this is coded as a continuation of the original problem.

An activity that makes use of students' solutions (e.g., connecting the dots to make a picture, when the dots are labeled with successive solutions; M-CZ-016), is considered checking – and therefore not a problem unto itself.

2.9 How to Identify the In- and Out-Points of Problems

Once we have identified a Problem Statement (PS) and a Target Result (TR), we have to determine where the problem begins and where it ends. This section will explain where to mark the in- and out-points of each problem so that the problem will be a meaningful segment for future analyses.

2.9.1 In-Point of the Problem

We will mark the in-point of a mathematical problem when the problem is first stated or assigned (whichever comes first).

However, if the teacher **explicitly/directly relates the preceding discussion** to the problem, we will include this discussion as part of the problem. In this case the in-point of the problem will be marked at the beginning of the discussion.

Also, if the immediately preceding activity involves preparing for working-on the problem by distributing materials, referring to the relevant textbook page or worksheet, displaying overhead transparencies, rearranging into groups, calling student(s) to the board, and so on, then the problem will begin with this activity.

If a problem is *referred to* with the intent of working on it later in the lesson, it will not be opened when it is first referred to. The problem will instead be opened when it is intended by the teacher to be worked on.

The "Set-Up" for a group of problems will be included with the first problem of the group.

2.9.2 Out-Point of the Problem

We will mark the out-point of a mathematical problem after a solution has been stated, the "check" of the solution is completed, or after the discussion around the solution has finished, whichever comes last.

Teachers may summarize the solution strategy used for the problem after the Target Result (TR) has been stated. This summary is considered part of that problem. However, summary statements that refer to several problems should not be included as part of the problem. Instead, they should be coded as separate "Non-Problem" segments, as discussed in Section 2.16.

If the teacher collects students' papers immediately after the problem is solved or after the problem has been worked-on, the out-point is marked after this activity is concluded. If the teacher begins a new segment while collecting papers, the out-point of the problem is marked at the beginning of the new segment.

For references back to the problem which occur after the TR has been reached (in the present lesson) AND another activity has started, the coder will have to decide whether or not the reference should be considered part of the problem.

- If the reference contains an *explanation* or extended discussion of the solution process or TR, then it should be coded as part of the problem. In this case, the new activity will be coded as part of the problem as well.
- If the reference is very brief and just mentions the problem or repeats the TR or a small step, or it is very far removed from the problem itself, then it should be coded as a separate, "Non-Problem" segment.

2.9.3 Transition Segments

A **transition statement** is a statement of less than 20 seconds, between two segments. We will put the transition statement into the succeeding segment (the second of the two segments). Therefore, the end-point of the first segment will be marked before the transition statement, and the in-point of the second segment will be marked at the beginning of the transition statement.

2.10 What are Answered Only Problems (AO)?

Definition: Answered Only (AO) problems are problems completed before the present lesson (and *not worked on* during the present lesson). Answers are shared either verbally or in written form. AO problems have NO public discussion of a solution strategy, and NO private working on time.

Examples:

- The teacher gives answers to homework verbally, on the chalkboard, or on a handout.
- The teacher gives answers to a test/quiz verbally, on the chalkboard, or on a handout.
- The teacher provides solution strategies in written form only (there is no discussion) (e.g., the teacher provides a hand-out with the steps students should have used to solve the equation).
- M-US-002 6:50-8:31

Notes:

- If anything more than answers are discussed -- for example, if there is any public discussion of solution strategies -- the problem is coded as an Independent Problem (IP, see Section 2.11 below).
- AO problems should be lettered consecutively.
- Sometimes the class goes through a series of AO problems, but they then decide to work out or have a lengthy discussion about one of the problems. If the class returns to work on an AO that has already been opened and closed, that problem will be coded twice: first as an AO problem, and later as an Independent Problem (IP).

AO a	AO b	AO c	IP 1	AO d
$3x^2 + x = 6$	$x^2 + 3x = 8$	$x^3 + 2x = 7$	$x^2 +3x = 8$	$x^2 + x^2 = 8$

2.11 What are Independent Problems (IP)?

Definition: Independent Problems (IPs) are problems on which the teacher expects students to spend time during the present lesson. They are worked-on by themselves. The exact time the whole class spends working on the particular problem is known.

IPs may be worked on entirely publicly or they may contain a private working on phase.

IPs should be numbered consecutively, together with Concurrent Problems (CPs; Pass 3).

Examples:
FT-AU-03 12:10-14:11
FT-SW-065 9:11-13:41

Special Cases:

- If problems are initially introduced as a group (e.g., a poster, worksheet, or textbook), but are then worked on one by one they will be coded as IPs since the time devoted to each single problem is known. The in-point of the first IP will be when the group of problems is first set-up or assigned.

- For a problem that has been completed prior to the lesson, if there is any public discussion of solution strategies, the problem is coded as an IP.

2.12 What are Concurrent Problems (CP)?

Definition: Concurrent Problems (CPs) are those problems that share some private working on time (CI 2, CI 3, CI 4, or CI 5). During that private time it is not known on which problems students are working. Thus, the exact time spent working on each of the CPs is unknown.

Note:
Problems that are completely public (CI 1) cannot be coded as CPs.

2.13 What are Concurrent Problem Phases?

Concurrent Problems (CPs) cannot serve as activity segments in this coding system. Instead, use the following four CP phases as content activity segments:

Concurrent Problem Set-Up (CPSU)
Concurrent problem Seat Work (CPSW)
Concurrent Problem Class Work (CPCW)
Concurrent Problem Mixed Activity (CPM)

Note:
If there are any CPs open there should always be a CP phase coded.

2.13.1 Concurrent Problem Set-up (CPSU)

Definition: CP Set-Up (CPSU) is a segment during which the teacher assigns multiple problems. To qualify as a CPSU segment, during the activity that immediately follows students must work on the assigned problems. If any other activity (e.g., checking homework, reviewing from a previous lesson) occurs between the initial assignment of CPs and the working-on segment, then the initial assignment of problems is **NOT** coded as a CPSU phase. In this case the CPSU phase would be the reassignment of the problems immediately preceding the working-on segment.

The in-point of the CPSU is signaled by any of the following markers:

- The first problem of the set of problems is stated.
- The teacher passes out worksheets or asks a student(s) to pass out worksheets.
- The teacher asks students to look at worksheets they already have from a previous lesson or to open their textbooks to a particular page.
- The teacher indicates group work or working with a partner.
- The teacher passes out other materials or asks students to distribute materials.

Below are three possible scenarios of CPSU segments:

Scenario 1: The teacher assigns three CPs to be worked on in Seatwork. (This is the most simple/ straightforward case).

CP Set-Up (CPSU)	CP Seatwork (CPSW)
CP1	
CP2	
CP3	

It may occur that teacher and students work out example problems to their completion during the CPSU segment. Two different scenarios can be distinguished:

Scenario 2: The teacher assigns three CPs and does one example problem that does not belong to the group of CPs assigned during the CPSU phase. We will call the example problem an IP/ITIP. The numbering of the problems is as follows: CP1-3 and IP4.

CPSU			CPSW
CP1			
CP2			
CP3			
	ITIP IP4		

Scenario 3: The teacher assigns three CPs and does one of the CPs as an example problem during the CPSU phase. In this case the example problem is no longer a CP but an ITIP/IP. The numbering of the problems is as follows: CP1-2 and IP3.

CPSU			CPSW
CP1			
CP2			
	ITIP IP3		

Notes:

- Remember, problems that are assigned with the explicit intent to be solved at a later time during the lesson will not be opened when they are first referenced to.

- If the students have already started working on the assigned CPs and the teacher then decides to solve one of the problems together as a whole class we code the CP Phase as CPCW. That problem is NOT an ITIP/IP but a CP.

- Problems that are part of an assigned set of CPs but that have been solved to completion prior, will be subtracted from the total number of assigned problems.

The **out-point** of the CPSU segment is coded 1) after the last CP is presented and students may start working (see Scenarios 1 and 2 below), or 2) the first operation is requested (see Scenario 3 below).

Notes:

- For all CPs assigned during the present lesson, code a CPSU phase. Only if there is no assignment of CPs in the present lesson (for example, students know how to proceed without instruction -- in classrooms with totally individualized learning, weekly work plans, or warm-up problems written on the board), can a CPSU phase be missing.

- If additional CPs are assigned during CPSW, code another CPSU Phase.

- This segment includes the period of time spent passing out worksheets and continues until the teacher has passed out worksheets to all students.

- If the teacher gives instructions or hints *before* students have begun working, this is part of the Set-Up. But, if any problem is worked out to its TR, it is an IP/ITIP (Section 2.14) as described above.

- If the teacher gives instructions or hints *after* students have begun working, this is not part of the Set-Up. It will either be coded as Seatwork or Classwork (to be described below).

- In some lessons, the teacher may set-up some CPs and then have the students work on them privately. After they have already started working privately, the teacher may additionally set-up more problems. In this case, there would be a CPSU segment, followed by a CPSW segment, and then another CPSU segment.

Examples:
M-NL-008 24:50-25:13
M-US-050 32:04-33:03
M-HK-087 36:31-37:03

(These are the same scenarios shown in Section 3.1.)

Scenario 1

CPSU	CPSW	CPCW
CP1		
CP2		
CP3		
CP4		

Scenario 2

CPSU	CPSW	CPSU	CPSW	CPCW
CP1				
CP2				
		CP3		
		CP4		

Scenario 3

CPSU	CPSW	CPSU	CPSW	CPCW
CP1				
		CP2		

2.13.2 CP Seatwork (CPSW)

Definition: CP Seatwork (CPSW) is the segment when students actively work on concurrent problems (CPs) at their seats (privately). They may work individually, in pairs, or in small groups.

The **in-point** of the CPSW Segment is when all students start working privately at their seats. This is often indicated by teachers comments such as: "Start working now," "You can start now," or physical markers by the teacher such as starting to monitor students' work, sitting down at the desk, working out constructions or problems on the chalkboard.

The **out-point** of the CPSW Segment is marked either 1) immediately before students publicly share the work they completed privately, (indicated by comments such as "Let's compare results" or "Let's go over the problems together"), or 2) if there is no public sharing of private work and another segment begins.

Notes:

- If additional CPs are assigned during CPSW, code another CPSU Phase.

CPSU	CPSW	CPSU	CPSW	CPCW
CP1				
CP2				
		CP3		
		CP4		

- While most of the class is working at their seats, one or more students may be working at the chalkboard. This should still be marked as CPSW.

Addition/Clarification to the coding manual: 2.13.2 CP Seatwork (CPSW).

03/03/2000

While most of the class is working at their seats, one or more students may be working at the chalkboard. This should still be marked as CPSW. **This is true *even if* there is public talk between the student and the teacher, and *even if* the student at the chalkboard reaches a target result.**

Example: M-CZ-048, 35:38-41:49

- Normally, there are no time requirements for the CP phases. There is **one exception**: The teacher may make brief announcements to the class, as students are working on problems at their seats. If these announcements last less than one minute, the segment remains "CP Seatwork" (CPSW). However, if the announcements last more than one minute, the segment should then shift to "CP Classwork" (CPCW).

- Also, any time the teacher goes over a problem or its TR publicly (even if this lasts less than one minute), the segment should shift to CP Classwork (CPCW).

- This segment includes the period of time spent collecting worksheets and continues until the teacher has collected worksheets from all students.

Examples:
M-NL-008 25:13-48:08
M-US-050 3:03-42:31
M-HK-087 37:03-40:32

2.13.3 CP Classwork (CPCW)

Definition: CP Classwork (CPCW) is the segment when the teacher/students actively work on or discuss Concurrent Problems (CPs) as a whole class (publicly).

In **in-point** of the CPCW Segment is when students begin to publicly share work they completed at their seats. This can be indicated by comments such as, "Let's look at what you got," or "What about number 12?".

The **out-point** of the CPCW Segment is when the TR of the last problem of the group has been stated or the related discussion to that problem or the entire set of problems has finished and a new segment begins.

Notes:

- There is no minimal time requirement for CPCW.

- In some lessons, the teacher may not go over any CP publicly -- although there may be some general public discussion <u>about the assignment</u>. This means that the CPs will close at the end of the CPSW segment. However, a CPCW segment would still follow, without any CPs open, because the discussion is about some general feature of the problems (e.g., the teacher may summarize what students should have learned from working the problems without going over any particular problem.). See the diagram below.

CPSU	CPSW	CPCW
← CPs open	CPs close ⟶	

- This segment includes the period of time spent collecting worksheets and continues until the teacher has collected worksheets from all students.

Examples:
M-US-050 42:31-47:58
M-HK-087 40:32-42:08

2.13.4 CP Mixed Activity Segment (Seatwork & Classwork) (CPM)

Definition: The teacher explicitly divides the class into groups, and assigns them different activities. One group works privately at their seats, while at the same time another group works publicly with the teacher.

Note:
This situation is rare. It generally overlaps with one of the mixed Classroom Interaction (CI) patterns. (See Section 1.2.2.)

2.14 What Happens if an Independent Problem (IP) Interrupts Another Problem(s)?

2.14.1 What Happens if an Independent Problem (IP) Interrupts another Independent Problem (IP)?

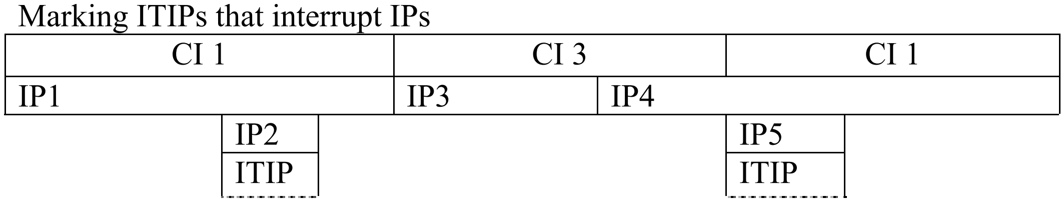
Definition: A new Independent Problem (IP) may be started and solved before another IP is completed. We code both problems as IPs, and number each one consecutively. However, this means that a period of time will be covered by two activity segments. Therefore we will also code this period of time (covered by the 2 IPs) as ITIP – Interruption of Type Independent Problem.

The times marked for the **beginning** and the **end** of an ITIP segment should be the same as the interrupting IP.

Example:

M-US-004 12:32-12:53

Marking ITIPs that interrupt IPs



2.14.2 What Happens if an Independent Problem (IP) Interrupts a Concurrent Problem Phase?

An Individual Problem (IP) can interrupt a CP Phase (usually the CPSU or CPCW phase). However, this means that a period of time will be covered by two activity segments. Therefore we will also code this period of time (covered by the CP Phase and IP codes) as ITIP – Interruption of Type Independent Problem.

The times marked for the **beginning** and the **end** of an ITIP segment should be the same as the interrupting IP.

Marking ITIPs that interrupt CP Phases

CI 1	CI 5	CI 1	CI 5
CP SU	CP SW	CP CW	CP SW

IP 9
ITIP

Addition/Clarification to the coding manual: 2.14 What Happens if an Independent Problem (IP) Interrupts Another Problem(s)?

04/10/00

ITIP: The code ITIP was designed to preserve the time spent on a particular problem that gets interrupted by another problem. As ITIPs can occur within IPs (2.14.1), but also within CPSU, CPM and CPCW (2.14.2), we need to further specify which of the content activity segments it interrupts.

ITIP: The original code ITIP describes the case where a problem interrupts another IP.
IIPSU (Interruption of Type Independent Problem To a CPSU): This code describes the case where a problem interrupts a CPSU.
IIPCW (Interruption of Type Independent Problem To a CPCW): This code describes the case where a problem interrupts a CPCW.
IIPM (Interruption of Type Independent Problem To a CPCW): This code describes the case where a problem interrupts a CPM.

2.15 What Happens if a Piece of an Independent Problem (IP) Interrupts Another Problem(s)?

Definition: Sometimes the class works publicly on one Independent Problem (IP) up to a certain point without finishing it. The class then starts working publicly on another Individual Problem (IP) which also remains unfinished. The class then goes back to finish the first problem and then completes the second. The problems are broken up into different pieces.

We code both problems as IPs, and number each one consecutively. However, this means that a period of time will be covered by two activity segments. Therefore we will also code this period of time (covered by the 2 IP codes) as ITPP – Interruption of Type Problem Piece.

The ITPP segment should be the time when the two IPs overlap. See diagram below.

Marking ITPPs

Example:
M-HK-031   1:58-19:00

2.16 What is a Non-Problem Segment? (NP)

Definition:
Non-problem segments (NP) contain mathematical information. They do not contain problems, but may reference problems. NP Segments must last ***at least 20 seconds***. If a segment seems to fit the definition but is ***less than 20 seconds***, code it as part of the segment before or after - whichever is most relevant.

NP segments that form the opening and closing of a lesson (the first or last segments coded) needn't meet the minimum time requirement. Code them no matter how short the segment is.

Examples of Non-Problem segments:

- Assignment of homework
- Historical background
- Lesson goal/topic (today or future)
- Meta-cognitive strategies
- Presentation of new information (concepts or resources)
- Real life connection/ application
- Reference to a prior problem (summary or repetition)
- Reference to a future problem
- Review of old information

Notes:

45. NP segments often are brief lectures by the teacher or interactions between the teacher and students where the questions the teacher asks do not meet the definition of a problem.
46. NP segments CANNOT interrupt problems. If you see something that looks like a NP segment, but it occurs within a problem, simply consider it as part of the problem.

Examples:

Z-FT-NL-0048	29:12-31:12
M-CZ-026	3:55-5:33
M-US-024	13:03-15:07

2.17 What if there is an Official Break in the Lesson? (BK)

Definition: Time during the lesson (or in-between double lessons) that the teacher has designated as a Break (BK) for students. The in-point of the BK is when the teacher publicly announces that students may take a break. The out-point of the BK is when the interaction clearly shifts back into a mathematics lesson.

If the teacher announces that students may have a break, but then an activity takes place that we would otherwise call "mathematics organization" or "mathematics work", do not code the period of time as "BK". Instead, use the most appropriate content activity category.

2.18 What if there are Technical Problems with the Video? (TP)

You may come across a video that has a Technical Problem (TP). For instance, the video may start late or lack audio. These difficulties may prevent you from making a confident coding decision. In these cases, use Technical Problem (TP) as a content activity category to mark the difficult section. The **in-point** of a TP segment is where the coding difficulty begins. The **out-point** is where you have sufficient information to make a coding decision.

2.19 What happens if another Content Coverage Code seems to interrupt an Independent Problem or Concurrent Problem Phase?

Our coding system ONLY allows for a very specific type of interruption to an Independent Problem (IP) or Concurrent Problem Phase (CP Phase): Independent Problems (ITIPs) or Problem Pieces (ITPPs) -- see Sections 2.14 and 2.15. <u>No other content activity category may interrupt a problem.</u> That is, Non-Mathematics (NM), Mathematics Organization (MO) and Non-Problem (NP) segments cannot interrupt either IPs or CP phases.

2.20 Reference Table: Types of Problems

		Worked On	
	Answered Only Problems (AOs)	**Independent Problem (IPs)**	**Concurrent Problems (CPs)**
Definition	AO problems are problems completed before the present lesson (and *not during* the present lesson). Answers are shared either verbally or in written form. Answered only problems have NO public discussion of a solution strategy, and NO private working on time.	IPs are those problems that are presented/ worked on by themselves. The exact time spent working on the problem in class is known.	CPs are those problems that share some private working on time. The exact time spent working on each of the CPs is unknown.
In-Point	The point when the problem is first stated. If the immediately preceding discussion or activity is explicitly/directly related to the problem, we will include this discussion as part of the problem and mark the in-point at the beginning of this discussion.	The point when the problem is first stated or assigned (whichever comes first). If the immediately preceding discussion or activity is explicitly/directly related to the problem, we will include this discussion as part of the problem and mark the in-point at the beginning of this discussion.	
Out-Point	The point when the solution is stated.	The point when the solution is stated, the "check" of the solution is completed, or when the discussion around the solution has finished, whichever comes last.	
Phases to Mark	None	None	CP Set-Up (CPSU), CP Seatwork (CPSW), CP Classwork (CPCW), CP Mixed Activity (CPM)
Labeling	Consecutive lettering.	Consecutive numbering for all worked on problems.	

2.21 Tips for Coders

To code a problem accurately, you must watch the video. Never rely on the transcript only. Sometimes, when a teacher/student presents a question, his/her verbal expression is insufficient.

Example: The teacher is presenting to students the difference between $(-3)^2$ and -3^2. However, verbally there is no difference. You can only tell the exact content of her presentation by looking closely at what the teacher writes on the blackboard.

Textbook Problems

Don't necessarily follow the labeling of problems in the textbook. Identify problems by using the definition given in this manual. It may be the case that you must label a single textbook problem as two problems.

Coding Answered Only Problems (AO)

Sharing homework is a likely place to find AO problems. Be aware that even though many of the homework problems may be answered only, some could be Independent Problems (IP) if a discussion about the solution method takes place.

If there is any brief segment (e.g., *20 seconds or less*) that is difficult to categorize based on the content of the segment, code it as part of the segment which follows.

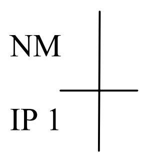
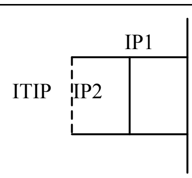
There should only be one Content Activity category marked at any time except for when an ITIP or ITPP occurs.

2.22 Pass 2 Coder Protocol

- Divide the lesson into Content Activity categories. Each Content Activity category must have an in point and an out point.
- For each problem, identify the Problem Statement (PS) and Target Result (TR).

2.23 Pass 2 Transcript Marking

- Mark all of the Content Activity categories in the second column (left of "Speaker")
- Use the following symbols for marking Pass 2
- Write in or circle the exact time of each shift in the text

	Draw a vertical line indicating the time of the segment and write the Content Activity type. Draw a horizontal line to indicate shifts between content activity segments. At each shift, also put a **||** at the exact point in the text.
<u>PS1 / TR1</u>	Underline the PS and TR of each IP in the text, and number them with the same number as their IP. If a PS is written on the board or overhead (and not included in the lesson transcript), write it in the transcript at the appropriate lesson time for easy future reference). For problems with interdependent TRs, mark each one as a portion of the TR. (e.g., If the first problem (IP1) has 3 TRs then we would label them: TR1-1, TR1-2, TR1-3)
	Draw a dashed line to indicate interruptions (ITIP/ITPP) to IPs and CP Phases.

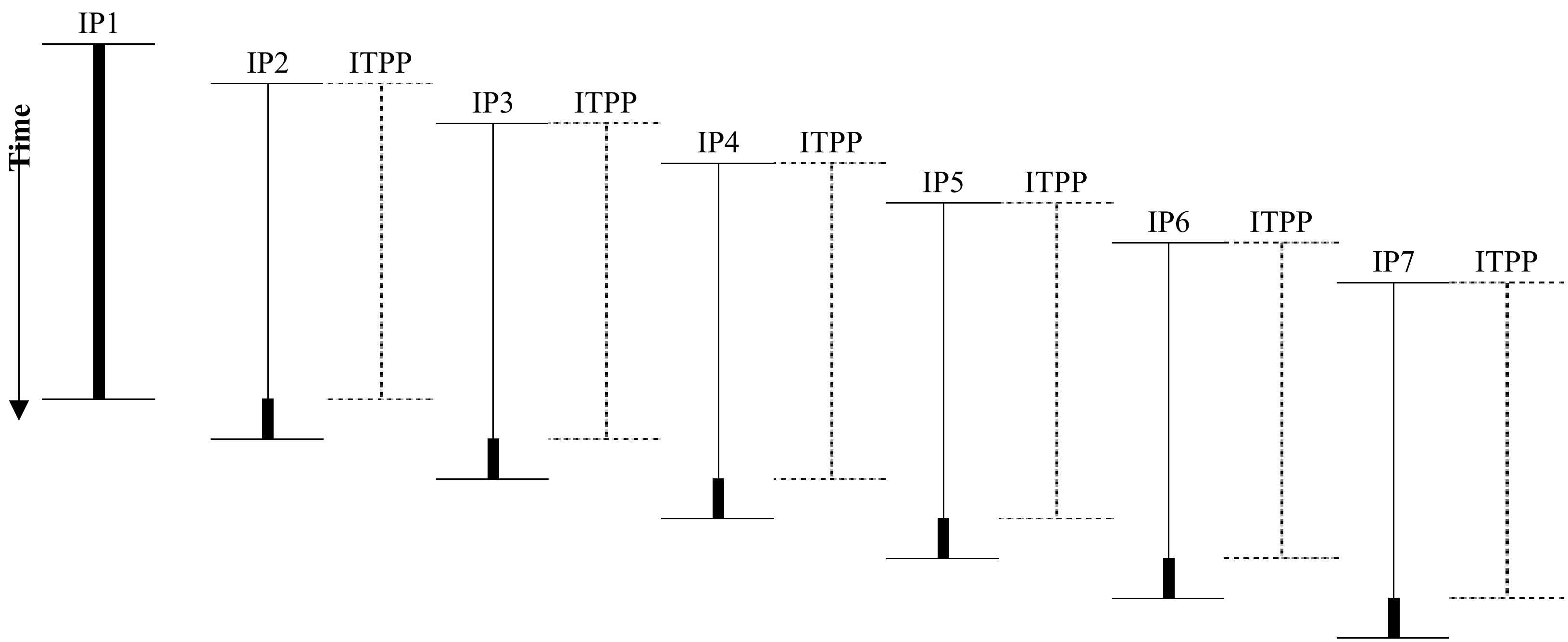
- Each segment in Pass 2 must be labeled as one of the following:

NM	Non Math	A non-mathematics or off-topic segment
MO	Mathematics Organization	A mathematics organization or management segment
AO	Answered Only Problem	Problem not worked on in the present lesson, but the answers are shared
IP	Independent Problem	Problem worked on by itself
CPSU	CP Set-Up	A segment in which concurrent problems are set-up
CPSW	CP Seatwork	A segment in which concurrent problems are worked on by students individually, in pairs, or small groups
CPCW	CP Classwork	A segment in which concurrent problems are worked on or shared publicly, as a class
CPM	CP Mixed Activity	A segment in which some students work on concurrent problems privately and some work publicly
ITIP	Interruption: Independent Problem	The segment when an IP overlaps with another IP or CP Phase.
ITPP	Interruption: Problem Piece	The segment when pieces of 2 IPs overlap.
NP	Non Problem	A segment containing mathematics information, but not a mathematics problem
BK	Break	An official lesson break
TP	Technical Problem	A technical problem in the videotape

Marking Interruptions of Type Problem Piece (ITPPs)

In-point: The point at which the interrupting problem piece starts
Out-point: The out-point of the problem that closed immediately prior.
# of ITPPs: One less than the number of problems (i.e., IPs – 1).

In the figure below, an IP opens and before it closes, 6 other IPs open. Once all 7 IPs have opened, each is discussed in turn and closed. The result is 7 IPs and 6 ITPPs – and a complicated situation to mark!



How do I mark situations like this?

The in- and out-points of each IP are marked. For the first IP, you need to do nothing more. For each of the interrupting IPs, you must also mark an ITPP. (Therefore, the total number of ITPPs is equal to the total number of problems minus 1.) For each interrupting IP, start the ITPP when the IP opens. End the ITPP when the immediately prior problem closed. For example, for IP**3**, open an ITPP when IP**3** opens and close the ITPP when IP**2** closes.

How does this solve our need to code TIME spent on problems?

Because we know exactly how much time is spent on each problem, we can't code these problems as CPs. It may seem counterintuitive then, that the way we've marked these problems doesn't reflect the actual time spent working on each problem. What this system will produce is not an accurate time per problem, but an accurate total time for all the problems (and an accurate average time for each).

Chapter 3. PASS 3: CONCURRENT PROBLEMS

In Pass 3 we will count and mark Concurrent Problems (CPs).
In addition, at the end of this Pass coders will enter the coded data into vPrism.

3.1 How to count and mark Concurrent Problems (CPs)

Concurrent Problems (CPs) are problems that share some private working on time. The exact time spent working on each CP is unknown**.**

Examples:

Z-FT-NL-0049	46:37-51:14
M-HK-024	10:39-21:47

Notes:
- The in and out points of CPs are usually marked the same as the in and out points for Independent Problems (IPs).
- Remember, whenever CPs are open there should also be a corresponding CP phase marked.

Rules for deciding how many CPs to open:
- Follow the decision tree presented in Chapter 2 (see Section 2.4.3).
  F. In general, all of the problems on a worksheet or textbook page will open UNLESS the teacher specifies **a particular subset** of these problems for students to work on.
- When just 1 student in the class is working on a different set of CPs than the rest of the class (e.g., taking a make-up test), do NOT open those CPs.
- When the teacher assigns different CPs to all students or groups of students (e.g. all the boys do problems 1-5 and girls do problems 6-10), open all of the CPs.

The following scenarios explain how to mark the in- and out-points of CPs.

Scenario 1

The teacher assigns at least two problems on which students are required to work privately, (e.g., problems from a worksheet, textbook, transparency). If the CPs share a common Set-Up, then the in-point of each CP within that group will be marked at the same time. **The out-point of each CP is marked when the Target Result (TR) is reached and public discussion of the particular CP ends (see CP1 – CP3 in the diagram below). If there is no public discussion of the CP, it closes when the CP Seatwork segment (CPSW) ends (see CP4 in the diagram below).**

Illustration of Scenario 1: Four problems are assigned at the same time and share a Seatwork phase. The results of 1, 2, and 3 are shared in Classwork.

CP Set-Up (CPSU)	CP Seatwork (CPSW)	CP Classwork (CPCW)
CP1		
CP2		
CP3		
CP4		

Scenario 2

The teacher assigns at least two problems on which students are required to work privately, (e.g., problems from a worksheet, textbook, transparency). If students have started working on the initial set of CPs and the teacher then assigns another set of problems <u>also</u> to be completed during that Seatwork time, then the two groups of problems have different in-points. **The in-point for each group of CPs is marked when that group is set up or assigned.** In Scenario 2, the only CP discussed publicly is CP4.

Illustration of Scenario 2:

CPSU	CPSW	CPSU	CPSW	CPCW
CP1				
CP2				
		CP3		
		CP4		

Example:
FT-AU 02 11:43 –24:41 CP1 and 13:25-31:41 CP2

<u>Addition/Clarification to the coding manual: 3.1 How to Count and Mark Concurrent Problems (CPs)</u>

3/9/00

If students are assigned additional problems privately and it appears that the assignment is intended for *most* students, open the additional problems when you see them being assigned to the first student. Because this happens privately, there will not be a CP Set-Up. (If the additional problems assigned do not appear to be intended for most students, disregard them.)

Example:
M-CZ-043 (29:06-46:00)

Scenario 3:
The teacher assigns a problem that is first worked-on by students privately (i.e., in seatwork). After the students begun working on the problem, but before they have finished with it, the teacher assigns one or more additional problems to be worked on privately. All of the problems share some Seatwork time.

In the scenario below, CP1 began as an IP, but was recoded as a CP when an additional problem was assigned (because it is now impossible to know how much time was devoted to CP1).

Illustration of Scenario 3:

<table>
<tr><td>CPSU</td><td>CPSW</td><td>CPSU</td><td>CPSW</td><td colspan="2">CPCW</td></tr>
<tr><td colspan="2">CP1</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="2"></td><td>CP2</td><td>CP1-2</td><td colspan="2">CP1-2</td></tr>
</table>

3.1.1 Examples of how to apply Pass 2 and 3 codes when there are Concurrent Problems (CPs)

EXAMPLE 1.

	LESSON ACTIVITY	**Pass 2 Codes**	**Pass 3 Codes**
1.	Teacher assigns textbook problems. S/He gives some hints, but doesn't do any of the problems to their TR.	CPSU	CPs open
2.	Class begins working on the problems at their seats (privately)	CPSW	
3.	Teacher assigns a few more problems.	CPSU	Additional CPs open
4.	Students work at their seats (privately)	CPSW	
5.	Teacher goes over one of the CPs with the entire class (publicly), to its TR	CPCW	One CP ends
6.	Teacher goes over another CP with the class (publicly), to its TR	CPCW	Another CP ends
7.	Students continue working at their seats (privately)	CPSW	Remaining CPs end
8.	Class starts a new activity.		

EXAMPLE 2.

	LESSON ACTIVITY	Pass 2 Codes	Pass 3 Codes
1.	Teacher passes out a worksheet.	CPSU	
2.	Class works on one of the worksheet problems together (publicly).	CPSU IP ITIP	
3.	Teacher tells the class to work on the rest of the worksheet problems at their seats (privately)	CPSU	CPs open
4.	Class begins working on the problems at their seats (privately)	CPSW	
5.	Teacher goes over one of the worksheet problems with the class (publicly), to its TR	CPCW	One CP ends
6.	Teacher goes over a new problem (not on the worksheet) publicly	CPCW IP ITIP	
7.	Students continue working on the worksheet at their seats (privately).	CPSW	

EXAMPLE 3.

	LESSON ACTIVITY	Pass 2 Codes	Pass 3 Codes
1.	Teacher passes out a handout.	MO (because a NP segment follows)	
2.	Class works on something else related to math, but not a mathematics problem.	NP	
3.	Teacher instructs the class to begin working on the handout.	CPSU	CPs open

CPn

Sometimes you might not know how many CPs were actually assigned by the teacher (to be worked on by the students). Other times you might know the number of a subset of all assigned CPs but not the entire set. This creates a difficulty in continuously numbering problems throughout the lesson.
We distinguish between two cases:

CASE 1:
If the number of assigned CPs is completely unknown, code the unknown number of CPs as CPn. The in-point of CPn is the same as the in-point of CPSU and the out-point of CPn usually is the same as the out-point of CPSW. Number the next problem(s) following the CPn segment as n+1, n+2 (on your transcript).

PASS 2 CC	IP 1	IP 2	CPSU	CPSW	IP n+1	IP n+2
PASS 3 CPs			CPn			

CASE 2:
If some of the assigned CPs are known mark for those CPs the in-and out-points and number them as usual. Code the CPs whose number is unknown as CPn. Number the next problem(s) following the CPn segment as n+1, n+2 (on your transcript).

PASS 2 CC	IP 1	IP 2	CPSU	CPSW	CPCW	IP n+1
PASS 3 CPs			CP3			
			CP4			
			CP5			
			CPn			

Note:
If there are several sets of CPs containing an unknown number in one lesson, code the first set as CPn, the second set as CPn+k, etc.

3.2 Pass 3 Coder Protocol

47. Mark the in-point and out-point of each Concurrent Problem (CP).
48. Fill in the "Content Activity" columns of the Lesson Table.
49. Enter all of the codes from Passes 1-3 into vPrism.
50. Fill in the "Time" column of the Lesson Table.

3.3 Pass 3 Transcript Marking

- Draw a line in the third column (left of transcript) to mark where CPs occur.
- Write in or circle the exact time of each shift in the text.
- Use the following symbols in pass 3.

PS1 / TR1	Underline the PS and TR of each CP in the text, and number them with the same number as their CP. If a PS is written on the board or overhead (and not included in the lesson transcript), write it in the transcript at the appropriate lesson time for easy future reference.
CP 1-7 |	Draw a vertical line in column three to mark the time where CPs occur. Number each CP consecutively (that is, including IPs). E.g. Number the CPs 1-7 if there are seven CPs; number them 1-n if the number of CPs is unknown.
● > CP	Draw a dot on the line to indicate where the CP ends in the segment. (i.e. when a CP ends, mark the text at the spot with > at where it exactly ends, and also put a dot on the line to indicate the change)

Chapter 4. PASS 4: CONTENT OCCURRENCE CODES

Most codes marked to this point have been coverage codes. In this pass, we will be marking occurrence codes. To refresh your memory of what occurrence codes are, please refer to the Introduction.

There are two types of occurrence codes in this Pass: General and Special Case. General occurrence codes can be applied anywhere in the lesson. Special case occurrence codes can only be applied during specific content activity segments.

All occurrence codes must be marked with in-points. Only one, Non-Mathematics Within Problems (NMWP), will be marked with out-points.

Notes:

- The in-point should be marked at the beginning of the discussion that contains the occurrence code. That is, once you find an occurrence code, mark the in-point to provide *just enough* context for that occurrence code to be easily understood.
- It sometimes happens that two occurrence codes of the same type occur close together in time. If the break between them is ***less than 2 minutes***, code them together as a single occurrence. (The break is defined as the time between the end of the first and the beginning of the second.) In this situation, the in-point of the code will be the in-point of the first occurrence.

Addition 4-26-2000

- For ALL occurrence codes: There may be multiple occurrences of the same occurrence in quick succession. To determine how many to mark, check the time of the break between *adjacent* occurrences. That is, determine whether the break between *occurrence 1* and *occurrence 2* is greater than 2 minutes, and whether the break between *occurrence 2* and *occurrence 3* is greater than 2 minutes. Do not measure the break between *occurrence 1* and *occurrence 3*.

- Occurrence codes can be applied anywhere that there is public interaction (including public talk in CI5 segments).

4.1 General Occurrence Codes

4.1.1 Assignment of Homework (AH)

Definition: The teacher assigns homework for the students to complete after the lesson ends. Mark the in-point when the teacher *announces* that a particular assignment is homework. This means that the task itself may not be stated by the teacher. For instance, if the teacher writes an assignment on the blackboard during CPSW, doesn't refer to it until CPCW, and then simply says, "Your homework for tonight is on the board," you'll mark the AH at the teacher's announcement.

Examples:
M-AU-004 29:33-30:01
M-HK-031 34:51-36:43

<u>Addition/Clarification to the coding manual: 4.1.1 Assignment of homework (AH)</u>

03/10/00

The teacher assigns homework for the students to complete after the lesson ends. Two different types of homework assignment may occur:

- The teacher assigns (a) specific problem(s) that have to be completed by all students, e.g. "For your homework please do problems 2 though 5 on page 124 in your textbook" and "Since we have no more time finish the problems at home."
- The teacher encourages students to study or review certain topics or concepts, e.g. "Please review for the test next week," "If you feel you need more practice there are more problems of this type on page 154 in your book" and "Go over the proof we did today one more time and be able to explain it." This type of assignment has an optional character. It is usually the students' responsibility to assess their understanding of the material in deciding whether to complete the assignment.

Note: The teacher's offer for private re-instruction at lunch time or after school is not coded as homework: "If you feel you still have questions on this see me during lunch time."

4.1.2 Goal Statement (GS)
Definition: Explicit verbal or written statements made by the teacher about the specific mathematics topic that will be covered in today's lesson. The topic must be the mathematics that students will learn in the entire lesson, or in a large part (that is, more than a third) of the lesson.

Examples:
FT-CZ-03 6:56-7:47
M-CZ-007 19:15-19:36
M-CZ-021 1:53-1:58

4.1.3 Historical Background (HB)

Definition: The teacher and/or the students connect mathematical content to its historical background (e.g., Pythagoras as the originator of a mathematical theorem).

Example:
FT-SW-063 11:05-12:35

4.1.4 Outside Interruptions (OI)

Definition: An outside interruption is any incident that disrupts classroom activities, such as announcements over the intercom, fire drills, a teacher remarking on a student(s) late arrival, or some individual from outside requiring the teacher's attention.

Notes:

- Even if an announcement over the intercom doesn't appear to disrupt the class, it should be marked as an OI.

<u>Addition/Clarification to the coding manual: 4.1.4 Outside Interruptions (OI).</u>

03/09/2000

- Any occurrence of an announcement over the intercom or **instance of the telephone ringing** should be marked, **even if it occurs during CI 5 (private work)** and/or it doesn't appear to disrupt the class.

- If a student enters the classroom late, only mark this as an OI if the teacher comments about it.

Examples:

FT-AU-04	1:19:51-1:21:06
Z-FT-NL-0049	24:01-24:17
M-US-013	18:24-18:26

4.1.5 Summary of Lesson (SL)

Definition: A summary of the mathematical content of the current lesson. These statements refer to work that has been completed during the lesson, or describe the main point of the lesson. The summary should occur near the end of (the public portion of) the lesson.

Examples:

M-HK-025	34:34-36:04
M-HK-047	32:57-34:00

4.2 Special Case Occurrence Codes

These Special Case Occurrence Codes can only be applied during specific Content Activity segments.

4.2.1 Non-Mathematics Within Problems (NMWP)[22]

Definition: A Non-Mathematics Within Problem segment is a period of time of AT LEAST 30 SECONDS that contains no mathematical content. That is, there is no opportunity for students to learn mathematics.

This code can occur only during IPs, CPSUs, CPCWs, CPM, or CPSWs (during a public announcement).

Mark both in-and out-points.

Note:

- Non-Mathematics Within Problems (NMWP) is conceptually the same as a Non-Mathematics (NM) segment.
- To qualify as an NMWP the Non-Mathematics must be the primary activity for the majority of students. The example M-AU-050 (14:56-15:52) would not be coded as an NMWP because working on problems is the primary activity and taking roll is a secondary activity.
- An Outside Interruption (OI) might also be coded as an NMWP, if it meets the definition.

Example:

M-NL-020 20:15-21:20 (ignore segment from 20:42-20:45)

4.2.2 Real Life Connection/Application - Non Problem (RLNP)

Definition: The teacher and/or the students explicitly connect or apply mathematical content to real life/the real world/experiences beyond the classroom. For example, connecting the content to books, games, science fiction, etc.

This code can occur only during Non-Problem (NP) segments.

Example:

M-HK-030 4:56-5:45

[22] Non-Mathematics Within Problems is not a separate code, but rather a means of identifying extended non-mathematical segments that occur during periods of time marked as problems. These segments are identical in nature to those marked as Non-Mathematics in Pass 2 (see section 2.1). The time spent on NMWP will be added to the time spent on NM (outside of problems) in order to obtain the correct total non-mathematics time.

4.3 Pass 4 Coder Protocol

- Mark all occurrence codes with in-points.
- Mark Non-Mathematics Within Problems (NMWP) with both in- and out-points.
- There is no minimum time requirement for occurrence codes, except for NMWP.
- If an occurrence code appears **within 2 minutes** of the same occurrence code, combine them as a single occurrence code and mark them as 1 occurrence.
- Occurrence codes can be applied anywhere that there is public interaction (including public talk in CI5 segments).

The codes to be applied in Pass 4 are:

General	
AH	Assignment of Homework
GS	Goal Statement
HB	Historical Background
OI	Outside Interruption
SL	Summary of Lesson
Special Case	
NMWP	Non-Mathematics Within Problems • Apply only to IP, CPSU, CPCW, & CPSW segments. • Must last 30 seconds or more. • Mark out-point.
RLNP	Real Life Connection /Application • Only apply to NP segments.

4.4 Pass 4 Transcript Marking

AH [*For the remaining questions, go home and finish them…..*	Use brackets to indicate the in-point of the occurrence code in the text; label the category beside the brackets
….so the next step in this problem is to subtract 5 from both sides. **NMWP [***Oh. Before I forget. Those of you who haven't yet bought tickets for Saturday's Homecoming dance, please do so by Thursday. I'm sure it'll be a lot of fun. It was fun last year, wasn't it? So don't miss out. Be sure to bring your money for the tickets by Thursday***.]** **NMWP** *So we were subtracting 5 from both sides, right?*	For **NMWP**s, use brackets to indicate the in- and out-points; label the category beside the brackets

Chapter 5. PASS 5: PROBLEM-LEVEL CODES

The goal of Pass 5 is to more closely examine what happens during problems. The following 15 codes should be applied to all types of problems as coded in Pass 2 (IPs, CPs, AOs).

5.1 Homework (H)

Definition: Code whether each problem is designated as homework.

Mark one of the following choices:

0 = Not a homework problem.
1 = Previously assigned as homework to be completed for today's lesson.
2 = Assigned today as homework to be completed for a future lesson.

Examples:

- NL-057, 3:46 "Homework: forty-two through fifty. Get it out in front of you. We are not going to discuss everything, just a couple of problems…" (code as 1)
- US-056, CPs 11-25 (see 30:20; code as 2)

5.2 How Many Students (HS)

Definition: Code whether the problem is intended for all students to work on in this lesson, or just a specified group of students.

Mark one of the following choices:

1 = all students
2 = fewer than all students

Notes:

- "Fewer than all students" applies when the class is divided into groups, and each group does a different problem or set of problems. The groups might be pairs of students, all the boys in the class, etc.
- "All students" applies when the whole class is expected to work on the problem, or follow along as someone else works on the problem. For example, when the class watches or listens to the teacher or a student solve the problem.

Examples:

- The teacher assigns problems 1-10 to all students and assigns 11-15 to those who finish quickly. Problems 1-10 are for all students. Problems 11-15 are for fewer than all students.

5.3 Required or Optional (RO)

Definition: Code whether each problem presented to the students was required or optional.

Mark one of the following choices:
1 = required
2 = optional

Example:

- The teacher assigns problems 1-10 to all students and assigns 11-15 to those who finish quickly. Problems 1-10 are required. Problems 11-15 are optional.
- It may be helpful to describe possible scenarios with combinations of the HS and RO codes:

		RO:	
		Required = 1	Optional = 2
HS:	All students = 1	Everyone solves problems 1-10.	
	Fewer than all students = 2	Students are split into two groups. One group solves problems 1-5, another solves 6-10.	Students who are fast to complete problems 1-10 are given the choice to continue onto problems 11-15.

5.4 Problem Context (PC)

Definition: Code the context within which the problem set-up or statement is presented. When there is not enough information to make a coding decision, code the problem as "99."

Addition/Clarification to the Coding Manual - 5.4 Problem Context (PC)

09/01/00

If additional materials are missing, you **MUST** code PC as "99." Do not use information available from the video, or make assumptions about what might appear on the additional materials.

Mark one of the following choices[23]:

1 = The problem set-up or statement is presented using mathematical language or symbols only
2 = The problem set-up or statement is presented using a context that contains more than mathematical language or symbols but is not a story
3 = The problem set-up or statement is presented as a story
99 = *missing*

Notes:

- A story contains narrative that is critical for solving the problem. Often stories contain characters and events and there is often a present or upcoming action. Stories tend to be 2 or more sentences.
- If a problem is integrally related to a story from a prior problem, code it as a "3", even if the story is not repeated. This often occurs on worksheets, where a story is presented and then a series of related questions are asked. It may also occur when the teacher presents problems in a similar manner verbally.
- References to or drawings of standard mathematical 2-D and 3-D shapes are considered mathematics language and symbols. They should be coded as "1" unless they are accompanied by an illustrative example or story (e.g., "this shape is like a milk carton")

<u>Addition/Clarification to the Coding Manual - 5.4 Problem Context (PC)</u>

9/29/00

Problem statements containing only numbers/symbols and measurement units **of any kind** (e.g., km, m, kg, ounce, minutes, hours, **monetary units, degrees**) should be coded as "1".

Examples:

- HK-006, "Find an estimated value by rounding off the numbers correct to 1 significant figure: $51.6 \times 11.71 \div 5.09$ (code as 1)
  HK-006, "Estimate the area of the stamp drawn below" (code as 2)
  HK-006, "Estimate the volume of the refrigerator depicted below" (code as 2)

- CZ-050, IP4 (code as 1), IP5 (code as 2), IP6 (code as 3)

- Graph the following equation: y=2x+37 (code as 1)
  "Graph the result of our long jump trials" (code as 2)
  "Karen is collecting data on the amount of time she spend driving to and from work on a typical day. For one week she records her travel times. Draw a graph to illustrate how her travel time varies by day of the week." (code as 3)

- Find the volume of a given cube. (code as 1)

[23] Coding choices 2 & 3 will be combined when computing reliability and running analyses using this code.

- Water is poured to fill up 3/4 of a given cube. Find the volume of the water. (code as 2)

- Jen has a glass of soda, with a diameter of 9 cm. Before drinking however, she decides to remove the ice from the glass. Assume that there are two perfect cubes of ice, with sides measuring 2cm. If she removes them, what will be the reduction in the height of the soda in her bottle? (code as 3)

5.5 Real Life Connection (RLC)

Definition: Code whether the problem is connected to a situation in real life. Real life situations are those that students might encounter outside of the mathematics classroom. These might be actual situations that students could experience or imagine experiencing in their daily life, or game situations in which students might have participated.
Code all AOs as "98."
When there is not enough information to make a coding decision, code the problem as "99."

> Addition/Clarification to the Coding Manual - 5.5 Real Life Connection (RLC)
>
> 09/01/00
>
> If additional materials are missing, you **MUST** code RLC as "99." Do not use information available from the video, or make assumptions about what might appear on the additional materials.

Mark one of the following choices:

0 = no real life connection

1 = problem statement or set-up

The problem statement or set-up contains a real life connection.

2 = working on only

Neither the problem statement nor the set-up contains a real life connection, but a connection is brought into the discussion while the problem is worked on or discussed. In this case, noting the similarity between the problem and situations that are confronted outside of school often provides the relevant information.

Addition/Clarification to the Coding Manual - 5.5 Real Life Connection (RLC)

10/23/00

The following sentences apply just to coding option "2" (working on only):
The real life connection must occur during public interaction time. "Public" means all CI patterns except CI5 (unless a public announcement is made during CI5).

98 = *code doesn't apply because the problem is an AO*
99 = *missing*

Notes:

- References to or drawings of standard mathematical 2-D and 3-D shapes are not considered to be real life connections. They should be coded as "0" unless they are accompanied by an illustrative example or story (e.g., "this shape is like a cereal box").
- Problems containing only numbers/symbols and measurement units (e.g. km, m, kg, ounce, minutes, hours) should be coded as "0".
- If a problem is integrally related to a real life connection contained in a prior problem, code it as a "1", even if the real life connection is not repeated. This often occurs on worksheets, where a real life connection is presented and then a series of related questions are asked. It may also occur when the teacher presents problems in a similar manner verbally.

Examples:

- CZ-050, IP5 (code as 1), IP6 (code as 1), IP4 (code as 2)

5.6 Forms of Representation

For each problem code the forms of representation used **at any point in the problem**. Mark whether each of the following forms is evident.

5.6.1 Graphs (GR)

Definition: Code whether one or more graphs (bar graphs, line graphs and so on) are present in the problem. They can either be part of the problem statement, used in the solution process, or mentioned in some way during the problem.

Code all AOs as "98."
When there is not enough information to make a coding decision, code the problem as "99."

Addition/Clarification to the Coding Manual - 5.6.1 Graphs (GR)

09/01/00

If additional materials are missing, you **MUST** code GR as "99." Do not use information available from the video, or make assumptions about what might appear on the additional materials.

Mark one of the following choices:

0 = no graphs
1 = one or more graphs
98 = code doesn't apply because the problem is an AO
99 = *missing*

Note:

- If the teacher indicates that students should draw a graph, code this as a graph present in the problem.

Example:

- HK-033, IP7 (16:17-22:25) (code as 1)

5.6.2 Tables (TA)

Definition: Code whether one or more tables are present in the problem. They can either be part of the problem statement, used in the solution process, or mentioned in some way during the problem.

A table is an arrangement of numbers, signs, or words that exhibits a set of facts or relations in a definite, compact, and comprehensive form. Typically, the rows and/or columns of a table are labeled and have borders.

Code all AOs as "98."
When there is not enough information to make a coding decision, code the problem as "99."

Addition/Clarification to the Coding Manual - 5.6.2 Tables (TA)

09/01/00

If additional materials are missing, you **MUST** code TA as "99." Do not use information available from the video, or make assumptions about what might appear on the additional materials.

Mark one of the following choices:

0 = no tables
1 = one or more tables
98 = code doesn't apply because the problem is an AO
99 = *missing*

Note:

If the teacher indicates that students should draw a table, code this as a table present in the problem.

Example:

- HK-059, CPs 7-11 (see 17:29; code as 1)

5.6.3 Drawings or Diagrams (DD)

Definition: Code whether one or more drawings or diagrams are present in the problem. They can either be part of the problem statement, used in the solution process, or mentioned in some way during the problem.

To count as a drawing or diagram, the drawing must include information relevant for solving the problem. It does not count as a drawing if the symbols are spatially arranged to highlight certain features, if arrows are pointing to certain symbols to highlight them, or if arrows or other nonstandard marks are used in place of standard symbols (e.g., an arrow is used instead of an equal sign).

Code all AOs as "98."
When there is not enough information to make a coding decision, code the problem as "99."

> Addition/Clarification to the Coding Manual - 5.6.3 Drawings or Diagrams (DD)
>
> 09/01/00
>
> If additional materials are missing, you **MUST** code DD as "99." Do not use information available from the video, or make assumptions about what might appear on the additional materials.

Mark one of the following choices:

0 = no drawings or diagrams
1 = one or more drawings or diagrams
98 = code doesn't apply because the problem is an AO
99 = *missing*

Notes:

- If the teacher indicates that students should make a drawing or diagram, code this as a drawing or diagram present in the problem.
- Maps count as drawings/diagrams.
- A "motivational" drawing/diagram doesn't count. The drawing/diagram has to provide some information needed to work on the problem.
- Drawing a "tree," (such as a factor tree or a probability tree) does ***not*** count as a drawing or diagram.

Example:

- US-056, CPs 19-21 (see 36:53; code as 1)

5.7 Physical Materials (PM)

Definition: Code whether materials are used/manipulated when presenting or solving each problem. Materials can be use/manipulated by the teacher and/or students, during either public or private interaction.

These materials include:

- measuring instruments (e.g., ruler, protractor, compass)
- special mathematical materials (e.g., tiles, tangrams, base-ten blocks)
- geometric solids
- cut-out plane figures (e.g., triangles and trapezoids cut from paper).

Papers, pencils, calculators and *computers* are **not** included here.

Code all AOs as “98.”
When there is not enough information to make a coding decision, e.g. materials are missing, code the problem as “99.”

Mark one of the following choices:

0 = no materials manipulated
1 = teacher manipulates materials
2 = students manipulate or have the opportunity to manipulate materials
3 = both teacher and students manipulate materials
98 = *code doesn't apply because the problem is an AO*
99 = *missing*

Notes:

- The use of measuring instruments for non-measurement purposes, such as underlining or drawing straight lines with a ruler, or drawing a circle of unspecified measure with a compass, does **not** count. If it is unclear whether or not measuring instruments are being used to measure, assume they are **not**.
- Using graph paper to plot points on the coordinate plane does not count, but using graph paper to measure the surface area of a student’s hand, or to find shapes with a

common area of 12 cm^2 does. That is, using graph paper as a measuring tool counts as a use of physical materials.

Examples:
- HK-027, IP1, 23:47 (code as 1)
- JP-003, IP1, 37:00 (code as 2)\

Addition/Clarification to the Coding Manual - 5.7 Physical Materials (PM)
08/29/00

To be coded as a 1, 2, or 3 materials must actually be used by the teacher or students to demonstrate, show, or do something mathematical. Do not code the problem as a 3 if the teacher only prepares or distributes materials, or assists students to obtain materials.

5.8 Degree of Student Choice in Selecting Solution Method (SC)

Definition: Students may be allowed and even encouraged to use a method of their choice, they may be provided with options from which to choose, or it may be impossible to determine from the video the degree of student choice in selecting solution procedures. A teacher's statement about student choice will usually occur during public interaction but may occur during private interaction.

When there is not enough information to make a coding decision, code the problem as "99."

Addition/Clarification to the Coding Manual - 5.8 Degree of Student Choice in Selecting Solution Method (SC)

09/01/00

If additional materials are missing, you **MUST** code SC as "99." Do not use information available from the video, or make assumptions about what might appear on the additional materials.

Mark one of the following choices:

1 = **open choice**

The teacher (or textbook) *explicitly states* that students are allowed, encouraged, or requested to use whatever method they wish to solve the problem. No constraints are placed on the methods. Some possible methods may have been demonstrated or identified, but it is clear that students are free to use any method they wish.

If the teacher does not explicitly state that students can use any method they wish, but (a) students share answers (that are accepted by the teacher) that clearly come from different solution methods, or (b) the teacher invites students to share an additional method, but no student actually shares, code the problem as open choice.

If the problem was started in a previous lesson or as homework, and the teacher explicitly states that students had an "open choice" of solution methods, code it as open choice.

2 = **limited choice**

Two or more solution methods are presented or identified before the problem is solved and students are explicitly asked to use one of <u>these</u> methods.

If students are given what seems to be an open choice and later in the problem it becomes apparent that their choice was in fact restricted, code this as a limited choice.

If the problem was started in a previous lesson or as homework, and the teacher explicitly states that students had a "limited choice" of solution methods, code it as limited choice.

3 = **no choice or nothing made explicit about choice of solution method AND the problem is first assigned in this lesson**

Mark this category if:
1) there is insufficient information to code the problem as open choice or limited choice **OR** that it is clear that students are supposed to use a particular method, **AND**
2) the problem is first assigned in this lesson

Examples:
- The teacher demonstrates one method and asks students to solve a similar problem.
- The teacher assigns a problem without discussing appropriate methods and then only one method or just the target result is presented.
- The teacher presents several methods and tells students which one(s) they **must** use.

4 = **no choice or nothing made explicit about choice of solution method**

AND the problem was previously worked on as homework or in a prior lesson

Mark this category if:
1) it is unknown whether students were given an open or limited choice **OR** if it is clear that students were supposed to use a particular method, **AND**
2) the problem was previously worked on as homework or in a prior lesson

99 = **missing**

Examples:
- JP-007, IP2 (see 10:14; code as 1)
- CZ-037, IP4 (see 23:01, 23:07; code as 2)
- NL-057, IP1 (see 3:46; code as 4)

5.9 Proof/Verification/Derivation (PVD)

Definition: Code whether each problem is a proof, verification, or derivation.

<u>Addition/Clarification to the Coding Manual - 5.9 Proof/Verification/Derivation (PVD)</u>

10/23/00

Code whether each problem is **or contains** a proof, verification, or derivation.
E.g. JP 027, IP2

Proof is defined as the process of establishing the validity of a statement, especially by derivation from other statements in accordance with principles of reasoning.

Verification is defined as the act or process of ascertaining the truth or correctness of a rule, especially by examination or comparison.

Derivation is defined as a sequence of statements (as in logic or mathematics) showing that a result is the necessary consequence of previously accepted statements.

To qualify as a PVD:
- the TR must apply to a class of problems, not just a single problem, e.g. proof of the Pythagorean Theorem, or
- the TR is non-numeric and is arrived at through deductive reasoning (that is, moving from known properties or relationships to "new" ones by employing a careful sequence of general theorems or previously established 'truths".), e.g. prove that the sides of these two congruent triangles are equal.

When there is not enough information to make a coding decision, e.g. materials are missing, code the problem as “99.”

Mark one of the following choices:
- 0 = not a PVD
- 1 = PVD
- 99 = *missing*

Notes:
- PVDs might be found more often in geometry lessons than in algebra or arithmetic lessons.
- If the TR contains variables, the problem is likely to be a PVD. That is, the TR is likely to be a statement about the properties of geometric figures, algebraic expressions or trigonometric expressions. If the TR contains a numeric value, the problem is unlikely to be a PVD.
- Checking would not count as a PVD as it would only apply to a particular case.
- Problem statements that contain the word “proof” (common in CZ and HK lessons) are not necessarily PVDs by our definition.

Examples:
- Showing that $-b \pm \sqrt{b^2} -4ac / 2a$ is an expression that generates the solutions to equations of the form $ax^2 + bx + c = 0$ *is a PVD*.
- Showing that -6 and 1/2 are the solutions to $2x^2 +11x - 6 = 0$ *is not a PVD*.
- Showing that **any point** on a semi-circle forms a right angle with the endpoints of the diameter *is a PVD*.
- Showing that a **particular point** on a semi-circle generates a right angle when it is connected to the endpoints of the diameter *is not a PVD*.

5.10 Number of Different Numerical or Geometric Target Results (NTR)

Definition: Code the number of different numerical or geometric answers that are **publicly** presented or discussed (either by the teacher or the students) and are accepted by the class as being correct. *Public* means all CI patterns except CI5 (unless the TR is announced publicly during CI5). Don't count answers that are different forms of the same number (e.g., 7/5 and 1 2/5).

Addition/Clarification to the coding manual: 5.10 Number of Different Numerical or Geometrical Target Results (NTR)
08/31/2000

Code TR as a "0" if the target result is written in the textbook, on the worksheet, or on an answer key, but **not** publicly presented or discussed.

Addition/Clarification to the coding manual: 5.10 Number of Different Numerical or Geometrical Target Results (NTR)
09/01/2000

Answers that are mathematically equivalent count as 1 TR. For example,
$2x - 7 = 3$ and
$-7 + 2x = 3$
are a single, target result.

Addition/Clarification to the coding manual: 5.10 Number of Different Numerical or Geometrical Target Results (NTR)
09/08/2000

If the problem statement is unknown, you **MUST** code NTR as "99."

Addition/Clarification to the coding manual: 5.10 Number of Different Numerical or Geometrical Target Results (NTR)
10/31/2000

If the target result is publicly presented but not clear/visible/identifiable, you **MUST** code NTR as "99."

Mark the number of target results presented. For example:

0 = no TR presented
1 = 1 TR presented
2 = 2 TRs presented
3 = 3 TRs presented
etc….
99 = PS is unknown

Notes:

- The TR is the answer to the problem statement. Sometimes, different solution methods are presented that lead to the same TR. Count this as 1 TR. (Solution methods are descriptions of the steps that will produce the solution or target result. To count as a method, enough of the steps need to be described so that an attentive student would be able to follow the description and use the steps to produce the solution.)
- Interdependent or partial TRs (as marked in Pass 2) count as 1 TR for this code. For example completing a value table counts as 1 TR.
- If data collection generates TRs that have the same numeric value, count these as separate TRs. For example, if students measure their hands and two students have the same measurement, count each of them as a TR.
- If the teacher accepts both "3.22" and "3" (as a rounded representation of 3.22), count this as 1 TR.

Example:

- US-056, IP7 (see 21:19-22:02; code as 7)

5.11 Number of Different Forms of the Target Results (DFTR)

Definition: Code whether more than one form of the TR is publicly presented and accepted by the class as being correct. If multiple TRs are publicly presented and accepted, code whether *any* of the single TRs is presented in more than one form. *Public* means all CI patterns except CI5 (unless the TR is announced publicly during CI5).

<u>Addition/Clarification to the coding manual: 5.11 Number of Different Forms of the Target Results (DFTR)</u>
09/08/2000

If the problem statement is unknown, you **MUST** code DFTR as "99."

<u>Addition/Clarification to the coding manual: 5.11 Number of Different Forms of the Target Results (DFTR)</u>
10/31/2000

If the target result is publicly presented but not clear/visible/identifiable, you **MUST** code DFTR as "99."

Mark the number of target results presented. For example:

0 = no TR presented
1 = 1 form of the TR
2 = > 1 form of the TR
99 = PS is unknown

Note:

- The TR is the answer to the problem statement. Sometimes, different solution methods are presented that lead to the same TR. Count this as 1 form of the TR. (Solution methods are descriptions of the steps that will produce the solution or target result. To count as a method, enough of the steps need to be described so that an attentive student would be able to follow the description and use the steps to produce the solution.)
- If the teacher accepts both "3.22" and "3" (as a rounded representation of 3.22), count this as more than one form of the TR.

Examples:

- US-056, IP10 (6/5 and 1 1/5)
- JP-003, IP2 ("opposite angles" and "facing angles")
- .25 & $\frac{1}{4}$

Addition/Clarification to the coding manual: 5.11 Number of Different Forms of the Target Results (DFTR)
09/01/2000

- 2x - 7 = 3 & -7 + 2x = 3 are 2 forms of a single, mathematically equivalent target result

5.12 Length of Working-On (LWO)

Definition: Code whether each problem is *publicly worked on* for at least 45 seconds. *Public* means all CI patterns except CI5. *Working on* the problem includes all public talk directly related to the problem, even if that time is also relevant to another problem.

Do not include:

- time spent assigning the CPs if that time includes no mathematical discussion.
- time spent in CI1 when the work is actually private. (This will be the case if the private work was less than 1 minute and therefore the segment was too short to shift to CI5.)

Mark one of the following choices:

0 = less than 45 seconds
1 = greater or equal to 45 seconds

Notes:

- To determine whether CPs are publicly worked on for at least 45 seconds, look over the public CP phases in the transcript and mark the times devoted to each CP.
- When totaling the time spent on a CP, include only discussions that occur between the in- and out-points of that CP.
- When totaling the time spent on an IP, include all public discussion between the in- and out-points of the problem.
- Sometimes problems share a common discussion time. In order for that time to count toward the 45 seconds of public working-on time for a given problem, the problem must be explicitly referenced by the teacher for at least 45 seconds.

Addition/Clarification to the coding manual:5.12Length of Working-On (LWO) 11/10/2000 ▪ When determining the length of working-on time of a problem during CI3, include the time when the problem is first publicly worked on (verbally or in a written form) till the out-point of the problem. The public written presentation of the problem counts, regardless of whether or not there is any public discussion. ▪ If several CPs are worked on simultaneously during CI3, then count the shared working on time towards each CP. Scenario:
CI3
CP1 (20 sec)
CP2 (20 + 15 sec)
CP3 (20 + 15 + 33 sec)

5.13 Facilitating Exploration (FE)

Code whether each problem meets the requirements for Facilitating Exploration. This code has 3 decision points. To qualify as Facilitating Exploration, there must be:

- An open choice (SC = 1) or limited choice (SC = 2)
- A public presentation of 2 or more solution methods◊ (at least one of which must be provided by a student)
- A discussion that includes at least one of the following
- a critique. This means discussing the strengths/weaknesses of a particular solution method/procedure.
- an extended examination. This means a lengthy discussion related to a particular solution method/procedure.
- a comparison of the solution method. This means, in discussing one method, a verbal reference is made to another method

When the problem is an AO **or** is less than 45 seconds (i.e., LWO = 0) **or** its target result is not presented/discussed publicly (i.e., NTR = 0), code the problem as "98."

Mark one of the following options:

0 = doesn't qualify as FE
1 = qualifies as FE, but there is **no** comparison made
2 = qualifies as FE, and there is a comparison made
98 = *not applicable*

- *the problem is an AO,* ***or***
- *the problem is less than 45 seconds (i.e., LWO = 0),* ***or***
- *the target result is not presented/discussed publicly (i.e., NTR = 0),* ***or***

Addition/Clarification to the coding manual 5.13 Facilitating Exploration (FE)

9/8/2000

G. the information necessary to code Student Choice is missing (i.e., SC = 99)

Note:

- ◊A solution method is a sequence of steps that is used to produce a target result. The sequence connects the problem statement and the target result. To count as a method, enough of the steps need to be described so that an attentive student would be able to follow the description and use the steps to produce the solution. Every problem that is solved (correctly or incorrectly) has a solution method, but some are more visible than others.

  Example:
  - JP007, IP1 (code as 2)

5.14 Coder Protocol

For each lesson you code, you will complete a Pass 5 codesheet. These will be provided for you, with problem information already exported into the table (see Angel).

Record all Pass 5 codes on the hardcopy of the codesheet. When complete, note your progress in your country's "Lesson Tracking" document, place the original in the designated folder to be used for data entry, and place a copy in the relevant lesson folder in the file cabinet.

5.15 Pass 5 Coding Cheat Sheet

Homework (H)

0 = not a homework problem
1 = previously assigned as homework to be completed for today's lesson
2 = assigned today as homework to be completed for a future lesson

How Many Students (HS)

1 = all students
2 = fewer than all students

Required or Optional (RO)

1 = required
2 = optional

Problem Context (PC)

1 = the problem set-up or statement is presented using mathematical language or symbols only
2 = the problem set-up or statement is presented using a context that contains more than mathematical language or symbols but is *not* a story
3 = the problem set-up or statement is presented as a story
99 = missing

Real Life Connection (RLC)

0 = no real life connection
1 = problem statement or set-up
2 = working on only
98 = code doesn't apply because the problem is an AO
99 = missing

Graphs (GR)

0 = no graphs
1 = one or more graphs
98 = code doesn't apply because the problem is an AO
99 = missing

Tables (TA)

0 = no tables
1 = one or more tables
98 = code doesn't apply because the problem is an AO
99 = missing

Drawings or Diagrams (DD)

0 = no drawings or diagrams
1 = one or more drawings or diagrams
98 = code doesn't apply because the problem is an AO
99 = missing

Physical Materials (PM)

0 = no materials manipulated
1 = teacher manipulates materials
2 = students manipulate or have the opportunity to manipulate materials
3 = both teacher and students manipulate materials
98 = code doesn't apply because the problem is an AO
99 = missing

Degree of Student Choice in Selecting Solution Method (SC)

1 = open choice
2 = limited choice
3 = no choice or nothing made explicit about choice of solution method AND the problem is first assigned in this lesson
4 = no choice or nothing made explicit about choice of solution method AND the problem was previously worked on as homework or in a prior lesson
99 = missing

Proof/Verification/Derivation (PVD)

0 = not a PVD
1 = PVD
99 = missing

Number of Different Numerical or Geometric Target Results (NTR)

0 = no TR presented
1 = 1 TR presented
2 = 2 TRs presented
3 = 3 TRs presented
etc.

Number of Different Forms of the Target Results (DFTR)

0 = no TR presented
1 = 1 form of the TR
2 = > 1 form of the TR

Length of Working-On (LWO)

0 = less than 45 seconds
1 = greater or equal to 45 seconds

Facilitating Exploration (FE)

0 = doesn’t qualify as FE
1 = qualifies as FE, but there is **no** comparison made
2 = qualifies as FE, and there is a comparison made
98 = code doesn't apply because the problem is an AO, is less than 45 seconds, or its target result is not presented/discussed publicly

Unit ID	**Event**		**IN**			**OUT**			H	HS	RO	PC	RLC	GR	TA	DD	PM	SC	PVD	NTR	DFTR	LWO	FE
M-JP-007	**IP**	**3**	0	53	24	10	14	3															
M-JP-007	**IP**	**4**	10	14	3	31	48	23															
M-JP-007	**CP**	**5**	31	48	23	49	10	22															
M-JP-007	**CP**	**6**	31	48	23	49	10	22															
M-JP-007	**CP**	**7**	31	48	23	49	10	22															
M-JP-007	**CP**	**8**	31	48	23	49	10	22															
M-JP-007	**CP**	**9**	31	48	23	49	10	22															
M-JP-007	**CP**	**10**	31	48	23	49	10	22															

5.16 TIPS FOR CODERS: A Pass 5 Checklist

Please be sure that your Pass 5 coding has followed these rules.

If….	Then….
H=1	SC = 4 or 99
PC = 2 or 3	RLC ≠ 0
RLC = 1	PC ≠ 1
PC = 99	RLC, GR, TA, DD & SC = 99
SC = 99	FE = 98
SC = 3 or 4	FE ≠ 1 or 2
NTR = 0	FE = 98
DFTR = 0	FE = 98
NTR = 99	FE = 98
DFTR = 99	FE = 98
NTR = 99	DFTR = 99
LWO = 0	FE = 98
AO	RLC, GR, TA, DD, PM & FE = 98 (regardless of whether or not materials are missing)
CPN	PC, RLC, GR, TA, DD, PM, SC, PVD, NTR, DFTR, = 99 LWO = 0 FE = 98

Chapter 6. PASS 6: CODES ABOUT RESOURCES, PROBLEMS, NON PROBLEM SEGMENTS & PRIVATE WORK

RESOURCES USED
MULTIPLE SOLUTION METHODS
PROBLEM SUMMARY
NON-PROBLEM SEGMENTS
PRIVATE WORK ASSIGNMENT
PRIVATE WORK SEGMENTS

In this Pass, we will look at the resources used in the lesson, further describe problems and non-problem segments, and closely examine what happens during private work.

6.1 Resources Used

Code whether the following resources are used in the lesson for mathematical purposes. The resources must be clearly identified by the teacher or visible on the videotape. The resources may be used by the whole class, a group, or an individual.

Note:

- If multiple resources are used simultaneously, code each resource as being used in the lesson.
- A single resource may be double-coded.

Examples:

- The teacher uses a ruler to draw a triangle on the chalkboard - code special mathematical material and chalkboard as "1".
- A special OHP calculator is used - code calculator and projector as "1".
- A teacher presents a computer simulation of the rotation of a 3-D model - code computer and special mathematical material as "1".
- Students use a calculator on the computer - code calculator and computer as "1".

6.1.1 Chalkboard (CH)

Definition: Code whether a chalkboard/whiteboard is used at any time in the lesson. If the teacher refers to something that has been written on the chalkboard (e.g., notes, definitions) code this a chalkboard use even if the information was not written during the videotaped lesson.

Mark one of the following options:
0 = Chalkboard not used
1 = Chalkboard used

Example:
- US-026, 05:57; HK-018, 05:33 (code as 1)

6.1.2 Projector (PRO)

Definition: Code whether an overhead projector, video projector, or computer projector is used at any time in the lesson.

Mark one of the following options:
0 = Projector not used
1 = Projector used

Example:
- US-026, 11:01; HK-018, 08:44 (code as 1)

6.1.3 Television or Video (TV)

Definition: Code whether a television or video is used at any time in the lesson. This includes prerecorded or live footage, film clips, etc. This does *not* include instances where a tv is used as a computer monitor or other projection device.

Mark one of the following options:
0 = Television or video not used
1 = Television or video used

- US-042, 07:56 (code as 1)

6.1.4 Textbook or Worksheet (TXW)

Definition: Code whether textbooks or worksheets (e.g., review sheets, study sheets, homework sheets) are used at any time in the lesson.

Mark one of the following options:
0 = Textbooks or worksheets not used
1 = Textbooks or worksheets used

Example:
- US-026, 05:03, HK-018, 06:19 (code as 1)

6.1.5 Special Mathematical Material (SMM)

Definition: Code whether there are any mathematical materials used for a mathematical purpose at any time in the lesson. These materials are usually commercially produced, however they can be pre-prepared by the teacher.

For example: special paper for graphing (i.e. paper with grids of common units used for drawing graphs), graph boards, Hundreds Tables, geometric solids, Base-ten blocks, rulers, measuring tape, compasses, protractors, and computer software that simulates constructions or models.

Write on the front page of the transcript each type of special mathematical material used in the lesson, and note the approximate in-point time(s). Also, list this information in the vPrism event note field for SMM.

Notes:

- Rulers used to draw mathematical figures count as SMM.
- Rulers used only to underline or highlight text do *not* count as SMM.
- Materials such as mathematics dictionaries, formula books, log books etc., count as SMM.
- Do not count models or materials made by the T or Ss in class. Do count models or materials made by the T prior to the lesson.
- Exclude calculators and computers. (Code them as CALC and COMP, respectively.)

Mark one of the following options:

0 = Special mathematical material not used
1 = Special mathematical material used

Example:

- US-026, 11:36; HK-018, 08:44 (code as 1)

6.1.6 Real-World Object (RWO)

Definition: Code whether real-world objects (e.g., cans, beans, toothpicks, maps, common geometric puzzles, dice, newspapers, magazines, springs) are used or shown at any time in the lesson for mathematical purposes. Real-world objects are those typically found outside the classroom.

Write on the front page of the transcript each type of real-world object used in the lesson, and note the approximate in-point time(s). Also, list this information in the vPrism event note field for RWO.

Notes:

- Include copies of actual newspaper or magazine articles, but exclude pictures of newspaper or magazine articles shown in textbooks, worksheets, OHPs, or elsewhere.

- Exclude pictures or drawings of real world objects shown in textbooks, worksheets, OHPs, or elsewhere.
- Exclude overhead projectors. (Code them as PRO.)
- Exclude rulers, compasses, protractors and measuring tapes. (Code them as SMM.)
- Exclude television and video. (Code them as TV.)
- Exclude calculators and computers. (Code them as CALC and COMP, respectively.)

Mark one of the following options:

0 = Real-world objects not used
1 = Real-world objects used

Example:

- US-026, 07:43 (code as 1)

6.1.7 Calculator (CALC)

Definition: Code whether calculators (i.e., regular calculators and graphing calculators) are used at any time in the lesson, and note whether or not they are used for graphing.

In order to code for calculator use you must either see calculators being used on the videotape, or hear a verbal reference related to the use of calculators in that lesson.

Mark one of the following options:

0 = Calculators not used
1 = Calculators used, not for graphing
2 = Calculators used, for graphing

Example:

- US-026, 14:17; HK-018, 38:22 (code as 1)

6.1.8 Computer (COMP)

Definition: Code whether computers are used at any time in the lesson.

Mark one of the following options:

0 = Computers not used
1 = Computers used

- HK-018, 08:44 (code as 1)

6.2 Multiple Solution Methods (MSM)

Definition: For each problem (IP, CP, AO), code whether more than one solution method is publicly presented (all CI patterns except CI5).

A solution method is a sequence of steps that is used to produce a target result. Every problem has a solution method but some are presented in more detail than others. The method might be presented in written or verbal form. A solution method can be presented solely by the teacher, worked out collaboratively with students, or presented solely by students.

Each solution method needs to use mathematically different steps. This means that the steps can not just be a sub-set of the steps from another method. The details of each step do not need to be made explicit and the target result does not even need to be re-calculated, but the key steps need to be described. Doing exactly the same steps in a different order does not count -- unless the teacher strongly emphasizes that they represent different solution methods.

Methods that are just referred to by names or labels do not count. Each solution method must be presented in enough detail so that an attentive student (who might have been absent recently) could follow the steps that are presented and use the method to produce the target result.

The teacher must accept each method as different and legitimate, rather than treating the one as a correction or elaboration of another.

Mark one of the following options:

0 = zero or one solution method publicly presented

1 = more than one solution method publicly presented, none was suggested by students

2 = more than one solution method publicly presented, at least one was suggested by students

98 = not applicable, because either:

- the problem is an AO
- CPN has been coded

Notes:

- "Suggesting a solution method" can range from naming the method (or providing a brief description of the first step) to actually presenting the method.
- If there are multiple TRs, and different solution methods are publicly presented for them, code this as MSM=1 or 2.
- If the teacher summarizes various solution methods generated by students during private work (and the teacher did not suggest the methods previously during the problem "set-up"), code this as MSM=2.
- Sometimes the teacher explicitly notes that the same problem will be solved using a different method, and this has been coded as a new problem. When this happens, the method for the second problem is not marked including multiple solutions because there is only one method presented for each problem. That’s OK. This is captured in another analysis.

Examples:

- HK035, IP4 (code as 1)
- JP007, IP1 (code as 2)
- CZ020, IP23 (code as 2)

- Solve 6x + 4 –2x = x + 16
  Student 1: 4x + 4 = x + 16; 3x + 4 = 16; 3x = 12; x = 4
  Student 2: 6x + 4 = 3x + 16; -12 = -3x; -4 = -x; 4 = x or x = 4 (different steps)
  (code MSM=2)

- Solve 6x + 4 –2x = x + 16
  Student 1: 4x + 4 = x + 16; 3x + 4 = 16; 3x = 12; x = 4
  Student 2: 3x = 12; x = 4 (fewer steps)
  (code MSM=0)

- "We could solve this system of equations by 'substitution' or by 'addition,' does everyone remember how? Yes? OK, let's look at the next one."
  (code MSM=0)

- "This problem we could solve like the last one, by getting the x on the left side of the equation, so let's look at the next one."
  (code MSM=0)

6.3 Problem Summary (PSM)

Definition: Code whether there is a summary for each problem. The summary can occur at any point in the lesson – during the problem, during a Non Problem segment, etc.

The summary might take the form of:

- a restatement of the major steps involved
- stating or pointing out an important or critical mathematical rule, principle, or procedure in the problem

Summary statements are typically made by teachers. They always occur **after the target result** is reached publicly.

When the problem is an AO or is less than 45 seconds (i.e., LWO = 0) or its target result is not presented/discussed publicly (i.e., NTR = 0), code PSM as "98".

Mark one of the following options:

0 = no summary
1 = summary
98 = not applicable, because either:

- the problem is an AO
- CPN has been coded

- the problem is less than 45 seconds (i.e., LWO = 0)
- the target result is not presented/discussed publicly (i.e., NTR = 0)

Notes:

- Statements that only repeat a Target Result or a simple step **immediately following the Target Result** marked in Pass 2 do not count as problem summaries (e.g. M-NL-027, IP5).
- Sometimes students publicly solve a problem (in written form or orally), and then the teacher goes over the problem again to confirm or correct what the student did. This should be coded as PSM=0.
- Students might ask the teacher to repeat a step in the problem. Code this as PSM=0 unless the teacher emphasizes that the step is a critical one.
- Sometimes an incorrect TR is presented publicly, and later corrected. Only code PSM=1 if the summary occurs after the corrected TR.
- Summaries that occur outside of a problem (e.g. in an NP segment or within another problem) must clearly relate back to the problem -- specifically, the problem statement or the target result. For example, when a general rule is given following a sequence of problems, there must be a clear reference back to a specific problem in order for that problem to be coded as PSM=1.
- For problems that have multiple TRs, only one target result needs to be summarized in order to code the problem as PSM=1.

Examples:

- M-HK-112; IP 4, code as "1",
- M-CZ-059, IP 4 , code as “1” . (Note: The summary occurs in the NP segment immediately following IP 4.)
- M-AU-006, IPs 5-8, code as “1”.

6.4 Types of Information or Activity in Non-Problem (NP) Segments

For every Non-Problem (NP) Segment code whether any of the following types of information or activity are present. Every NP Segment should include *at least one* of these 4 codes.

6.4.1 Contextual Information (CON)

Definition: Information presented during the NP segment provides some context for the mathematics work that takes place in the lesson. The contextual information must take one of the following forms:

- a goal statement (see definition for GS in Pass 4)
- a discussion of some historical background (see definition for HB in Pass 4)
- a real life example (see definition for RLNP in Pass 4, RLC in Pass 5, & RWO in Pass 6)
- connecting particular mathematical ideas discussed or worked on in the current lesson, to a past or future lesson. Connections to the past always count as long as a particular

mathematical idea is referenced. Connections to the future include agenda setting, but do *not* include assigning homework or tests.

Mark one of the following options:

0 = No contextual information presented
1 = Contextual information presented

Note:

- If GS, HB or RLNP has been coded in the NP segment, code the segment as CON=1.

Examples:

- M-US-068, 10:11 and 32:20, code as "1".
-

6.4.2 Mathematical Concept/Theory/Idea (CTI)

Definition: There is information presented during the NP segment regarding a particular mathematical concept, theory or idea. The information about the concept, theory or idea might be presented in varying degrees of detail. However to qualify, it must involve more than simply naming the concept, theory or idea.

The information might take the form of:

- an introduction of a new concept/theory/idea,
- a review of a mathematical concept/theory/idea previously learned,
- a summary of concepts/theories/ideas worked on in the current lesson, or
- an illustrative example that highlights a mathematical concept/theory/idea.

Mark one of the following options:

0 = No information related to a mathematical concept/theory/idea presented
1 = Information related to a mathematical concept/theory/idea presented

Notes:

- The discussion of a particular mathematical formula or theorem in an NP segment (which is necessarily outside of the context of a problem) would be marked as 1.
- If students are asked to read information about a mathematical concept, theory or idea, during the NP segment, code this as "1" (e.g., M-NL-073, 23:43).

Examples:

- M-CZ-013, 02:01, code as “0.”
- M-CZ-013, 11:32 and 16:24, code as “1.”
- M-US-068, 10:11 and 32:20, code as ".1"

6.4.3 Activity (AC)

Definition: The NP segment contains an activity. Discussion of an activity counts, as long as the activity takes place in the current lesson. Activities will be specifically related to mathematics in some way but not to any particular mathematical problem (i.e. IP or CP).

The activity might take the form of:

- A game (e.g. Bingo, Hangman, trivia game, flashcard drill, word search)
- Any task that does not involve problems (e.g. worksheet page not coded as containing problems).

✐ Mark one of the following options:

0 = No activity presented
1 = Activity presented

Notes:

- If students write down a homework assignment in their journal or write down notes, do not count this as an "activity" - code this as "0".
- Showing students how to use a calculator or computer during a NP segment does not count as AC - code this as "0" (e.g., M-SW-283, 17:14).

Examples:

- M-AU-013, 2:49 & 48:24, code as "1".

6.4.4 Announcing or Clarifying Homework or Test (HT)

Definition: The teacher announces or clarifies a future homework assignment or a test.

Mark one of the following options:

0 = No announcing/clarifying homework or test
1 = Announcing/clarifying homework or test

Note:

- If AH (see Pass 4) has been coded in the NP segment, code the segment as HT=1.

Examples:

- M-US-068, 02:21, code as "1".

6.5 Private Work Assignment (PWA)

Definition: For each CI4 & CI5 segment (see sections 1.2.2.3 & 1.2.3.1), code whether students work on an assignment that requires them to repeat steps, do more than repeat steps, or is a mix. For CI4 segments, code the assignment that students work on privately.

The assignment can include many problems, one problem, or just part of a problem. (If the assignment doesn't include any problems, code as "98".)

Use questions 5 & 6 from the Teacher Questionnaire regarding what is "mainly new" and "mainly review" to help make coding decisions. Refer also to the additional materials and lessons tables to help determine what the assignment is. (Most teacher questionnaires and additional materials are located on Video 5 → Scanned Materials.)

For each CI4 & CI5 segment mark the in-point and one of the following choices:

1 = not able to make judgement
Use this coding option when it is not clear whether the assignment is "repeating steps" or "more than repeating steps".

For example, you might not be able to make a coding decision when:

a) Students commence work on a set of problems without any introduction by the teacher, and there is no other indication about whether the problems are new or review. For example, a lesson that follows a weekly work plan (e.g., M-NL-054). OR,

b) CPN has been coded within the segment (e.g., M-NL-014). (Assignments containing CPN could be coded as "mix" if at least one problem is "repeating steps" and one problem is "more than repeating steps".)

2 = repeating steps

The students work on an assignment that requires them to repeat steps, or sequences of steps, that they have already done/seen in a previous lesson, or in the current lesson. The mathematical concept(s) and solution method(s) are known to the students.

If the teacher states that the assignment is "practice/review", either during the lesson or on the Teacher Questionnaire, this is a strong indication that the assignment is "repeating steps".

Sometimes the exact steps for how to do an assignment are shown in the textbook/worksheet (e.g. M-AU-001, 27:58). In these cases, code the assignment as "2".

Sometimes a "worked example" is shown in the textbook/worksheet, and the assignment is to do problems with the same steps as the example. Look to see if the teacher points out the "worked example" or if the class works through similar problems publicly. If so, code it as "2". If there is no reference to the worked example, and the assignment would otherwise be coded as "more than repeating steps", code it as "3".

3 = more than repeating steps

The students work on an assignment that requires them to do *more than* simply repeat steps or sequences of steps that they have already done/seen. The mathematical concept(s) may or may not be known to the students.

The assignment might require students to adjust a known solution method, create a new solution method, or put known steps together in a novel way. The assignment might require students to do some sort of discovery or exploration of a concept (e.g. finding a new mathematical rule or pattern).

Problems that are "open choice" (as coded in Pass 5) and involve sharing different solution methods, often indicate that students had to do "more than repeat steps" (e.g., M-SW-233, 5:57 & 16:24, code as "3").

Do not rely solely on the information provided by the teacher to code the assignment as "3", because his/her notion of "new" may not match ours.

4 = mix

The assignment contains several problems. At least one of the problems can be classified as "repeating steps", and at least one of the problems can be classified as "more than repeating steps".

Note: You don't have to make a decision about *every* problem in the assignment. As long as one problem is "repeating steps" and at least one is "more than repeating steps", you can code the assignment as a "mix" (e.g., M-US-005).

98 = not applicable
The CI4 or CI5 segment does not contain problems (e.g., NP, MO, or NM from Pass 2 was coded).

Notes:

- It is important to note that the PWA code is applied to the **assignment** given during a CI4 or CI5 segment. For instance, if the class works together on a new problem, but then the students do some of the *known* steps in that problem privately, the assignment should be coded as "2" (e.g. , M-CZ-028, 14:24)
- For assignments that contain CPs, think about what the required steps are for each problem in comparison to the steps that students already know. Watch how the problems are solved publicly (e.g. CPCW), or if they are not solved publicly, try to solve them yourself.
- If there are two CI4 or CI5 segments in a lesson where the assignment students work on stays **exactly the same**, both segments should have the same code. However, if the nature of the **assignment changes** (e.g. the teacher shows students how to do the assignment or some of the critical steps), then the segments may have different codes.
- **Word or story problems** need to be looked at carefully:
  In many cases, students can solve these problems by first transforming the words into equations, and then applying known steps in a familiar way (code as "2").

  But, if the word problem requires students to adjust a known solution method, create a new solution method, or put steps together in a novel way, then it meets the definition of "more than repeating steps" (e.g., M-SW-233, 5:57 & 16:24, code as "3").

Examples:

- M-CZ-064, 04:05, code as "2"
- M-CZ-028, 44:08, code as "2"
- M-HK-038, 27:42, code as “2”
- M-JP-010, 10:21, code as “3”
- M-AU-001, 4:32, code as “3”
- M-SW-106, 11:46, code as “4”

6.6 Private Work Segments

Codes in this section are to be applied only to segments previously marked as CI5 (Private Work, see 1.2.3.1).

6.6.1 Organization of Students (OS)

Definition: For each private work segment, note how the *majority* of students appear to be working -- individually, in pairs, or in groups.

Organization of Students (OS) is marked as a coverage code for each CI5 segment. Within a single CI5 segment there may be shifts in OS.

Notes:

- Note that the students seating arrangement does not necessarily tell you how students are working. For example, if students are seated in a group arrangement but the majority work independently on an assignment, code this as "1".
- Sometimes students work on an assignment individually, but are allowed to talk to their neighbors. In these cases, code how the *majority* of students appear to be working.
- Sometimes there are CI5 segments during which students do not work on an assignment. Code these segments as "1".
- In order to code for OS, you may need to watch the end of the previous public segment, listening for teacher instructions.

  Code one of the following coverage codes:

  0 = unknown organization

  1 = the majority of students appear to work individually

  2 = the majority of students appear to work in pairs

  3 = the majority of students appear to work in groups

Examples:

- JP-044 (CI5: 28:18- 43:29). Shift from OS = 1 (28:18-38:24) to OS = 2 (38:24 – 43:29).

- CZ-002 (CI5: 10:18-17:31). At 10:04 teacher says, “work in groups". Code as OS = 3.

6.6.2 Display Information (DI)

Definition: Code whether the teacher displays mathematical information on the board or overhead projector for each CI5 segment.

Displaying Information should take one of the following forms:
- Displaying mathematical information for all students to see
- Organizing the blackboard or overhead in preparation for classwork
- Positioning props used for teaching (e.g. posters, cut-outs)

Code one of the following options:

0 = no display of information

1 = display of information

Displaying Information	NOT Displaying Information
• Writing problem statements or target results on the board or overhead	• Writing the page or problem numbers of the current assignment or homework
• Writing mathematics information on the board or overhead transparency (even if it's not discussed publicly)	• Putting a prepared transparency on the overhead projector
• Putting a prepared poster on the board	• Erasing the board
	• Writing information on the board as part of a Public Announcement (PA) or while assisting a student

Examples:

- JP044 (CI5: 3:26-9:26) , teacher writes on board @4:31, code as 1.
- JP044 (CI5: 28:18-43:29) , teacher writes on board @ 39:20, code as 1.
- CZ002 (CI5: 27:55-28:55), teacher writes on board @28:09, code as 1.

6.6.3 Administrative Activity (AA)

Definition: Code whether the teacher engages in administrative activity that is *unrelated to the students' current assignment* at any point during each Private Work (CI5) segment.

The AA may take the form of private, verbal exchanges between the teacher and student(s) (e.g., the teacher checking with students to see if their homework is complete), or it may not involve students at all.

Examples of AA include:

- distributing papers that are not the current assignment
- grading papers
- taking roll

Code one of the following options:

0 = no administrative activity

1 = administrative activity

Administrative Activity	NOT Administrative Activity
• Teacher writes notes at his/her desk, and the content of the notes is unclear	• Teacher walks around the classroom and makes observational notes regarding students' progress on the current assignment (e.g., JP-044)
• Teacher has an extended conversation, or several brief conversations with different students, of an administrative or organizational nature	• Teacher has a brief conversation (i.e., 1-2 sentences) with an individual student of an administrative or organizational nature • Public Announcements (PA) of an administrative or organizational nature • Erasing the board

Examples:

- CZ002 (CI5: 10:18-17:31) Teacher takes roll and writes on her booklet @11:15 – 12:04, code as 1.
- NL036 (CI5: 4:41-5:53) Teacher checks with students to see if their homework is completed @ 4:50- 5:50, code as 1.

6.6.4 Public Announcements (PA)

Definition: Public announcements are those remarks made by the teacher during private work that are intended for or addressed to all students.

Mark each Public Announcement with an in-point only.

Code a new PA each time there has been a pause of **at least 10 seconds** in the teacher's public talk.

6.6.4.1 Type of Public Announcement

Code one of the following choices for each Public Announcement:

1 = Mathematical Information Related to the Current Assignment

The Public Announcement contains mathematical information that is intended for students to use in completing the mathematics of the current assignment. For example, the teacher clarifies or explains a problem or its solution, affirms an answer, step, or procedure, or clarifies the use of tools needed for the current assignment.

Examples:

- "I see a lot of you forgetting to add the base of the pyramid when finding it's total surface area. Remember to do that."
- "When you're drawing the line to represent the linear question, be sure that all of your points fall on that line. If they don't, you've done something wrong."
- "With this equation, you're working with fractions. So what's representation of pi will you want to use? Right. Twenty-two over seven."

2 = Organizational Information Related to the Current Assignment

The Public Announcement contains an organizational reference to mathematics work, but it is not necessary for students to complete the mathematics of the current assignment. For example, the teacher provides general, administrative information about an assignment or assesses students' progress on an assignment.

Examples:

- "Check your answer with the answer written on the board."
- "Don't forget to put your name on your paper."
- "If you finish quickly, continue with problems 5-10."
- "If you're finished, let me check your answer."
- "You have five more minutes to work on this assignment."
- "Who's done with number 2?"
- S: "Are we supposed to do problems 1 and 2?" T: "Yes, 1 and 2."

3 = Information Unrelated to the Current Assignment

The Public Announcement contains either no mathematical information (e.g., the teacher responds to disciplinary problems or makes off-topic announcements) or mathematical information that is completely unrelated to the current assignment.

Examples:

- “Remember to bring back your permission slips for the museum visit tomorrow."
- "HEY! It's way too noisy in here. Tone it down!"

4 = Unknown

Use this coding option only when there is not enough audio available to determine what type of public announcement is taking place, or when the meaning of the teacher announcement is unclear.

Consider these options hierarchically. For example, if an announcement contains information related to the current assignment, only some of which is mathematical in nature, code the PA as 1.

> <u>Addition/ Clarification to the coding manual 6.6.4 Public Announcements (PA) 2/7/01</u>
> The “Current Assignment” refers to the activity that the majority of students are asked to do in that particular CI5 segment. This can be mathematics problems, non-problem mathematics work, or even non-mathematics or mathematics organization.
>
> For example, if students are asked to copy notes from the blackboard, the current assignment is the note-taking activity. Any Public Announcement made during this time that is unrelated to the note-taking should be coded as PA3.

Notes:

- Public announcements where the teacher gives homework may be coded in different ways, depending on whether or not the homework is to finish the private work assignment.
- If the homework is to finish the seatwork assignment, code PA as "2".
- If the homework is something other than finishing the seatwork assignment, code PA as "3".
- If the homework is to finish the seatwork assignment *and* do something else, code PA as "2".
- If you are not sure what the homework is, code PA as "4".
- The volume level of the teacher's voice does not by itself indicate a Public Announcement. For example, if the teacher uses a loud voice to talk to a single student, this does not count as a PA.

Examples:

- NL 036 (CI5: 27:48-43:04) PA at 28:33 , code as 3.

- JP 044 (CI5: 3:26-9:26) PA at 3:36, code as 2; PA at 6:49, code as 1; and PA at 8:11, code as 2.
- JP 044 (CI 5: 28:18 – 43:29) PA at 35:29, code as 3; and PA at 37:57, code as 1.

6.7 Pass 6 Coder Protocol

First, write in the codes by hand, onto the codesheet. Then, enter them into vPrism and Excel (see Table below)

Pass 6 Codes	Apply To	vPrism or excel
Resources (8 codes)	Lessons	vPrism (in-points at start of lesson)
Multiple Solution Methods	Problems	Pass 5 Excel codesheet
Problem Summary	Problems	Pass 5 Excel codesheet
Non-Problem Types (4 codes)	NP segments	vPrism (same as NP segments)
Private Work Assignment	CI4 & CI5 segments	vPrism (in-points at start of CI4 or CI5)
Organization of Students	CI5 segments	vPrism (in & out points)
Board Preparation	CI5 segments	vPrism (in-points at start of CI5)
Administrative Activity	CI5 segments	vPrism (in-points at start of CI5)
Public Announcement	Occurrences throughout CI5 segments	vPrism (in-points)
Type of Public Announcement	Public announcements	See Public Announcement

Chapter 7. PASS 7: PURPOSE CODE

7.1 Purpose (P)

The Purpose (P) code is a coverage code. That is, all points in the lesson must be coded as one of the following 3 mutually exclusive categories: Addressing Content Introduced in Previous Lessons (P1), Introducing New Content (P2), or Practicing/Applying Content Introduced in the Current Lesson (P3).

Incorporate Non Math, Mathematics Organization, Technical Problem and Break segments into the immediately following Purpose segment. If there is a NM or MO segment at the very end of the lesson, include it into the immediately preceding Purpose segment.

Code one of the following options:

1 = Addressing Content Introduced in a Previous Lesson(s) (P1)
The class goes over content that has been previously introduced. The purpose of this segment may be to review, reinforce, secure knowledge, re-teach, re-instruct, lead into new content, check homework, or evaluate students.

Activities during this segment may take the form of:
- Warm-up problems/ games/ mental math
- Review problems
- Teacher lecture/ class discussion
- Checking previously completed work/ homework
- Quiz/ grading

P1 segments are typically of the following nature:
- Practice or application of a topic learned in a prior lesson, or
- Review of an idea, concept, theory, or formula learned previously.

P1 Notes:
- During a P1 segment the teacher expects students to know the content being reviewed. If the students do not appear to know this content, the teacher may briefly provide re-instruction.
- A segment coded as P1 addresses only content that has been introduced previously. As soon as a teacher introduces any new content, shift to P2. It does not matter how smoothly the transition to new content occurs, or even if it appears that the teacher intends for the previously learned content to lead into the new content.
- If students are working on CPs that meet the definitions of both P1 and P3 (i.e. a mix of review and practice of new), code the segment as P3.

2 = Introducing New Content (P2)
The class is introduced to content that has not been worked on in a previous lesson. The purpose of this segment may be to acquire knowledge, concepts, procedures, or skills.

Activities during this segment may take the form of:
- Exposition/ demonstration/ illustration
- Teacher led exploration/ student exploration
- Class discussion
- Reading from the text/ taking notes
- Assigning a task involving new content, which is intended to be worked on in the current lesson
- Working on a problem in order to introduce an idea, content, theory, or formula for the first time

P2 segments are typically of the following nature:
- A new idea, concept, theory, or formula is presented. Immediately after it is presented, it may be reviewed or summarized (see related Note below).

P2 Notes:
- During a P2 segment, the teacher does not expect students to know all the content being presented, or to be able to answer his/her questions regarding that content.
- A Goal Statement (GS), or some other form of "foreshadowing" new content, does not by itself indicate a shift to P2. Rather, the teacher must actually introduce content that is new.
- If a Goal Statement (GS) immediately precedes the introduction of new content, include the GS as part of the P2 segment.
- If in Pass 6, a PWA was coded as "more than repeating steps" or "mix," (i.e., PWA = 3 or 4, respectively), Purpose should be coded as P2.
- Summaries of ideas, concepts, theories or formulas learned today should be coded as part of the purpose segment that *precedes* it. For example, if the summary comes immediately after students work on practice/application problems on a topic learned in this lesson (P3), it should be coded as P3. If the summary comes immediately after the presentation of a new idea, concept, theory or formula (P2), it should be coded as P2.
- Sometimes following the introduction of new material and prior to the practice/ application/consolidation of that material, there is mathematical content that does not precisely fit either P2 or P3 – include this as part of the P2 segment.

3 = Practicing/Applying/Consolidating Content Introduced in the Current Lesson (P3)
The class is involved in practicing or applying some of the content that has been introduced in the current lesson. The purpose of this segment may be to practice, consolidate knowledge, or apply knowledge, concepts, procedures, or skills.

Activities during this segment may take the form of:
- Assigning a practice/application task

- Working on a problem(s) to practice or apply an idea, concept, theory, or formula that was introduced in this lesson.
- Sharing/ class discussion of problems
- Re-instruction
- Concluding

P3 segments are typically of the following nature:

- Practice or application of a topic already learned in this lesson.
- An idea, concept, theory, or formula already presented in this lesson is discussed, reviewed, or summarized AFTER the class has engaged in some practice/application problems on a topic learned in this lesson (see related Note below).

P3 Notes:

- During P3 segments, the teacher expects students to be able to work on problems using their knowledge of the new content introduced.
- PWA (from Pass 6) should be coded as either "not able to make judgment," "repeating steps," or "not applicable," (i.e., PWA = 1, 2, or 98, respectively).
- Summaries of ideas, concepts, theories or formulas learned today should be coded as part of the purpose segment that *precedes* it. For example, if the summary comes immediately after students work on practice/application problems on a topic learned in this lesson (P3), it should be coded as P3. If the summary comes immediately after the presentation of a new idea, concept, theory or formula (P2), it should be coded as P2.
- If students are working on CPs that meet the definitions of both P1 and P3 (i.e. a mix of review and practice of new), code the segment as P3.

98 = Not Able To Make Judgement (P98)

Use this coding option in those rare instances where you are not able to make a judgement regarding purpose. For example, the entire lesson is coded as CPN and there is no other information provided by the teacher in the questionnaire to inform you of the purpose.

General Notes:

- You may use ideas created with your National Research Coordinator during the International Meeting to assist in making coding decisions, as long as these ideas don't violate the definitions listed above.

Examples:

- M-AU-041
  - 00:42-10:00 = P1
  - 10:00-16:29 = P2
  - 16:29-end = P3
- M-CZ-081
  - Entire lesson = P1
- M-SW-101
  - 1:20-5:25 = P1
  - 5:25-23:54 = P2
  - 23:54-end = P3

7.2 Pass 7 Tips for Coders

Before coding for Purpose, collect information regarding what is new and review in the lesson from the following sources:

Teacher Questionnaire (original questionnaires are located on Video 5 -> Scanned Materials -> TQ; translated questionnaire files are located on LessonLab Drive -> Public Documents -> Deliverable Backups -> TQ translation)

PWA coding from Pass 6 (refer to vPrism data entry or lesson folder)

Usually shifts in Purpose correspond to shifts in Pass 2 coding.

7.3 Pass 7 Coder Protocol

Note purpose shifts on the printed transcript
Enter times into vPrism
Export from vPrism to check data entry

Chapter 8: CREATING EXTENDED LESSON TABLES

***PART A: ADDITIONAL INFORMATION TO INCLUDE*[24]**

MATHEMATICAL GENERALIZATIONS
LABELS & SYMBOLS
LINKS

PART B: CONSTRUCTING ELTs

Extended Lesson Tables will be created for a subset of the lessons, by specially trained coders. In Part A, we will mark additional items interest for the extended lesson tables: Mathematical Generalizations, Labels & Symbols, Link to the Current Lesson, and Link to a Different Lesson. In Part B, we will create the extended lesson tables.

8.1 Mathematical Generalizations (MGs)

Definition: There are two conditions that must be evident for a period of time in the lesson to be marked as containing an MG:

- **There must be generalized mathematical information** (i.e., MGs must apply to a class of problems, beyond any particular set of problems worked on in the current lesson).
- **There must be an explicit attempt to point out the generality** (i.e. there should be a clear verbal or written marker indicating the teacher's or student's intent to generalize).

Statements about generalized mathematical information do not by themselves count as an MG. To count as MGs, such statements must simultaneously synthesize the mathematics and highlight the generality.

MGs can be presented orally or in written form, using words or symbols. However, if they are presented in written form they must be referred to publicly. MGs might contain specific numbers if they are presented in a generalized way. For example, "the angles of a square always add up to 360 degrees".

MGs can only be marked in public interaction (i.e. in CI 1 to CI 4 or in public announcements during CI 5). MGs will be marked as Occurrences with in-points only.

[24] These additional items included in the Extended Lesson Tables are not codes. That is, reliability will not be computed and analyses will not be run on them.

MGs are likely to be found when:

- An explicit request is made for generalized information. This information may be "review" or "new" for the class. If there is a request for an MG and an attempt to answer it that is accepted, then we must code it as an MG. A request is not marked as an MG unless there is an attempt to provide an answer.
- Premises, definitions or summary statements related to the solving of problems are presented.

Occasionally Problem Statements and Target Results will include generalizations. These should be counted as MGs. Also, a single step in a problem might qualify as an MG if it meets the definition.

MGs must contain enough mathematical information so that an average student can recall and apply the information.

Counter-examples:

- *"Distance OA, how do I calculate it? Let's ask Erine. Well it's Pythagoras."* *(M-SW-242, 8:18)*
- *"Always take the following figure if you want to round. Not the one that's indicated, but you have to keep in mind the following figure." (M-SW-242, 11:07)*

8.1.1 Types of Mathematical Generalizations (MGs)

There are three different kinds of MGs: **procedural, definitional** and **conceptual**. All MGs should clearly fall into one of these categories, although we will not mark them as such.

Procedural MGs describe general solution procedures used for a class of problems.

Examples:

- *"To solve equations first calculate like terms, secondly simplify, thirdly isolate x."*
- *"We calculate the surface area of any geometrical solid by first calculating the single surface areas and then adding them up."*
- *"One of the rules for statistical analysis that we looked at last week was that when you're analyzing numbers in statistics it's often a good idea to write them in order, smallest to largest." (M-AU-006, 15:21)*

Definitional MGs resemble "traditional" or "accepted" mathematical definitions and conventions. Definitions and conventions are culturally agreed upon statements or procedures that are not subject to proof. To count as an MG, there must be more than simply labeling or naming a mathematical term. That is, there must be some discussion of the distinguishing or specific properties of the mathematical term.

Examples:

- *"A cube (mathematical term) is a prism (larger group) that has equal sides and right angles (properties)"*

- *“Linear functions (mathematical term) are functions (larger group) that result in a straight line (properties)”*
- *“Prisms have a parallel base and top area.”*
- *“We always write percent with the symbol %, and x% means x/100”.*

Notes:

- If labeling is accompanied by a definition of the mathematical term, mark this as an MG.
- Conversions between standard units of measurements **do not** count as MGs (e.g., 1 cm = 10 mm, $1.00 = 100 cents, 1 week = 7 days)
- Discussions about the linguistic roots of words (e.g., "iso" is from the Greek, meaning "the same") do not, by themselves, count as MGs.

Conceptual MGs describe the conceptual or structural nature of mathematics.

Conceptual MGs may be theorems , properties or formulas.

<u>Theorems</u> state or summarize mathematical claims that can be proven. The mathematical claim should be either verbally (sentence statement) or symbolically expressed.

<u>Properties</u> describe special characteristic features of mathematical objects or operations. They often take the form of axioms or beginning assumptions (premises). They apply to large numbers of cases.

<u>Formulas</u> are symbolic expressions with variables that describe a mathematical operation or procedure for the general case. Formulas often capture mathematical properties with special clarity and precision.

Examples:

- *“Every angle with the vertex on a circle that intercepts a diameter AB is a right angle” or “$a^2+b^2=c^2$”.*
- *“The commutative property for multiplication states that factors can be multiplied in any order without altering the result.”*
- *“… the commutative property can be expressed as $a \cdot b=b \cdot a$.”*
- $a^m \cdot a^n=a^{n+m}$

Notes:

- If a number of properties are discussed or described, count each individual property as a separate MG. (e.g.-“*Uh do you remember the triangles’ conditions of congruence that [you] all studied before…What was the first one? The three pairs of sides are each equal* [MG1]. *The two sides and the angle they contain are equal* [MG2]. *One pair of sides and the angles at either end of them are each equal* [MG3] *(M-JP-026, 40:16-40:57)*)).
- If several forms of the same formula are discussed or described, count each form as a separate MG. (e.g., “So who will tell me how to calculate the area of a triangle? *A times VA over two* [MG1]. *B times VB over two* [MG2]. *C times VC over two* [MG3]. *(M-CZ-096, 07:00-07:45)).*

- If a formula is written or discussed in the context of solving a problem publicly, count it as an MG (e.g., "*Dylan will come to the blackboard now. And he will try to calculate the perimeter of the triangle. O equals A plus B plus C* [MG4R]. (*M-CZ-096, 10:32*)).
- If a formula is both written on the board and stated verbally, count this as one MG.
- If a generalization is rephrased to highlight a different concept or idea, mark these as separate MGs. (e.g. ("*A number is divisible by two if the digit in the ones place is divisible by two* [MG1]. 21:00-*How do you know a number is divisible by two? If it's an even number* [MG2]. *M-US-57, 20:46*).
- Geometric figures that are drawn without specific measurements are usually intended to represent general cases.

8.1.2 Marking the In-point of an MG

The **in-point** of the MG is marked the first time that the mathematical generalization is clearly stated. If the request for the MG is necessary to understand the generalization, the in-point should be at the request.

MGs should be numbered consecutively as they appear in the lesson. For example: MG1, MG2, MG3, etc.

8.1.3 Repeated MGs (MGR)

Repeated MGs should also be marked with an in-point and an "R". For example: MG1, MG2, MG3, MG2R, MG4. To be marked as a repeated MG, the MG must be repeated in a new context *(i.e. a shift in a Pass 2 content activity segment)* or a new problem. If an MG is repeated several times within the same context or problem, mark only the first clear statement as an MGR.

Example of Repeated MG:

- M-HK-029 9:22-10:01

8.2 Labels & Symbols (LAS)

Definition: LAS is marked when an explicit attempt is made to use precise mathematical language to point out the "name" given to the particular mathematical idea/concept or its symbolic representation.

The purpose of marking Labels & Symbols is to capture times when the teacher emphasizes precise mathematical terms, and makes a special effort to call attention to those terms. Just using the terms or symbols is not enough to mark LAS.

Details of the idea/concept itself may or may not also be provided. If labeling, as defined above, is accompanied by a definition of the mathematical term, mark this as both LAS and MG.

LAS can only be marked in public interaction (i.e. in CI 1 to CI 4 or in public announcements during CI 5). LASs will be marked as Occurrences with in-points only.

A) Labels

LAS is marked when an explicit attempt is made to point out the "name" of a mathematical idea/concept.

Examples:

- *"Remember, these are called isosceles triangles"*
- *"What's this called? Yes, a linear equation."*
- *"So how about this number 11? It is uneven, an odd number and it is not divisible. That's exactly what we're talking about today, divisibility." (M-US-57; 18:56)*

LAS is <u>not</u> marked when the "name" is simply used in a sentence:

Counter-Examples:

- *"What are the lengths of the sides in this isosceles triangle?"*
- *"When we solve this linear equation we have to divide both sides by 2."*
- *"Remember to combine the exponents first and then simplify the rest."*
- *"T: How do I calculate this problem?*
  S: Using the Pythagorean formula." (M-SW-242, 8:09)

Classification tasks, by themselves, do <u>not</u> count as LAS:

Counter-Examples:

- *"First of all, what operations do you know? Yes? There's multiplication…division…the additions and the subtractions." (M-SW-266, 19:43-20:05)*
- *"Of these 4 expressions, which ones are equations and which ones are not equations." (M-AU-056, 1:19)*

Measurement terms do <u>not</u> count as LAS:

Counter-Examples:

- *Leap year, liter, acre*

B) Symbols

LAS is marked when symbols are (1) defined or (2) pointed out explicitly.

Examples:

a) "We always write percent with the symbol %, and x% means x/100."
b) "When we label the angles in a triangle, let's use capital letters and write A, B, and C."
c) "The way to write 'equivalence' is with three horizontal bars."

LAS is <u>not</u> marked when the symbol just is used in a sentence or written without drawing special attention to it.

Counter-Examples:
a) "So this should be 78 percent" (or written 78% on chalkboard).
b) "What's the size of angle A in the triangle?"
c) "We can prove that $a^2 - b^2 = (a + b)(a - b)$*."*

8.2.2 Marking the In-point of LAS

The **in-point** of LAS is marked in the same way as MGs. That is, the first time that the label or symbol is clearly stated. If the request for the LAS is necessary to understand the generalization, the in-point should be at the request.

LASs should be numbered consecutively s as they appear in the lesson. For example: LAS1, LAS2, LAS3…

8.2.3 Repeated LAS (LASR)

Repeated LASs should also be marked the same way as MGs. That is, with an in-point and an "R". For example: LAS1, LAS2, LAS3, LAS2R, LAS4. To be marked as a repeated LAS, the LAS must be repeated in a new context or a new problem. If a LAS is repeated several times within the same context or problem, mark only the first clear statement as an LASR.

8.3 Links

8.3.1 Link to the Current Lesson (LC)

Definition: An explicit verbal reference by the teacher that **connects particular mathematical ideas** discussed or worked on within the current lesson. Simply repeating a mathematical idea does not count as a link. It must be *connected* with another idea. The link should help students organize related information.

Links can only be marked in public interaction (i.e. in CI 1 to CI 4 or in public announcements during CI 5). Links will be marked as Occurrences with in-points only.

Examples:
- Comparing two solution methods presented by different students during the lesson.
- Contrasting two problems done during the lesson.
- Taken from transcript (M-CZ-021, 10:39): So, we have said that if we multiply fractional expression by whole expression we take similar steps as if we multiply a fraction by integer. So, how do we multiply a fractional expression by the whole expression? HENRY, tell us the rule. We multiply the numerator by the whole expression and the denominator doesn’t change. Yes, and why doesn’t the denominator

change? We are able to justify it. We can write the whole expression as fraction? Yes, then I can use the rule for multiplication of fractions thus, even with fractional expressions as we will see today. Numerator times numerator, denominator times… Denominator.

Note:

- Lesson summaries and goal statements do not count as LC unless an explicit connection between mathematical ideas is made.

8.3.2 Link to a Different Lesson (LD)

Definition: A verbal reference by the teacher to **particular mathematical ideas** discussed or worked on in the current lesson to another lesson (either past or future).

Links to the past always count as long as a particular mathematical topic or idea is referenced. Links to the future only count if the connection between particular mathematical ideas is made explicit. For example, activities such as setting a test, assigning homework, or stating the agenda for a future class, do not count unless an explicit connection is made.

Links can only be marked in public interaction (i.e. in CI 1 to CI 4 or in public announcements during CI 5). Links will be marked as Occurrences with in-points only.

Examples:

- Taken from transcript (M-CZ-021, 01:36) *So, last week we have learned to multiply fractional expressions by whole expressions. We have said that, in fact, the steps are the same as if we multiply fractions by integers. We have found out that if we multiply or extend or simplify fractional expressions, the procedure is the same as with the fractions. Today we will add the multiplication of fractional expressions by fractional expressions.*
- Taken from transcript (M-CZ-021, 04:08) *Last time, in our ten minute test, I forgave you if you had forgotten or had wrong conditions. Today the conditions will be a part of the grade, so, watch out for it.*
- Taken from transcript (M-HK-047, 23:45) *Do you still remember what descending powers means? We previously had a chapter in the book that specifically talked about powers, right? Arrange it according to the powers of the variable, arranging them from high to low.*
- Taken from transcript (M-NL-022, 10:00 not LD)-"*Right, the total...looks a little bit like question fourteen, doesn't it?"* (17:06 LD)-"*Looks a little bit like question fourteen. There it said, at fourteen, what percent. And at number fifteen, what percentage is fourteen of two hundred and twenty?"*

Counter Example:

- Taken from transcript (M-SW-266, 2:06-2:57) If a teacher appears to be making a reference to the past in order to establish an agenda, then do not mark as a link. (e.g., *"Before we get into the corrections directly, what do you need to work out the* *solutions to these problems?…The papers with the formulas. Yes…Anything else? The formulas that we've learned. And then Steve, he tells us 'The formulas that we've learned.' Good! So then we need to agree on this point. These formulas, we …have them on a piece of paper or in our heads.").*

8.4 Constructing Extended Lesson Tables

An Extended Lesson Table is constructed to provide a country-blind or anonymous summary of the content flow of the lesson. All references that might identify the country in which the lesson was conducted (e.g., names of teacher or students, names of money units, written words on the chalkboard) are removed or replaced with country-neutral references.

Extended Lesson Tables are used to (1) provide a quick and easily accessible overview of the lesson for later reference, (2) to provide a clear record from which problems can be linked with entries in the topic list, and (3) to afford the possibility for others to code further the nature and quality of content using country-blind data. In this section, we describe how to construct an Extended Lesson Table.

We will create 2 files for each Extended Lesson Table: a text file and a graphics file. The text file will be created in Microsoft Word, and will not contain any pictures or graphics. The graphics file will be created in HomePage, and will contain all accompanying pictures & graphics.

8.4.1 Text File

8.4.1.1 Heading

The top of each table includes the following headings:

TIMSS 1999 Video ID:
ELT ID:
Materials:

8.4.1.1.1 TIMSS 1999 Video ID

Write the original TIMSS 1999 Video ID# of the lesson here. This will include the name of the country in which the lesson was videotaped. This number will be masked when the table is given to other coders.

8.4.1.1.2 Extended Lesson Table ID

A new number will be assigned to the Extended Lesson Table using an index of TIMSS 1999 Video ID#s and Extended Lesson Table ID#s. This number always will remain on the table and will be used to connect the Extended Lesson Table with the videotape via the index.

8.4.1.1.3 Materials

List all materials (instructional aids) introduced or used during the lesson. The material must be clearly identified by the teacher or visible on the videotape, as coded in Pass 6.

- Chalkboard
- Overhead projector
- Television or videotapes
- Textbook or worksheets (including review sheets, study sheets, homework sheets)
- Student workbook (including notebooks, formula books, journals, diaries)
- Mathematical models and construction aids (for example, graph paper, Hundreds tables, geometric solids, maps, Base-Ten Blocks, rulers, compasses, protractors)
- Real-world objects (for example, cans, beans, toothpicks [i.e. objects from outside the classroom])
- Calculators (including regular calculators and graphing calculators)
- Computers

<u>8.4.1.2 Table Columns</u>

Each table will include the following 4 columns:

Time Code	Classroom Interaction	Content Activity & Occurrence Codes	Description

8.4.1.2.1 Time

Mark the In-Point of all lesson segments identified in columns 2-5. Each in-point will begin a new row in the Extended Lesson Table. The first In-Point is the beginning of the lesson. The last In-Point is the time the lesson ends.

8.4.1.2.2 Classroom Interaction

Enter the appropriate Classroom Interaction code (CI 1 - CI 5), from Pass 1, for each segment. As a reminder, the possible codes are the following:
CI 1: Public Interaction

CI 2: Public Information Provided by Teacher, Optional for Student Use
CI 3: Public Information Provided by Student, Optional for Student Use
CI 4: Mixed Private and Public, Not Optional
CI 5: Private Work

Private Work (CI5) segments are further coded in Pass 6, according to the organization of students. List this information in brackets. The possible codes are:
Unknown Organization
Individual
Pairs
Groups

8.4.1.2.3 Content Activity & Occurrence Codes

Enter the appropriate Content Activity Segment from Passes 2 & 3. The possible segments are:
AO: Answered Only Problem
CP: Concurrent Problem
IP: Independent Problem
CPSU: Concurrent Problem Set-Up
CPSW: Concurrent Problem Seatwork
CPCW: Concurrent Problem Classwork
NP: Non-Problem
MO: Mathematics Organization
NM: Non Math
TP: Technical Problem
BK: Break

Non-Problem segments are further coded in Pass 6. List these codes in brackets. The possible codes are:
CON: Contextual Information
CTI: Mathematical Concept/Theory/Idea
AC: Activity
HT: Setting/Clarifying Homework or Test

Enter all Occurrence codes from Pass 4. The possible codes are:
AH: Assignment of Homework
GS: Goal Statement
HB: Historical Background
OI: Outside Interruption
RLNP: Real Life Within Non-Problem Segments
SL: Summary of Lesson

Enter the following Occurrence codes from Pass 6:
PA1: Mathematical Content Public Announcement

(Mathematical Content Announcement made during private work)

The NP categories: CON: Contextual Information
CTI: Mathematical Concept/Theory/ Idea
AC: Activity
HT: Setting/ Clarifying Homework or Test

Mark the In time of the following Pass 6 codes in your exported table:
PSM: Problem Summary
MSM: Multiple Solution Methods

Enter all Mathematical Generalizations, Links, and Labels & Symbols:
MG: Mathematical Generalization
LC: Link to Current Lesson
LD: Link to Different Lesson
LAS: Labels & Symbols
For easy reference to MGs and LASs in the exported table, before you type in the description for these in the V-prism note fields, enter their corresponding number first by using a 2 letters 3 digits format, e.g. MG001:, LA002: ….

8.4.1.2.4 Description

a. General information

- The description column should contain sufficient contextual information to enable someone who does not have access to the video to get a sense of the mathematical content and the key pedagogical decisions.
- If you can convey information clearly and succinctly directly from text, do so and use quotes. Otherwise, summarize.
- Indicate who is speaking using T, S, SN (new student) or Ss (multiple students)
- When possible, use mathematical symbols for ease of reading
- All measurement units should be metric. All monetary units should be dollars.
- Organize the rows according to shifts in the Pass 2 and 3 coding. Arrange everything inside the rows by chronological order (as they occurred in the lesson)
- Left justify all text
- If something is not mathematically accurate, but clearly accepted by the class, write [sic]

b. Information regarding problems

- Include the following information for all AO, IP and CPs:
- Problem Statement - write PS001 in bold
- Solution Method(s) - include all steps that are publicly presented
- Target Result(s) - write TR001 in bold

- If the problem is solved publicly in written form, include all written steps
- If the problem is solved publicly through discourse, include enough talk to show what steps were taken
- Include all answers (correct and incorrect) that are dealt with publicly. Note if an answer is regarded as incorrect and how it is corrected.
- If there are multiple solution methods publicly presented, include all of them.
- If students are given an open or limited choice, note this.
- If problems are assigned to less than all students as coded in Pass 5, note and explain.
- Include the following information for CP segments:
    - CPSU-indicate which CPs are assigned
    - CPSW
    - CPCW
    - CPs -- include only those worked on publicly (move the other CPs, including their problem statements and target results to the graphics document)

c. Information regarding other segments

- Provide a 1-line description for all Mathematics Organization and Non-Mathematics segments.
- For Pass 4 Occurrence Codes, provide a 1-2 line description.
- For Outside Interruptions (OI) indicate the duration.
- Briefly describe each Public Announcement listed in Column 3.
- For MGs provide all needed context. This should include the most complete statement of the MG. When the MG is short, write it verbatim.
- Provide a brief description of each Link.

d. Description of Other Important Mathematical Information

- Include any extended discussions about mathematical labels.
- Include instances when students publicly identify errors.
- Include instances which indicate good mathematical thinking on the part of students such as student initiated questions.
- All important mathematical information should be captured. For example, statements that contain "Because" or elaborations of a conceptual nature, etc.
- Include statements indicating whether the content is new or review.
- Indicate in the last row the time of the end-point of the lesson.
- For currency, use pesos (=dollars) and centavos (=cents)

8.4.2 Graphics File

- Include graphics when they carry mathematical information that can't be easily expressed in words
- Include graphics when they help to clarify the solution method or TR
- Include graphics when unique SMMs or RWOs are used.

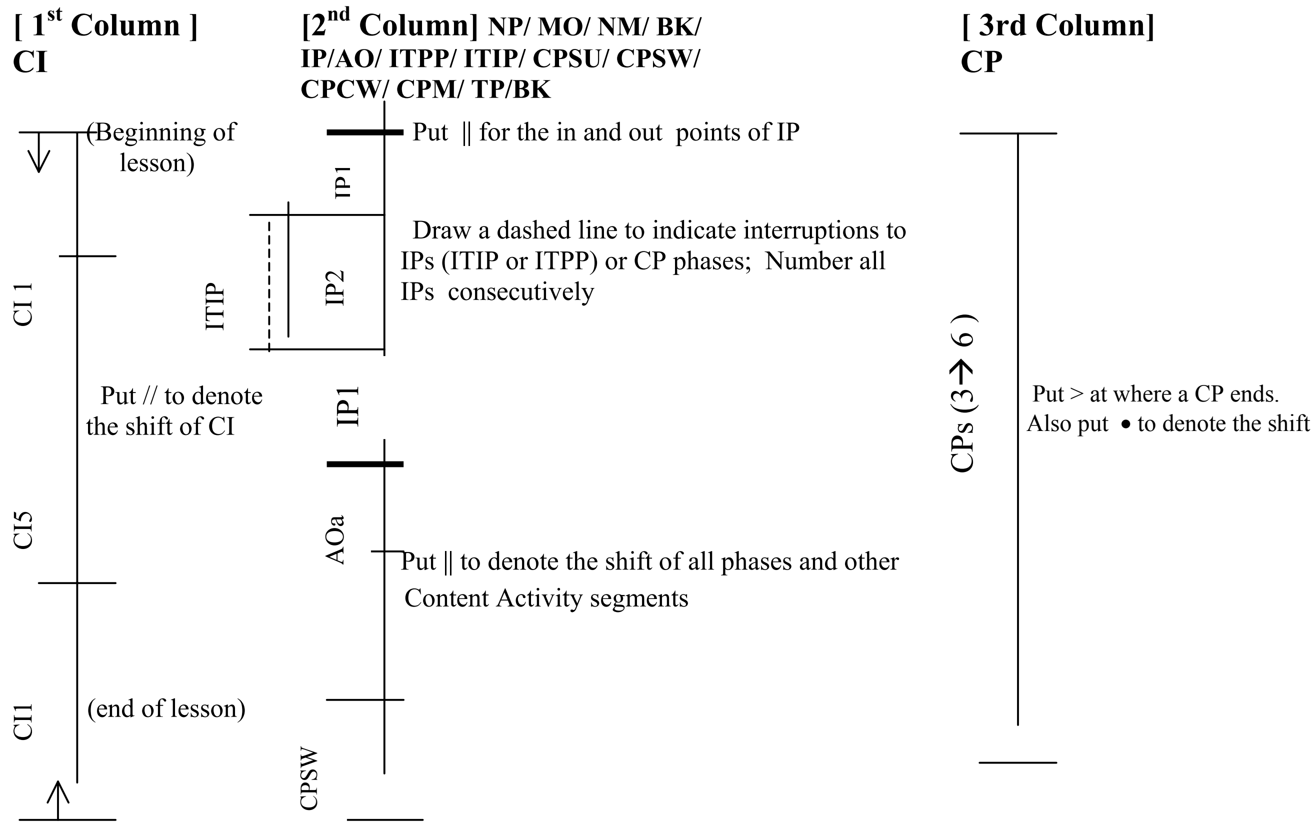
- All graphics should be referenced in the Description column of the text file.
- Graphics should *not* contain any extensive written information, as this may indicate the country. If the written information is important to include, type it in yourself.
- Ensure that all inserted graphics are clearly legible. If not, add typed comments to clarify.
- It is not necessary to repeat the same (or very similar) graphics.
- Lengthy text (e.g. from a textbook, on the board) should be typed and included as part of the text file, not the graphics file. Otherwise, this will be an indication that the lesson was from an English-speaking country.
- Include all CPs that are assigned, but not gone over publicly, as part of the graphics file. List each CP as a separate row, and note its problem statement and target result (i.e, not given

Appendix A. Transcript Marking

CODE	NAME	PASS	COLUMN POSITION	COLUMN SYMBOL	TEXT SYMBOL	MINIMUM TIME REQUIRED	TIME REQUIRED: EXCEPTIONS	NOTE TIME	COUNTING & LABELLING
-	Beginning of Lesson	1	-	-	↓	-	-	Yes	-
-	End of Lesson	1	-	-	↑	-	-	Yes	-
CI 1 to 5	Classroom Interaction 1 to 5	1	Left	⌶	//	1 minute	Beginning or End of Lesson: no Minimum	Yes	-
PS	Problem Statement	2	-	-	Underline	-	-	No	PS**1**, PS**2**… or PS(PRT**1a**, **1b**, **2a**, **2b**…)
TR	Target Result	2	-	-	Underline	-	-	No	TR**1**, TR**2**… or TR(PRT**1a**, **1b**, **2a**, **2b**…)
AO	Answered Only Problem	2	Right	⌶	-	-	-	Yes	AO**a**, AO**b**…
IP	Independent Problem	2	Right	⌶	{ … }	-	-	Yes	IP**1**, CP(**2-5**), IP**6**, ITIP**7**…
CP	Concurrent Problem	2	Right	●	<<..<.>.>>	-	-	Yes	CP(**1-4**), IP**5**, CP(**6-n**)…

CODE	NAME	PASS	COLUMN POSITION	COLUMN SYMBOL	TEXT SYMBOL	MINIMUM TIME REQUIRED	TIME REQUIRED: EXCEPTIONS	NOTE TIME	COUNTING & LABELLING
PRT	Partial Result Task	2	Right	(from […) (…to])	**[…]**	-	-	Yes	PS(PRT**1a**, **1b**, **2a**, **2b**…) TR(PRT**1a**, **1b**, **2a**, **2b**…)
ITIP	Interruption of Type: Independent Problem	2	Right		**{ … }**	-	-	Yes	IP**1**, ITIP**2,** IP**3**, ITIP**4**…
ITPP	Interruption of Type: Problem Piece	2	Right		**(…)**	-	-	Yes	-
NM	Non-Mathematics Segment	3	Center		-	30 seconds	Beginning or End of Lesson: no Minimum	Yes	-
MO	Mathematics Org/ Mgmt Segment	3	Center		-	30 seconds	Beginning or End of Lesson: no Minimum	Yes	-
CPSU	Concurrent Problem Set-Up	3	Center		||	-	-	Yes	-

CPSW	Concurrent Problem Seat Work	3	Center	I	||	-	Announcement must be **longer than 1 minute** to shift out of CPSW to CPCW or CPM	Yes	-
CPCW	Concurrent Problem Class Work	3	Center	I	||	-		Yes	-
CPM	Concurrent Problem Mixed	3	Center	I	||	-		Yes	-
NP	Non-Problem Segment	2	Center	I	-	20 seconds or 3 utterances	-	Yes	-
BK	Official Break	2	Center	I	-	-	-	Yes	-



CI	Classroom Interaction 1=public; 2=public by teacher optional; 3=public by student optional; 4=mix, not optional; 5=private	Code a shift only if another pattern lasts for ***more than one min*** No minimum time at the opening and closing of lesson
AO	Answered only problem; letter AO a	
IP	Independent problem; number	If the TR is a formula, rule, definition etc., it will only be coded as a Prob if it is worked for ***at least 2 mins*** and at least 2 operations are applied
CP	Concurrent problem; number	
ITIP	Interruption: Independent problem; number	
ITPP	Interruption: Problem Piece	
NM	Non Math	MO & NM must last ***at least 30 secs*** For MO and NP (Not NM) no minimun time requirements at the beginning and end of the lesson.
MO	Mathematics Organization	
NP	Non Problem	NP must last ***at least 20 secs***
TP	Technical problem	
BK	Break	
CPSU	CP Set-Up	No time requirement for CP phases. Exception: ***more than a min*** Public announcement during CPSW is coded as CPCW. However going over a prob publicly to its TR should shift to CPCW (even if this lasts less than a min).
CPSW	CP Seatwork	
CPCW	CP Classwork	
CPM	CP Mixed	

A transition statement is a statement of ***less than 20 sec***, between two segments. We will put the transition statement into the succeeding segment (the second of the two segments).

Appendix B. Decisions regarding Difficult Coding Segments

LESSON	TOPIC	TIME CODE	QUESTION(S)	RESOLUTION	RATIONALE	CONSEQUENCES FOR FUTURE CODING
M-AU-002	area of a circle	4:21 - 31:25	Is CP5 a PVD?	Yes	CP5 is the culmination of deductive reasoning, seen from CP2-CP5.	-
M-AU-003	peer assessment of games project	00:00:39-00:37:27	Concurrent Problems or Non Problem?	Concurrent Problems	evidence of students working on specific problems while testing games (eg 00:11:29)	-
M-AU-007	algebraic fractions	00:02:03-00:08:23	Concurrent Problems or Independent Problems with Interruptions of Type Problem Piece (ITPP)?	Independent Problems with ITPPs	actual time worked on each problem is known	decision to mark these problems on additional pages due to complexity of marking needed
M-AU-008	Pythagoras theorem and procedural text type	00:09:08-00:30:32	Procedural text writing activity/task - problem or Non Problem?	Non Problem	task does not fit definition of Problem; important aspects of task should be captured in analyses of NPs	-
M-AU-017	Multiple topics	Whole lesson	Self paced/ individualized instruction using multiple booklets from a single publisher.	CPN	Different students work on different unidentified problems.	Not applicable for lesson tables analysis.
M-AU-020	Statistics-graphing on computer	Whole lesson	Students have to graph their own data with Excel, is it one IP ? or CPN ?	I IP	It is like one problem statement with multiple target results.	

M-AU-031	Measurement and Ratio	15:45 – 42:58	How many questions are there? Where do they open and end?	There are altogether 7 CPs. The first 4 CPs open at 15:35 and end at 28:27. The fifth to seventh CPs open at 25:42; 5th ends at 38:55; 6th ends at 41:41; and the 7th ends at 42:58. There are two CPSU within this segment.	Making a table is counted as one problem only if the entries for the table are directly correlated; and they follow a certain format given. (e.g. a table for a linear function with x valued corrected with the y value) However in this lesson, the table is used to present the 4 different measurements and they are basically independent. They are counted as 4 problems. With the 3 problems in part (2), there are altogether 7 CPs.	Look at the structure of the table to identify the number of problem. It is not necessary that a table is a problem, sometimes a table may be a representation of several questions.
M-AU-034	Trigono-metric Ratio (tangent)	6:01-11:35 23:38-26:25	How many CP's are there?	15 CPs	Because each group does 3 problems (construct 3 triangles for a given gradient), and there are 5 gradients altogether, the total number of CPs worked out by the class is 3x5, which is 15 CPs	If teacher assign different problems to different groups of students during CPSU, the total number of CPs should be the total number of problems given out by the teacher, (even though not everyone in class has a chance to work out all of them)
M-AU-034	Trigono-metric Ratio (Tangent)	26:25 – 29:58	What kind segment is it? IP or CPs??	1 IP	The problem statement given by the teacher is to look for the relationship between the gradient and the angle constructed by that gradient. Students can pick any triangle and look for the linkage, however the target result expected by the teacher should be one: whenever you got the angle of tangent , you got the gradient.	Look for the bigger problem statement, if the other problem examples are only to demonstrate the result of the big problem statement. There should be only one independent problem.

M-AU-073	Revision for semester test	05:27 - 41:12	Type of segment? CPs? Other?	CPs 1-n	The additional materials supplied by the T include several tests from previous years; it appears that Ss might be working on one/more of these; the exact number of CPs however cannot be determined	-
M-AU-078	Exterior angles of a polygon	06:15 - 40:30	Investigation - one IP or several CPs?	One IP	This particular investigation is considered one problem comprised of several interdependent component parts	Problems of this type need to be carefully considered on an individual basis; they should only be marked as IPs when the component parts are interdependent, otherwise they might be comprised of a number of CPs
M-CZ-023	Simultaneous Equations	39:59-47:59	Teacher provides "extra problems" to 3 students during CPSW, and then goes over the problems publicly. When should we open the problems?	2 IPs	Open the problems when they are opened/discussed publicly. Not when they are provided privately to only a few students.	-
M-CZ-038	Equations	3:47-13:50	Three Ss work privately on 1 unique problem each (as an examination). The rest of the class works on another problem. What kind segment is it? IP or CPs?	1 IP	The 3 Ss who each work on their own problem privately are in a situation similar to a single S who takes a test late. Those problems are not open to all Ss. To open 4 CPs in this segment would be misleading.	▪ We will need to keep the code (in Pass 5): "Is this problem completed by all Ss?" ▪ We will need to capture "examining" in the Purpose dimension.
M-CZ-043	Word Problems about motion	29:06-46:00	Ss finish an IP privately. When the T sees that individual Ss are finished, she assigns them, individually, a set of problems. Where do the CPs start?	(The IP becomes a CP.) The CPs start when we see the first S being assigned the set of problems. There is no CPSU.	This will give us the best estimate of the length of time spent on the problems.	If Ss are assigned CPs privately, open the CPs when you see the first student being assigned the set of problems.

M-CZ-048	Graphing	35:38-41:49	Ss are working on CPs. One S solves each of the CPs at the board, speaking publicly with the T. Is it CPSW or CPCW?	CPSW	We already have a rule (2.13.2) that "while most of the class is working at their seats, one or more students may also be working at the chalkboard. This still should be marked as CPSW."	We will add a clarification to the manual that public talk may also occur if this occurs during CI3. (Even if the S reaches a TR, code it as CPSW.)
M-HK-018	Pythagorean Formula	22:03-26:43	Are Physical Materials used for IPs 11-17?	No	Teacher shows a "grid" on the overhead, but this doesn't count.	Grids, shown on the overhead or blackboard, do not count as Physical Materials.
M-HK-030	Interest Rate	00:41:18-00:47:23	Is that a break ?	Break	If the teacher has clearly indicated the period of time as a break, any non mathematical public talks within this period (e.g. riddles) is part of the break. It would not be coded as NM.	-
M-HK-087	Factorization	00:22:04-00:23:49	Is that really a break for the lesson?	It is a break (BK)	Even though the break includes the student asking mathematics problems privately, it should be coded as a break.	During the break, there is no classroom interaction type coded.
M-JP-002	Congruence	18:11 - 48:51	Is IP2 a PVD? What type of Student Choice?	Not a PVD. Open Choice.	The problem is not a PVD b/c no deductive reasoning is visible (next problem is a PVD). SC is open b/c they are not limited with regard to the method, just the conditions.	-

M-NL-017	Interpreting tables	#7, 9, and 10 on worksheet	Should PC be coded as "2" or "3"?	#7f = "2," all other problems = "3"	The set-up for #7 is insufficient to be counted as a story. When the text of "f" is added, it is still insufficient to be a story.	-
M-NL-027	Area & Volume	21:08-25:15	Open HW correction as CPs?	Yes, CPs.	1) Ss will clearly work on HW correction, 2) we have the answer sheet, and 3) the answer sheet shows solution strategies, not just answers.	Open HW as problems if students clearly work on them and they are provided with more than answers alone.
M-NL-050	Probability	41:54-47:49	Are these problems?	Yes.	See rationale for M-US-017	See consequences for M-US-017
M-SW-003	Equations & equations in word problems	11:15-22:20	When there is a CPM how are the problems coded? Are the publicly solved problems coded as ITIPs, CPS or IPs?	All problems are coded as CPs	There have been 8 other cases of this type all of which coded the problems as CPs. There is no really good way to represent adequately what is going on during that time during the lesson and we felt after exploring all different coding options that coding CPs is the least misrepresenting one.	We would like to be made aware of any other lesson that poses the same problem and decide on a case by case basis. If we find many more lessons of this type we might have to reconsider the coding.
M-US-001	Probability	8:03-26:35	Are there problems? How many?	One long IP, with 3 ITIPs.	The teacher gives the p.s. -- look for examples of probability in this story -- before they read the book. Therefore, the entire segment is an IP, with some interrupting problems.	-
M-US-017	Statistics - Methodology	27:07-32:44	Teacher and textbook questions about research methodology (sampling) are phrased as "problems", although there is not a clear "operation".	Count them as problems.	In statistics, these questions seem to be considered as problems, both by the teacher and the textbook. They have a clear problem statement and target result. We will add "applying statistical concepts" to our list of operations.	Add to our definition of mathematical operation - within "a method of mathematizing a real-world situation" - Applying Statistical Concepts.

M-US-034	Adding/Subtracting Negative Numbers	3:40-13:12 & 40:34-43:88	The class works on 16 CPs. Then, at the end of the class, they discuss one of the CPs. Should it remain open the entire lesson?	Open 15 CPs from 3:40-13:12. Then open 1 IP from 40:34-43:88.	This solution works best for this lesson -- given the nature of the problems, and the lesson itself.	
M-US-038	Ratio	5:20-18:05	TV comes on while students are working on problems.	Outside Interruption & Non-Mathematics Within Problems	The tv clearly interrupts many (and at times all) of the students as they are working on CPs.	-
M-US-052	Inequality	26:10 – 30:52	The teacher is teaching the 7th graders in class while the 8th graders are doing their assigned classwork in seat. Is that segment CPM?	CPM for this segment. CI 4 for classroom interaction.	This is CPM, because the teacher is working with the group of 7th graders (who are regarded as part of the class as they joined the lesson) publicly, while the other group is working privately at their seats.	It is a prototypical CPM. CPM happens when one group of students are working with the teacher publicly and the other group of students are working privately. The teacher intentionally divided the class into groups.

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Appendix J

Steps for Weighting the Data for Each Country

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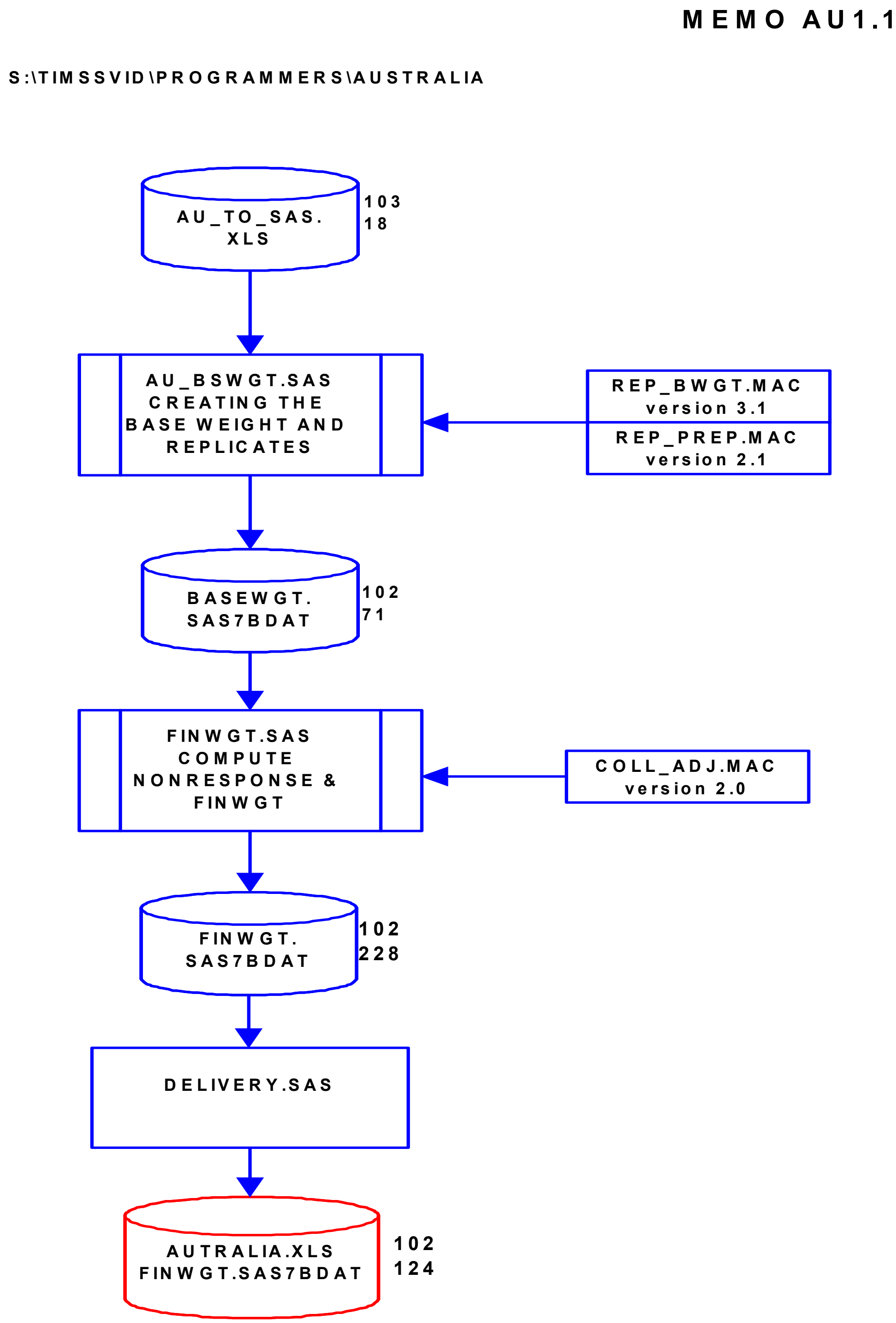
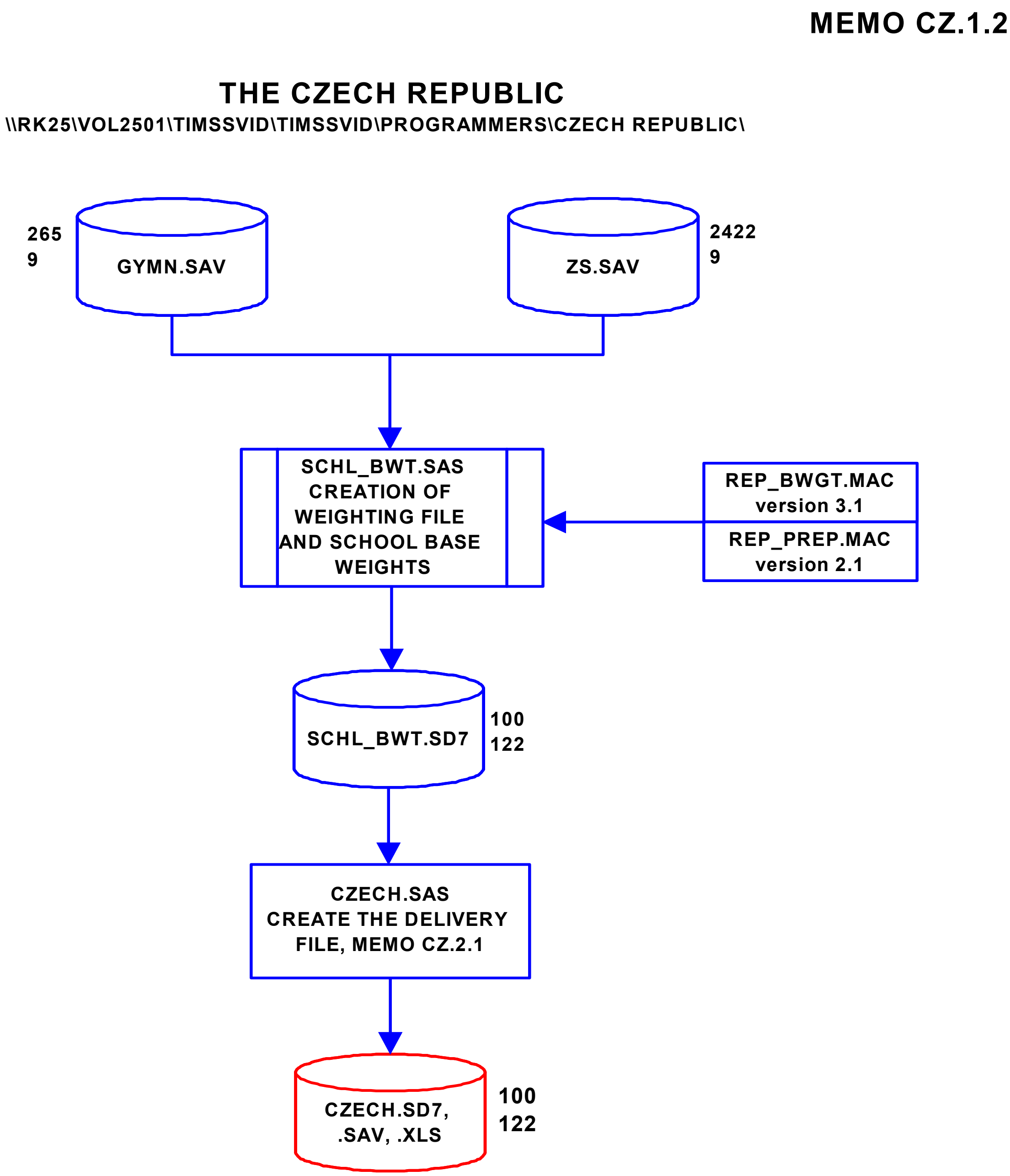
Figure 1. Steps for Weighting the Data for Australia



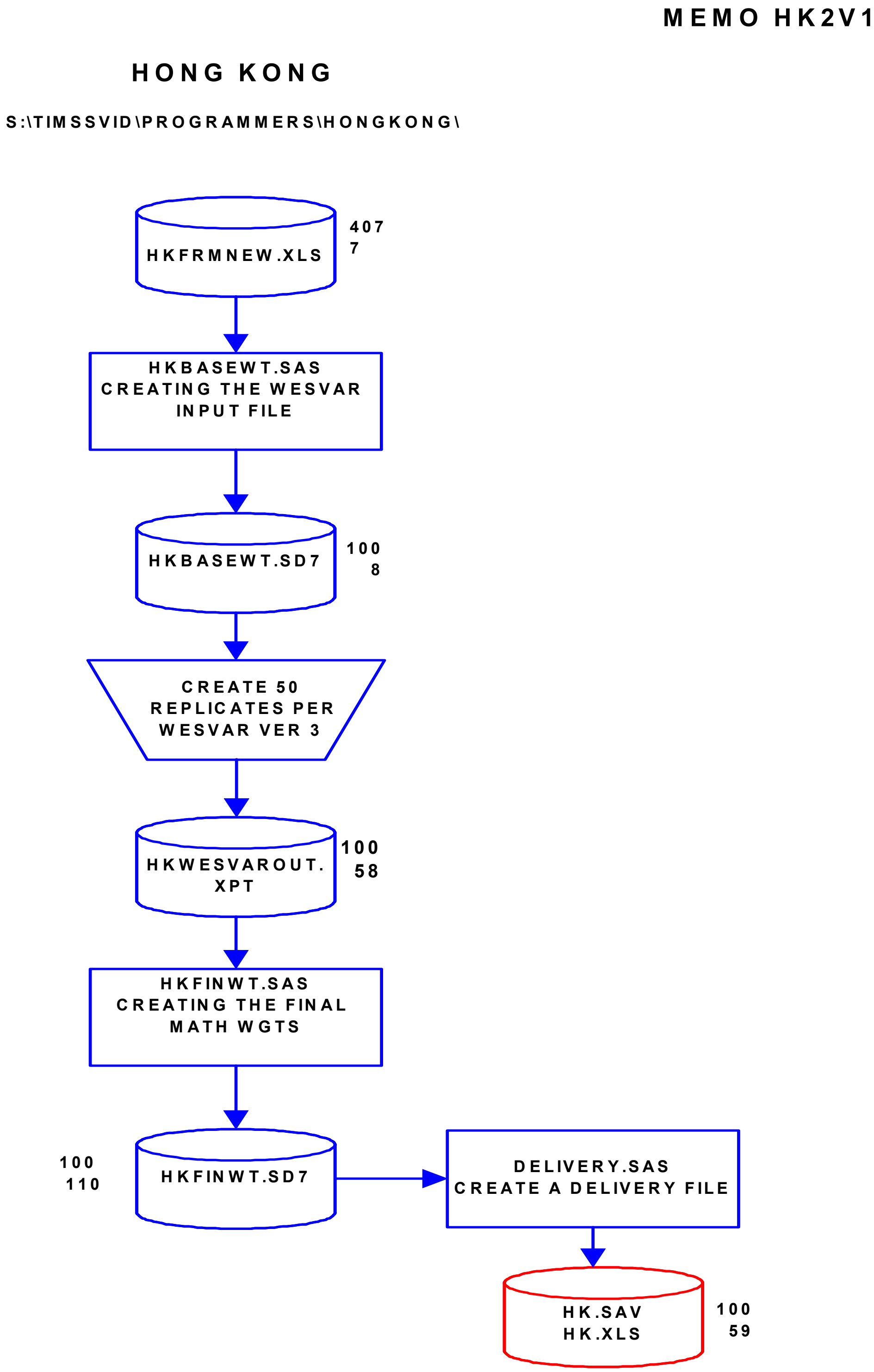
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 2. Steps for Weighting the Data for the Czech Republic



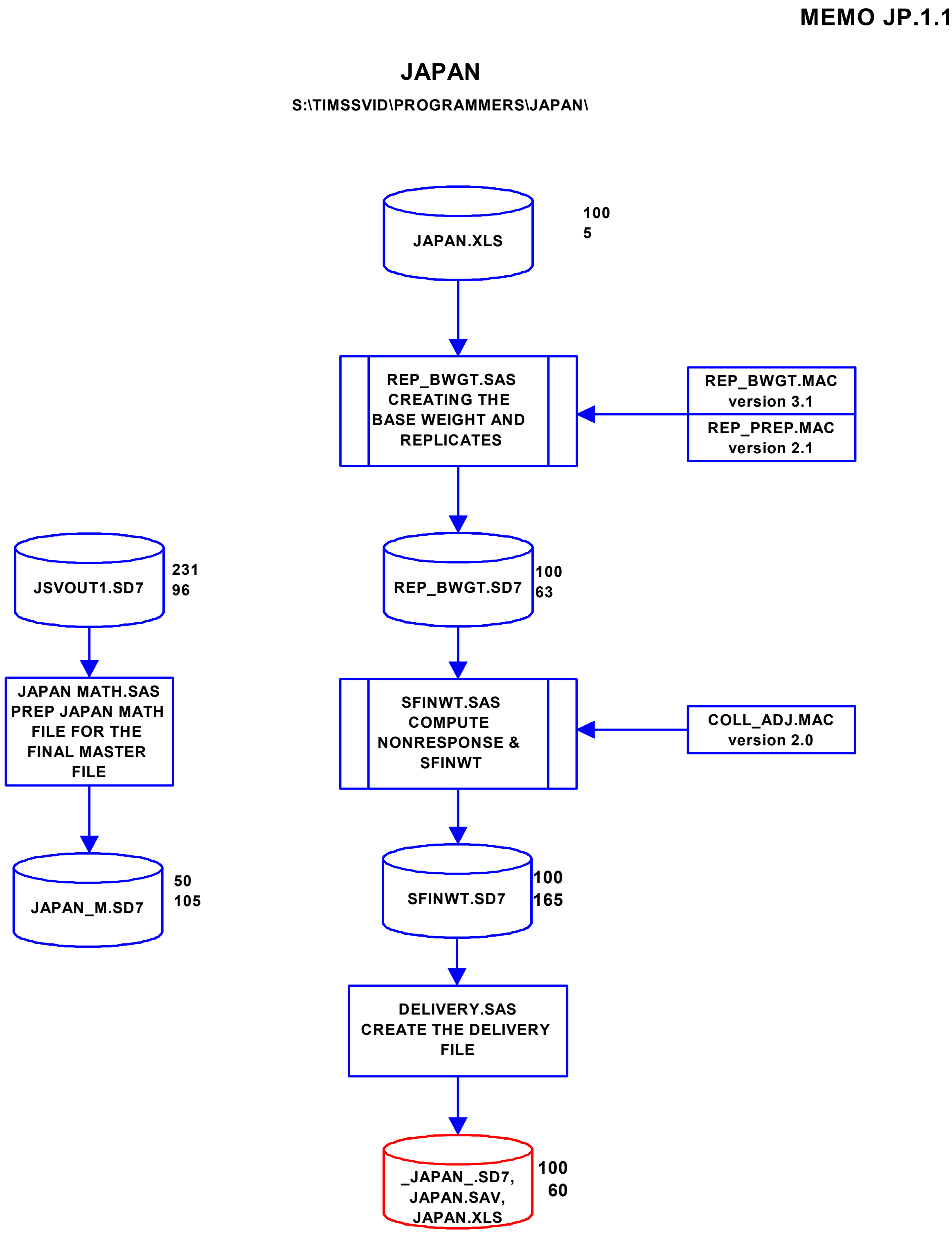
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 3. Steps for Weighting the Data for Hong Kong SAR



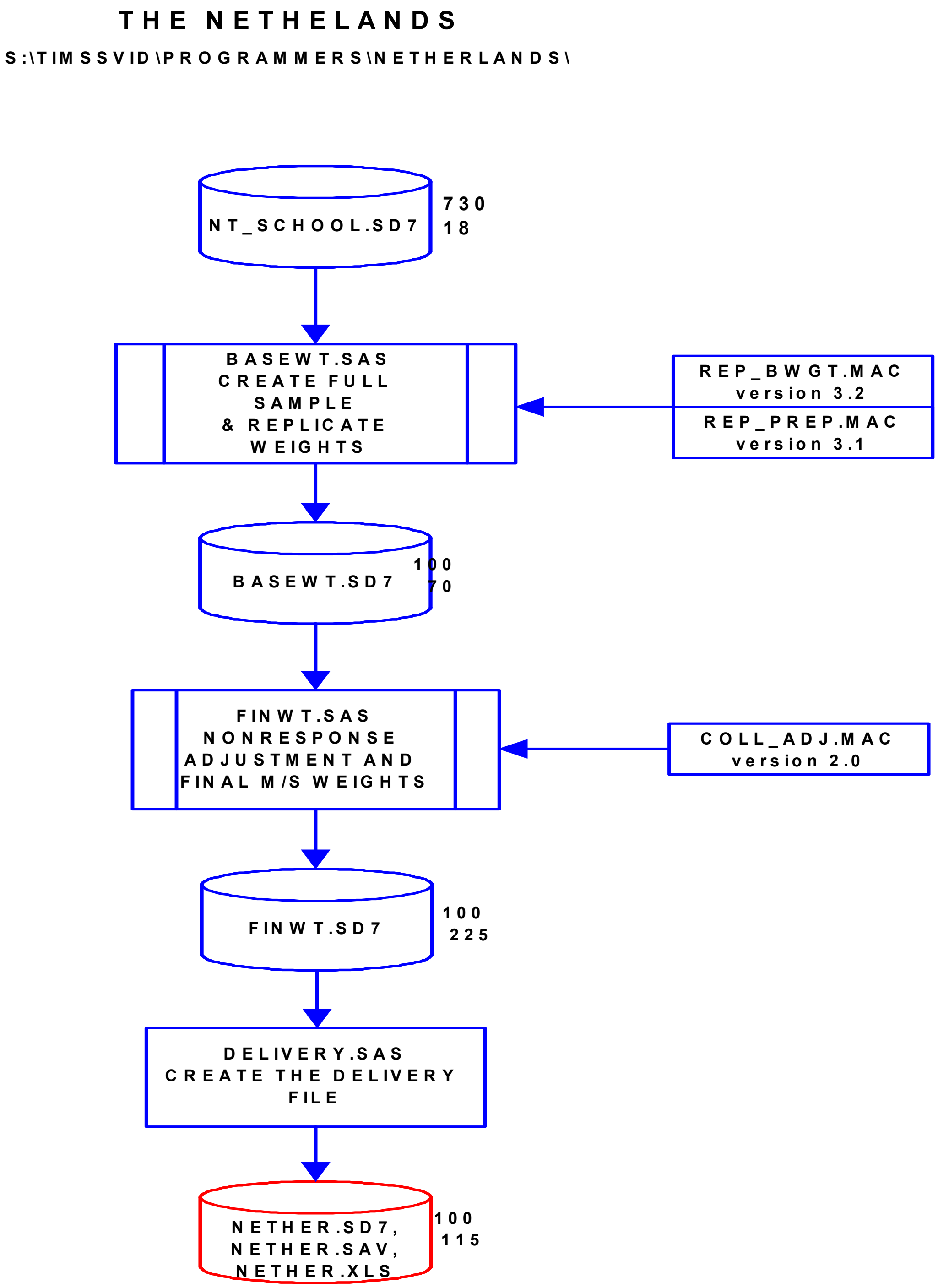
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 4. Steps for Weighting the Data for Japan



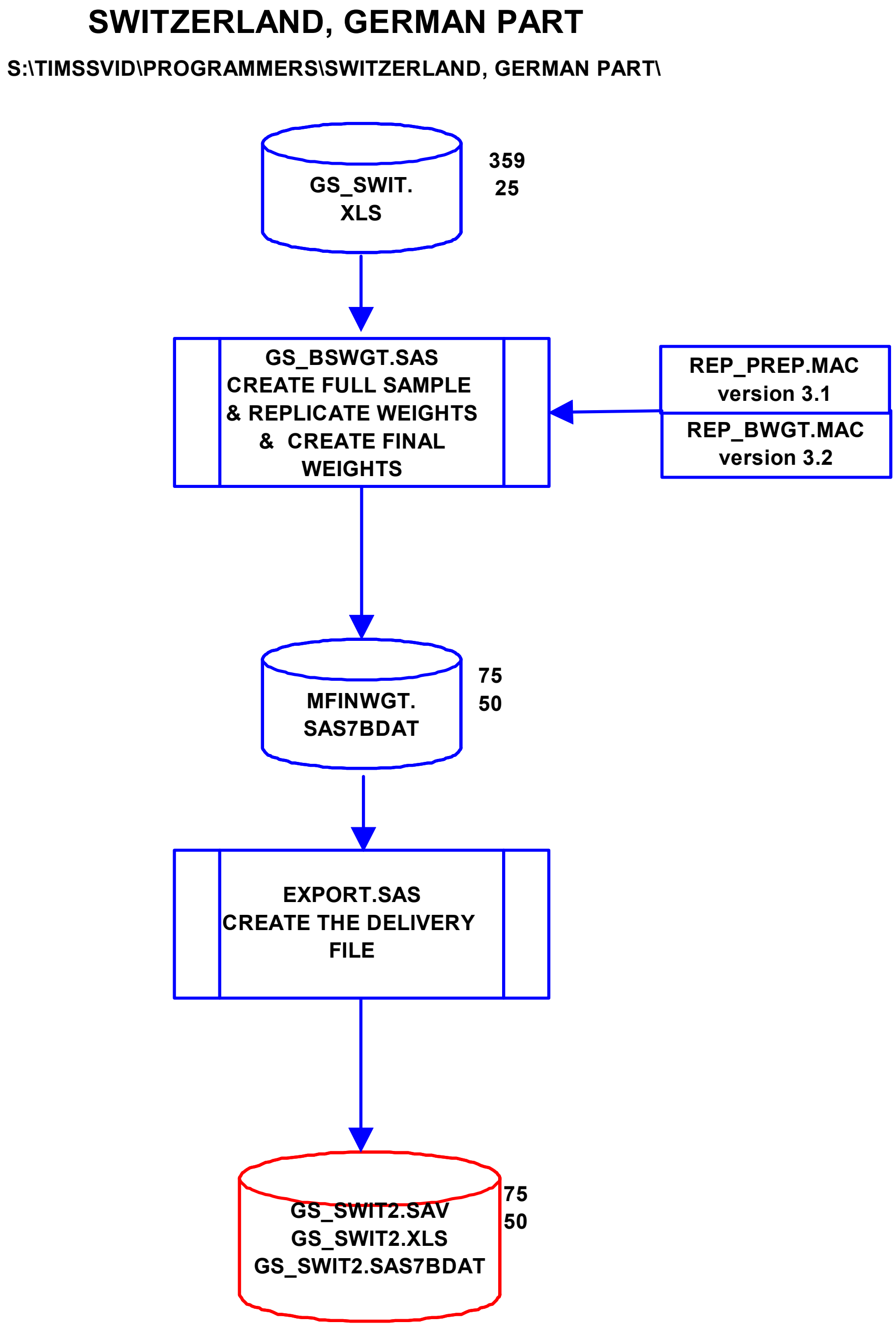
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 5. Steps for Weighting the Data for the Netherlands



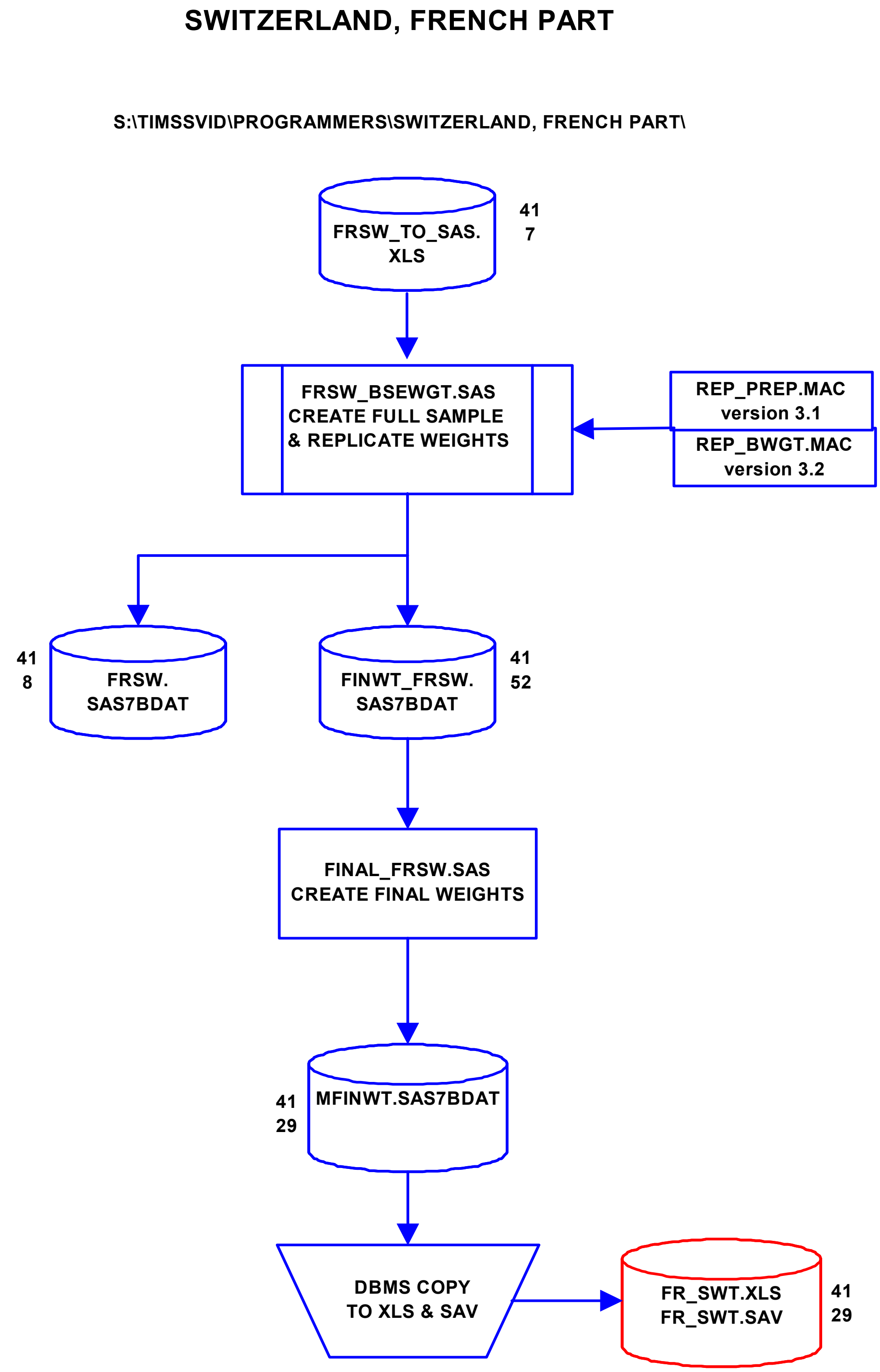
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 6. Steps for Weighting the Data for German-Speaking Switzerland



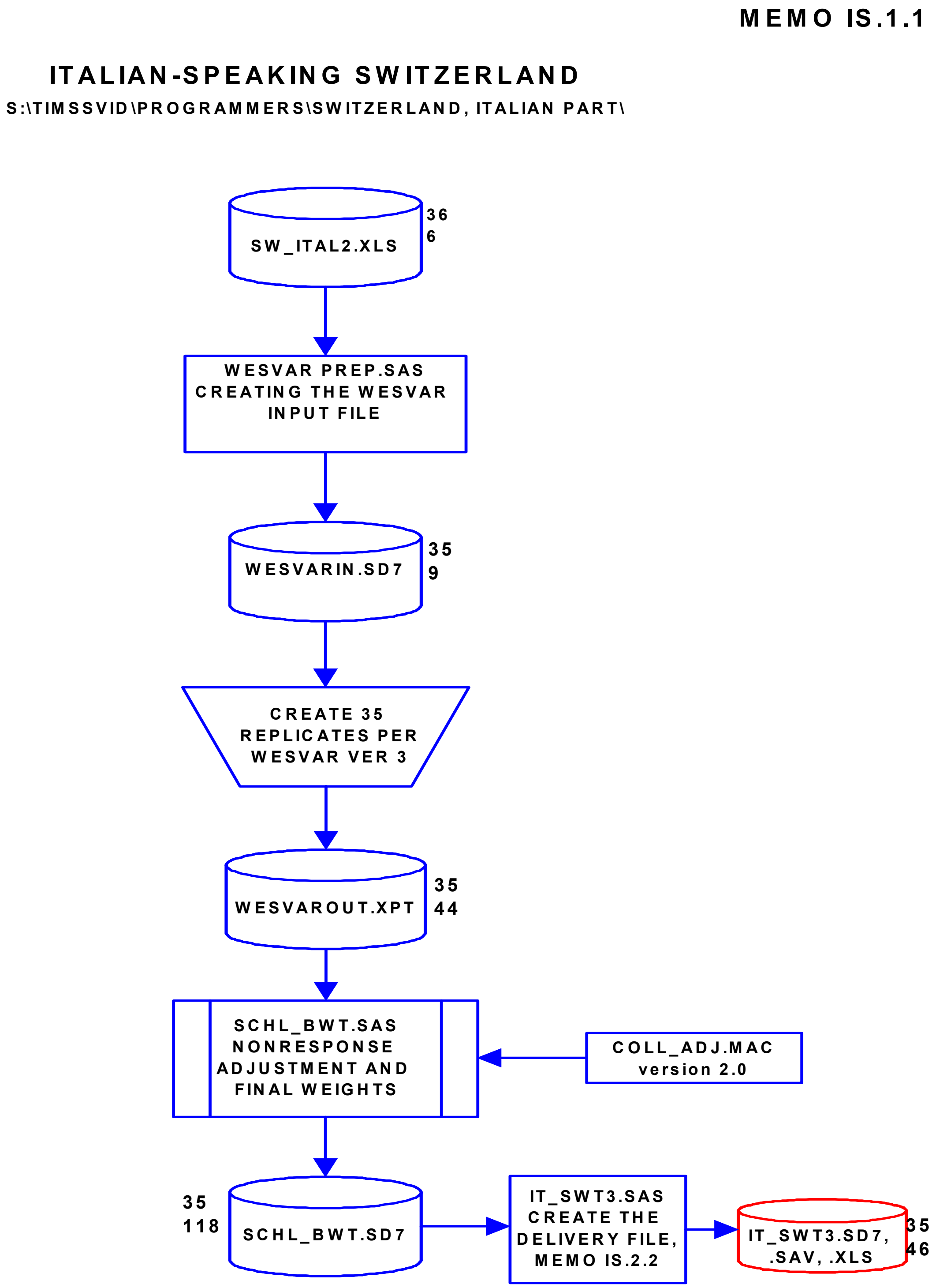
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 7. Steps for Weighting the Data for French-Speaking Switzerland



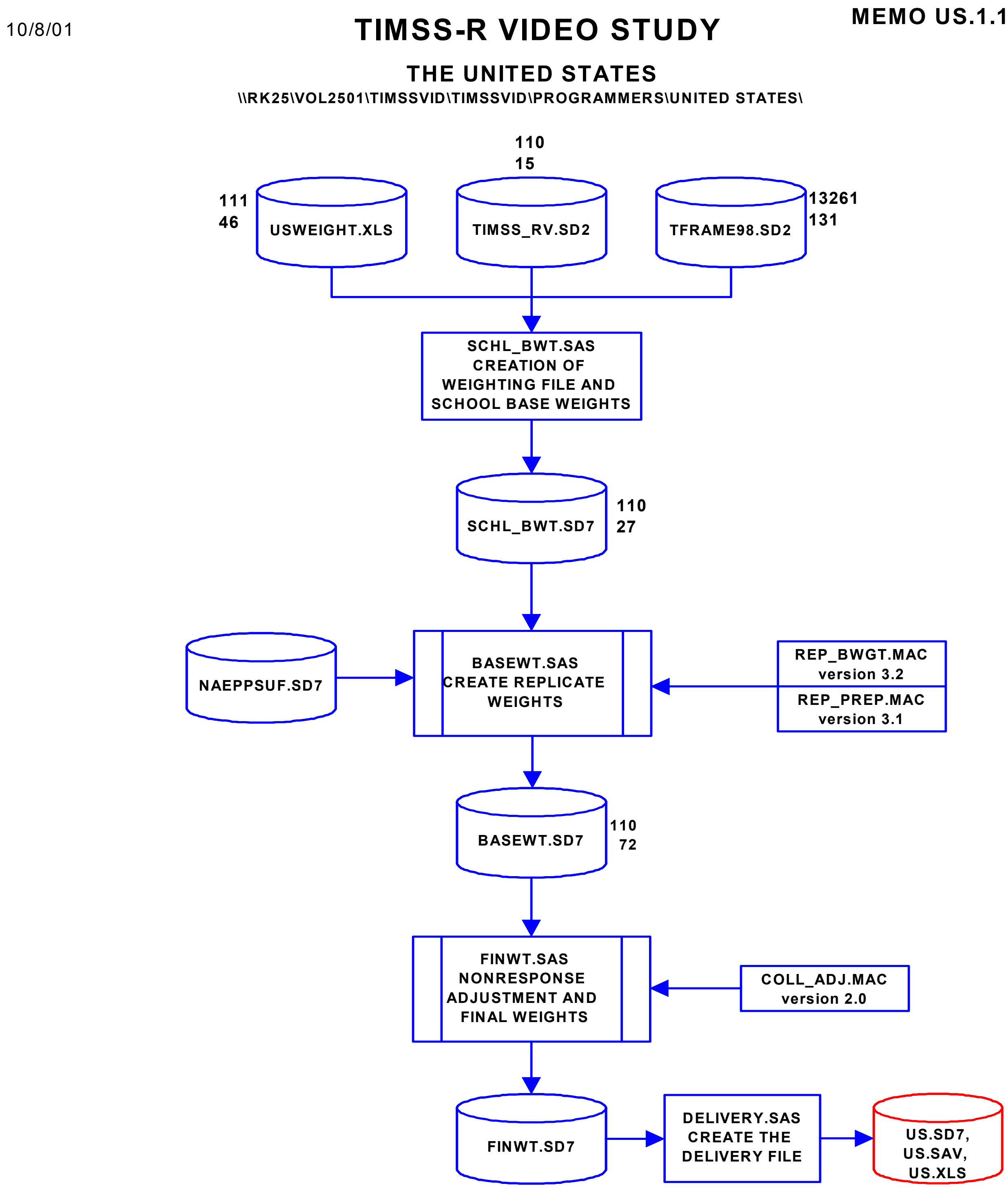
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 8. Steps for Weighting the Data for Italian-Speaking Switzerland



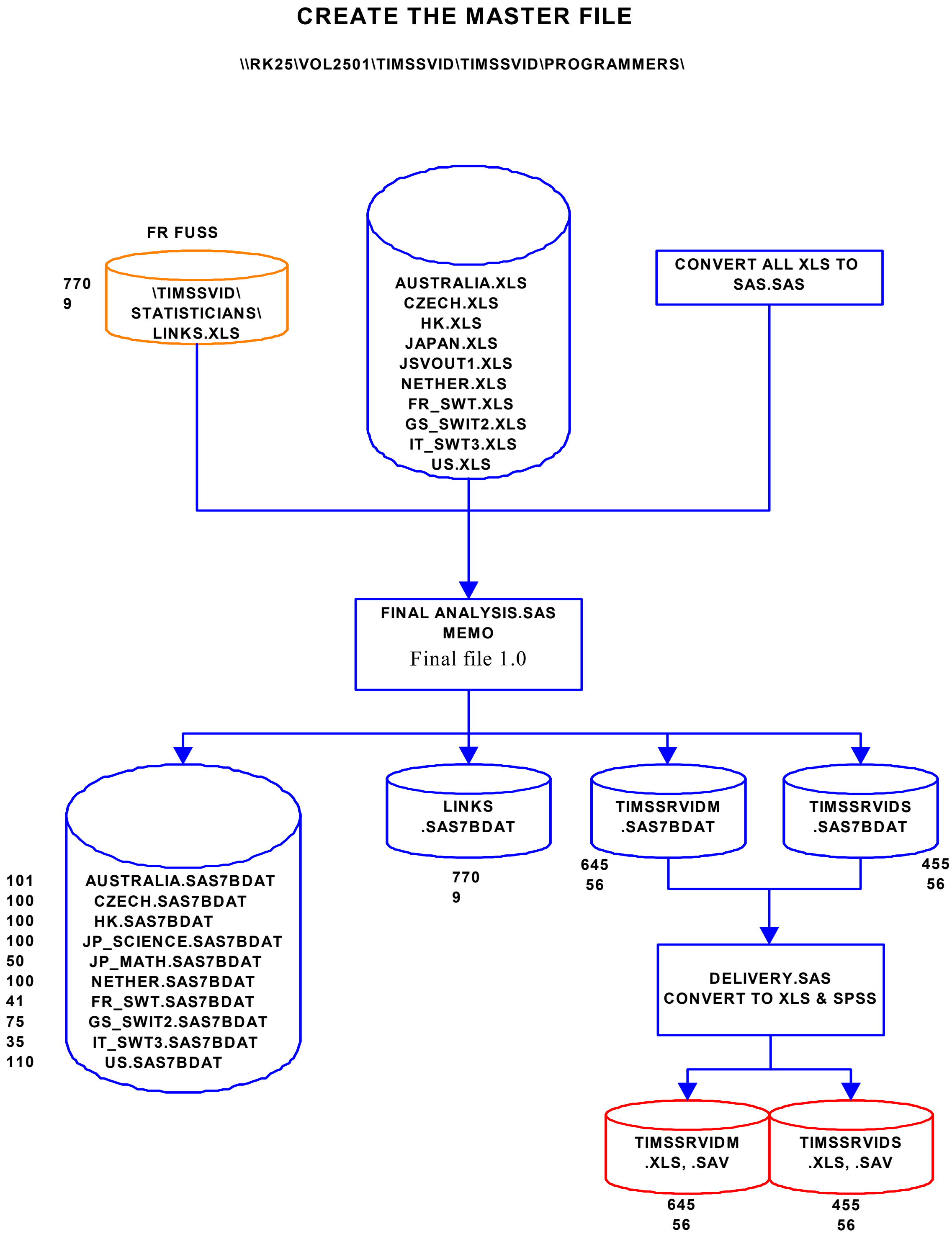
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 9. Steps for Weighting the Data for the United States



SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.

Figure 10. Steps for Creating the Master File for Weighting the Data



SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study, Video Study, 1999.