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ABSTRACT

This publication provides a comprehensive overview of work done across all parts of the National Center for Education Statistics (NCES). Each issue contains short publications, summaries, and descriptions that cover all NCES publications, data product, and funding opportunities developed over a 3-month period. Each issue also contains a message from the NCES on a timely topic and a featured topic with invited commentary. This issue opens with the "Note from NCES" by Eugene Owen, which discusses the methodology of the Third International Mathematics and Science Study (TIMSS). The featured topic is "The TIMSS 1999 Video Study," and this section contains: (1) "Teaching Mathematics in Seven Countries: Results from the TIMSS 1999 Video Study" (James Hiebert, Ronald Gallimore, Helen Garnier, Karen Bogard Givvin, Hilary Hollingsworth, Jennifer Jacobs, Angel Miu-Ying Chui, Diana Wearne, Margaret Smith, Nicole Kersting, Alfred Manaster, Eileen Tseng, Wallace Etterback, Carl Manaster, Patrick Gonzales, and James Stigler); (2) "Invited Commentary: The TIMSS 1999 Video Study and the Reform of Mathematics Teaching" (Thomas J. Cooney); and (3) "Invited Commentary: Lessons Learned from Examining Mathematics Teaching around the World" (Edward A. Silver). The second section, "Early Childhood Education," contains: (4) "Young Children's Access to Computers in the Home and at School in 1999 and 2000" (Amy H. Rathbun and Jerry West); (5) "Prekindergarten in U.S. Public Schools: 2000-20001" (Timothy Smith, Anne Kleiner, Basmat Parsad, and Elizabeth Farris); and (6) "Schools' Use of Assessments for Kindergarten Entrance and Placement: 1998-99" (Naomi Prakhas, Jerry West, and Kristin Denton). The next section, "Elementary and Secondary Education," contains: (7) "The Nation's Report Card: Science 2000" (Christine Y. O' Sullivan, Mary A. Lautko, Wendy S. Grigg, Jiahe Qian, and Jimming Zhang); (8) "Including Special-Needs Students in the NAEP 1998 Reading Assessment, Part 1, Comparison of Overall Results with and without Accommodations" (Anthony D. Lutkus and John Mazzeo); and (9) "Mathematics Teachers' Familiarity with Standards and Their Instructional Practices: 1995 and 1999" (Marisa Burian-Fitzgerald, Daniel J. McGrath, and Valena Plisko). The next section, "Postsecondary Education," contains: (10) "Characteristics of Undergraduate Borrowers: 1999-2000" (Melissa E. Clinedinst, Alisa F. Cunningham, and Jamie P. Merisotis); and (11) "Descriptive Summary of 1995-96 Beginning Postsecondary Students: Six Years Later" (Lutz Berkner, Shirley He, and Emily Forest Cataldi). The final section, "Data Products, Other Publications, and Funding Opportunities," lists these resources. (SLD)

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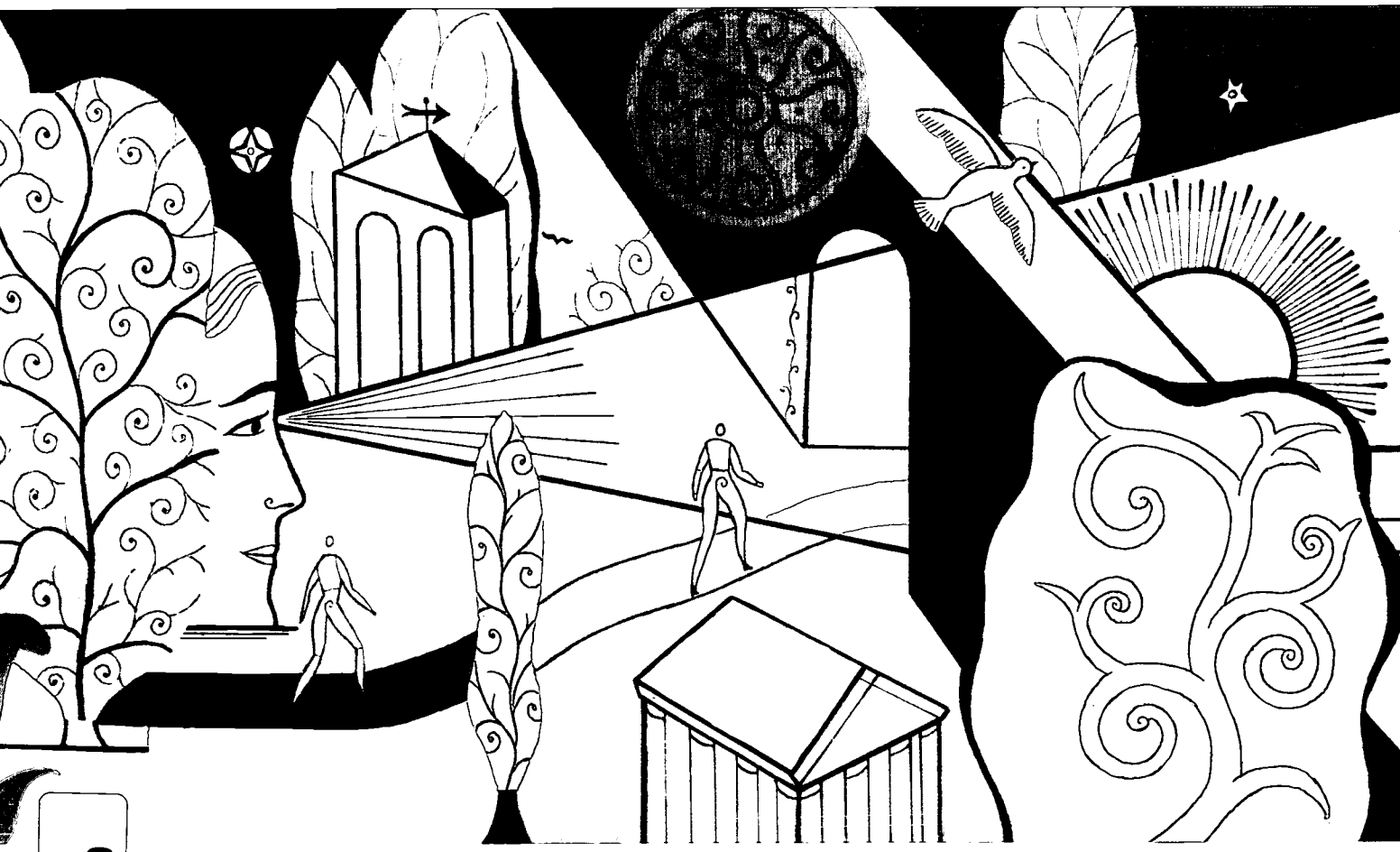

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EDITORIAL NOTE

National Center for Education Statistics

The National Center for Education Statistics (NCES) fulfills a congressional mandate to collect and report "statistics and information showing the condition and progress of education in the United States and other nations in order to promote and accelerate the improvement of American education."

EDUCATION STATISTICS QUARTERLY

Purpose and goals

At NCES, we are convinced that good data lead to good decisions about education. The *Education Statistics Quarterly* is part of an overall effort to make reliable data more accessible. Goals include providing a quick way to

- identify information of interest;
- review key facts, figures, and summary information; and
- obtain references to detailed data and analyses.

Content

The *Quarterly* gives a comprehensive overview of work done across all parts of NCES. Each issue includes short publications, summaries, and descriptions that cover all NCES publications and data products released during a 3-month period. To further stimulate ideas and discussion, each issue also incorporates

- a message from NCES on an important and timely subject in education statistics; and
- a featured topic of enduring importance with invited commentary.

A complete annual index of NCES publications will appear in the Winter issue (published each January). Publications in the *Quarterly* have been technically reviewed for content and statistical accuracy.

General note about the data and interpretations

Many NCES publications present data that are based on representative samples and thus are subject to sampling variability. In these cases, tests for statistical significance take both the study design and the number of comparisons into account. NCES publications only discuss differences that are significant at the 95 percent confidence level or higher. Because of variations in study design, differences of roughly the same magnitude can be statistically significant in some cases but not in others. In addition, results from surveys are subject to nonsampling errors. In the design, conduct, and data processing of NCES surveys, efforts are made to minimize the effects of nonsampling errors, such as item nonresponse, measurement error, data processing error, and other systematic error.

For complete technical details about data and methodology, including sample sizes, response rates, and other indicators of survey quality, we encourage readers to examine the detailed reports referenced in each article.

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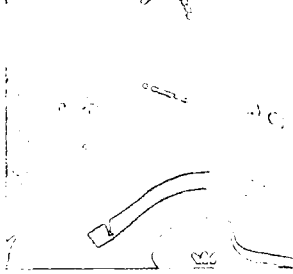


Data Products, Other Publications, and Funding Opportunities

Data Products

Other Publications

Funding Opportunities

NOTE FROM NCES

Eugene Owen, Program Director,
International Studies Program

Using Quantitative and Qualitative Methods to Study Teaching and Learning

In embarking upon the endeavor known as TIMSS (the Third International Mathematics and Science Study), the National Center for Education Statistics (NCES) was determined to create a new kind of international comparative education study. In the past, international studies relied either on qualitative methods (such as observing relatively small numbers of teachers in the classroom) or on quantitative methods (such as administering surveys to nationally representative samples of students and teachers). Too often, however, the kinds of questions that one wanted to answer were answerable only by using methods of both types. This situation presented challenges to a statistical agency that is more comfortable with quantitative than with qualitative techniques. Nevertheless, NCES decided to combine these approaches in TIMSS, which was administered in 1995 and 1999 and has another round of data collection scheduled for 2003. In addition to including some components that are primarily quantitative and others that are primarily qualitative, TIMSS includes one major component—the video study—that integrates both approaches.

Quantitative Components

TIMSS 1995 and TIMSS 1999 included the questionnaires and written assessments that are the key traditional components of a quantitatively oriented international education study. At the core of both administrations of TIMSS were in-depth surveys of 4th-, 8th-, and 12th-grade students, their principals, and their teachers. In addition, mathematics and science assessments were given to the students at all three grade levels. Results from the surveys and assessments were released in a series of national and international reports that provide national estimates of student performance as well as other information about mathematics and science teaching and learning.

Qualitative Components

TIMSS was cofunded by the National Science Foundation, which has a long-standing interest in curriculum development and its impact on mathematics and science teaching and learning. In TIMSS 1995, as in a few earlier international education studies, development of the student, teacher, and principal surveys was preceded by qualitative curriculum studies that examined opportunities to learn mathematics and science in various countries. The TIMSS 1995 curriculum studies covered more than 50 countries and served as the basis for many of the survey questions.

In addition to the curriculum studies, TIMSS 1995 included a set of case studies that looked at four questions: How are national standards implemented in the classroom? What is the life of the secondary student like? How are student ability differences handled? and What kind of training do new teachers get before they teach and as they become more proficient? Schools in one principal city and two other cities in each of three countries—Japan, Germany, and the United States—were selected as the focus of the case studies. In-depth interviews and observations were the data collection methods used to come to an understanding of mathematics and science education. Information from the case studies was used to enrich and illustrate the data from the TIMSS 1995 surveys and assessments.

The Video Study Component

One of the most exciting and innovative parts of TIMSS involved observing teachers in the classroom, recording the observed lessons on videotape, and coding these lessons for quantitative analysis. The resulting statistics provide measures of the commonness or rarity of the observed dimensions of teaching and learning. Conversely, the qualitative observations that have been captured on videotape allow us to reconnect the statistics to the social milieu in which they occurred.

A video study was conducted in both 1995 and 1999. In 1995, teachers and their classrooms were observed in Japan, Germany, and the United States for an hour of instruction in mathematics. A nationally representative sample of 100 classrooms was selected in each country. Because both the results of the mathematics assessment and the results of the video study for Japan in 1995 were so different from the results for Germany and the United States, the decision was made to replicate the video study in other countries with relatively high achievement on the assessment. Thus, in 1999, classrooms in Australia, the Czech Republic, Hong Kong, the Netherlands, Switzerland, and the United States were videotaped. Featured in this issue of the *Quarterly* are findings about mathematics instruction from the TIMSS 1999 Video Study.

Future Components

As with all NCES international projects, we will continue to innovate and seek ways to address ongoing policy issues. Just as the TIMSS video component evolved as a better way to understand what actually takes place inside classrooms, we anticipate that other components will surface in the future to address emerging and different needs in the field of international statistics.

Featured Topic: The TIMSS 1999 Video Study

Teaching Mathematics in Seven Countries: Results From the TIMSS 1999 Video Study

James Hiebert, Ronald Gallimore, Helen Garnier, Karen Bogard Givvin, Hilary Hollingsworth, Jennifer Jacobs, Angel Miu-Ying Chui, Diana Wearne, Margaret Smith, Nicole Kersting, Alfred Manaster, Ellen Tseng, Wallace Etterbeek, Carl Manaster, Patrick Gonzales, and James Stigler

This article summarizes the report of the same name. The article was originally published as* Highlights From the TIMSS 1999 Video Study of Eighth-Grade Mathematics Teaching*, a separate publication providing an overview of the report. The sample survey data are from the Third International Mathematics and Science Study (TIMSS) 1999 Video Study.

The Third International Mathematics and Science Study (TIMSS) 1999 Video Study is a follow-up and expansion of the TIMSS 1995 Video Study of mathematics teaching. Larger and more ambitious than the first, the 1999 study investigated eighth-grade science as well as mathematics, expanded the number of countries from three to seven, and included more countries with relatively high achievement on TIMSS assessments in comparison to the United States. This report focuses only on mathematics lessons; the report on science lessons will be released at a later date.

The countries participating in the mathematics portion of the TIMSS 1999 Video Study included Australia, the Czech Republic, Hong Kong SAR,[1] Japan, the Netherlands, Switzerland, and the United States. The TIMSS 1995 and 1999 average mathematics scores for these countries are displayed in table 1. On the TIMSS 1995 mathematics assessment, eighth-graders as a group in Japan and Hong Kong SAR were among the highest achieving students while

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

eighth-grade students in the United States scored, on average, significantly lower than their peers in the other six countries.

Release of the TIMSS 1995 Video Study results garnered attention from those interested in teaching and learning. In part, this attention was due to both the novel methodology, in which national samples of teachers were videotaped teaching an eighth-grade mathematics lesson in their regular classrooms, and the differences in teaching among the countries. Three countries participated in the 1995 Video Study—Germany, Japan, and the United States—and comparisons of the results suggested that each country had a distinct cultural pattern of teaching mathematics. Discussion of results from the 1995 Video Study can be found in Stigler et al. (1999) and Stigler and Hiebert (1999).

In many ways, the TIMSS 1999 Video Study of eighth-grade mathematics lessons begins where the 1995 study ended. Some findings address lingering questions that could not be answered in the first study or questions that have emerged over time as many audiences have interpreted the results. Other findings address new questions arising from advances in the field and from advances in the research methodology used in the study—the "video survey."

The mathematics portion of the TIMSS 1999 Video Study included 638 eighth-grade lessons collected from all seven participating countries. This includes eighth-grade mathematics lessons collected in Japan in 1995 as part of the earlier study.[2] In each country, the lessons were randomly selected to be representative of eighth-grade mathematics lessons overall. In each case, a teacher was videotaped for one complete lesson, and in each country, videotapes were collected across the school year to try to capture the range of topics and activities that can take place throughout an entire school year.[3] Finally, to obtain reliable comparisons among the participating nations, the data were appropriately weighted to account for sampling design. Sampling and participation rate information, as well as other technical notes, are detailed in an appendix to the complete report from which this article presents highlights. For more detailed discussion of the technical aspects of the study, see the technical report (Jacobs et al. forthcoming).

[2]Japan agreed to collect new data for the science component of the video study. Therefore, the Japanese mathematics lessons collected for the TIMSS 1995 Video Study were reexamined following the revised and expanded coding scheme developed for the 1999 study.

[3]The complete report includes video clip examples on CD-ROM. Video clip examples are also available at http://nces.ed.gov/pubs2003/timssvideo.

Table 1. Average scores on TIMSS 1995 and TIMSS 1999 mathematics assessments of countries participating in the TIMSS 1999 Video Study

	Average scores	
Country	1995[1]	1999[2]
Australia[3] (AU)	519	525
Czech Republic (CZ)	546	520
Hong Kong SAR (HK)	569	582
Japan (JP)	581	579
Netherlands[3] (NL)	529	540
Switzerland (SW)	534	—
United States (US)	492	502
International average[4]	—	487

—Not available.

[1]Third International Mathematics and Science Study (TIMSS) 1995: AU>US; HK, JP>AU, NL, SW, US; JP>CZ; CZ, SW>AU, US; NL>US.

[2]TIMSS 1999: AU, NL>US; HK, JP>AU, CZ, NL, US.

[3]Nation did not meet international sampling and/or other guidelines in 1995. See Beaton et al. (1996) for details.

[4]International average: AU, CZ, HK, JP, NL, US>international average.

NOTE: Rescaled TIMSS 1995 mathematics scores are reported here. Due to rescaling of 1995 data, international average is not available. 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.

What Can Be Learned From a Video Survey of Teaching Across Cultures?

Classroom teaching is a nearly universal activity designed intentionally to help young people learn. It is the process that brings the curriculum into contact with the students and through which national, regional, or state education goals are to be achieved. It is reasonable to assume that teachers and teaching make a difference in students' learning. However, methodically studying the direct effects that teachers and teaching may have on student learning is difficult, though not impossible. The TIMSS 1999 Video Study is based on the premise that the more educators and researchers can learn about teaching as it is actually practiced, the more effectively educators can identify factors that might enhance student learning opportunities and, by extension, student achievement. By providing rich descriptions of what actually takes place in mathematics and science classrooms, the video study can contribute to further research into features of teaching that most influence students' learning.

Comparing teaching across cultures has additional advantages.

- Comparing teaching across cultures allows educators to examine their own teaching practices from a fresh perspective by widening the known possibilities. In addition to examining how teachers across one's own country approach mathematics, opening up the lens to include an examination of how teachers in another country approach the same topic can make one's own teaching practices more visible by contrast and therefore more open for reflection and improvement.
- Comparing teaching across cultures can reveal alternatives and stimulate discussion about the choices being made within a country. Although a variety of teaching practices can be found in a single country, it sometimes requires looking outside one's own culture to see something new and different. These observations, combined with carefully crafted follow-up research, can stimulate debate about the approaches that may make the most sense for achieving the learning goals defined within a country.

Using national video surveys to study teaching has special advantages.

- Video enables detailed examination of complex activities from different points of view. Video preserves classroom activity so it can be slowed down and viewed multiple times, by many people with different kinds of expertise, making possible detailed descriptions of many classroom lessons.
- Collecting a random national sample provides information about students' experiences across a range of conditions, rather than exceptional experiences only. The ability to generalize nationally can elevate policy discussions beyond the anecdotal. Therefore, it is important to know what actual teaching looks like, on average, so that national discussions can focus on what most students experience.

What Are the Major Findings From the TIMSS 1999 Video Study of Eighth-Grade Mathematics Teaching?

Based on the coding and analysis of the eighth-grade mathematics lessons videotaped for this study, the following points can be made:

Eighth-grade mathematics teaching in all seven countries shared some general features.

The comparative nature of this study tends to draw attention to the ways in which the seven countries differed in the teaching of eighth-grade mathematics. But it is important to remember that both differences and similarities are expected in cross-country and cross-cultural comparisons. When a wide-angle lens is employed across countries, it is clear that all seven countries shared common ways of teaching eighth-grade mathematics. Viewed from this perspective, some similarities are striking.

- In all of the countries, eighth-grade mathematics was often taught through solving problems; at least 80 percent of lesson time, on average, was devoted to solving mathematics problems.
- Eighth-grade mathematics lessons in all seven countries were organized to include some public (whole-class) work and some private (individual or small-group) work. During the time that students worked privately, the most common pattern across the countries was for students to work individually, rather than in pairs or groups.
- On average, lessons in all of the countries included some review of previous content as well as some attention to new content.
- At least 90 percent of lessons in all the countries made use of a textbook or worksheet of some kind.
- Teachers in all of the countries talked more than students, at a ratio of at least 8:1 words.

While there were some shared general features, there was discernible variation across the countries in teaching eighth-grade mathematics. Distinctions included the introduction of new content, the coherence across mathematical problems and within their presentation, the topics covered and the procedural complexity of the mathematical problems, and classroom practices regarding individual student work and homework in class.

A sample of these findings is summarized below.

- Eighth-grade mathematics lessons in the Czech Republic placed a greater emphasis on reviewing previously learned content than those in all of the other countries except the United States; lessons in Japan placed a greater emphasis on introducing new content than those in all six of the other countries; and lessons in Hong Kong SAR placed a greater

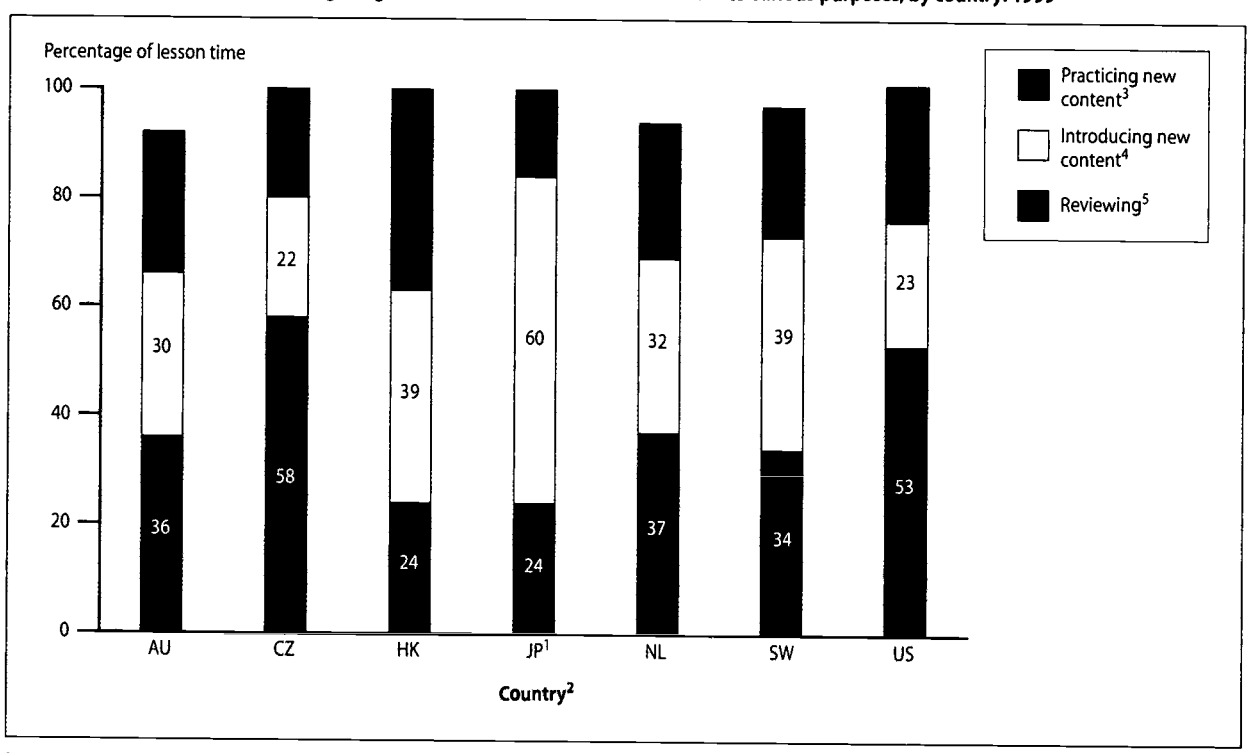
emphasis on practicing new content than those in the Czech Republic, Japan, and Switzerland (figure 1).

Although, on average, eighth-grade mathematics lessons in all of the countries included some time reviewing previous content and some time introducing and practicing new content, there were differences in emphases in each country. Combining the time spent on both introducing and practicing new material provides another way of detecting differences: Australia, Hong Kong SAR, Japan, the Netherlands, and Switzerland devoted more time, on average, to studying new content (ranging from 56 to 76 percent of lesson time) than reviewing previous content; the Czech Republic spent more time, on average, reviewing previous content (58 percent of lesson time) than studying new content; and in the United States there was no detectable difference between the average percentage of lesson time devoted to reviewing previous content and studying new content (53 and 48 percent of lesson time, respectively). Moreover, while a single mathematics lesson could combine time spent reviewing and introducing and practicing new content, there were a number of lessons that were entirely devoted to just one of those purposes. In the Czech Republic and the United States, a greater percentage of eighth-grade mathematics lessons were spent entirely in review of content previously presented than in Hong Kong SAR and Japan (28 and 28 percent of lessons compared to 8 and 5 percent, respectively).

- Eighth-grade mathematics lessons across the seven countries focused on a range of topics, from whole numbers and fractions to solving linear equations and trigonometry.

Among the almost 15,000 mathematics problems identified and examined as part of this study, at least 82 percent of problems per lesson, on average, focused on three topic

Figure 1. Average percentage of eighth-grade mathematics lesson time devoted to various purposes, by country: 1999



[1]Japanese mathematics data were collected in 1995.

[2]AU=Australia; CZ=Czech Republic; HK=Hong Kong SAR; JP=Japan; NL=Netherlands; SW=Switzerland; and US=United States.

[3]Practicing new content: HK>CZ, JP, SW.

[4]Introducing new content: HK, SW>CZ, US; JP>AU, CZ, HK, NL, SW, US.

[5]Reviewing: CZ>AU, HK, JP, NL, SW; US>HK, JP.

NOTE: For each country, average percentage was calculated as the sum of the percentage within each lesson, divided by the number of lessons. Percentages may not sum to 100 because of rounding and the possibility of coding portions of lessons as "not able to make a judgment about the purpose."

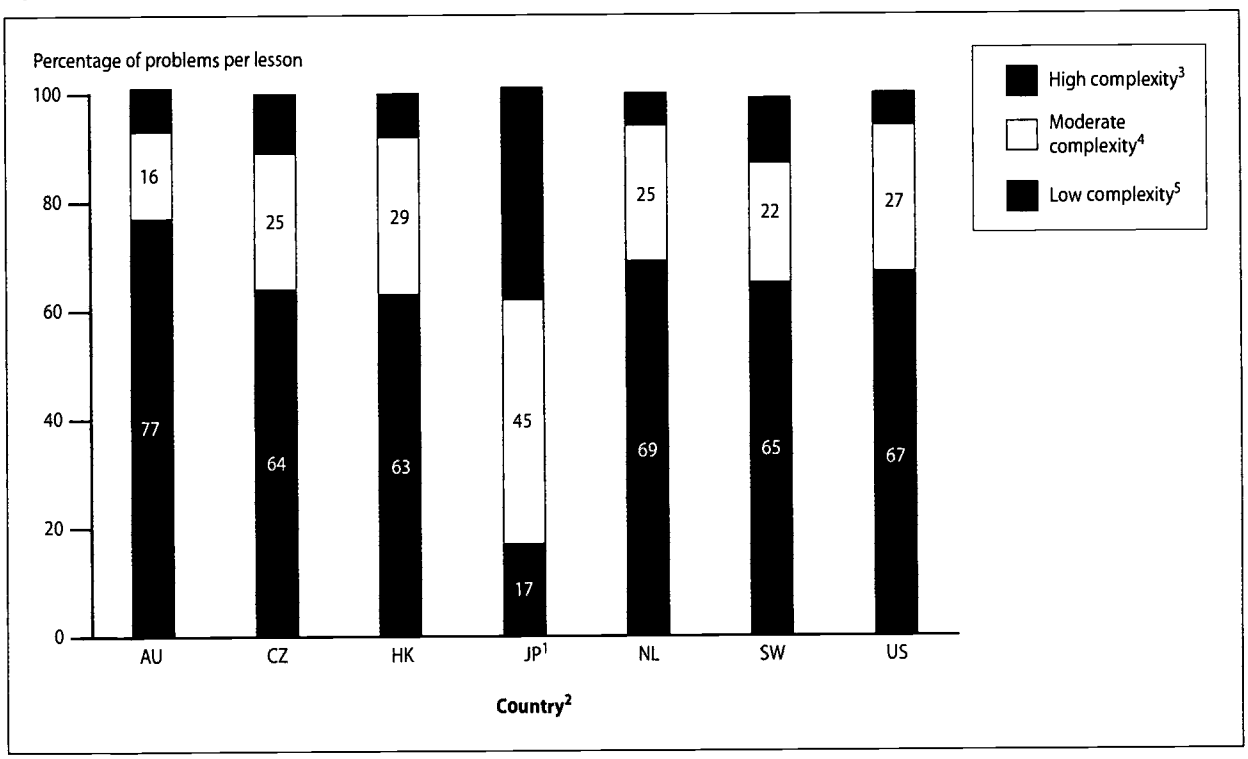
SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study (TIMSS), Video Study, 1999. (Originally published as figure 3.8 on p. 50 of the complete report from which this highlights summary is drawn, *Teaching Mathematics in Seven Countries: Results From the TIMSS 1999 Video Study* [NCES 2003-013]).

areas: number, geometry, and algebra. In one country, Hong Kong SAR, 14 percent of problems per lesson, on average, focused on trigonometry. In some lessons, all problems encountered by students focused on one topic or one subtopic (e.g., linear equations), whereas in other lessons, problems were identified as being from more than one subtopic or even from more than one topic (e.g., number and geometry). No single lesson is likely to include a range of problems related to all topics and subtopics typically covered in grade 8 mathematics.

- The level of procedural complexity of problems in Japanese eighth-grade mathematics lessons was different from that in the other countries (figure 2).

The overall complexity of the mathematics presented in the lessons is an important feature of the mathematics but is difficult to define and code reliably. This is due, in part, to the fact that the complexity of a problem needs to take into account the experience and capability of the student encountering the problem. What is complex to one student may be less complex to his or her classmate. One type of complexity that can be defined and examined independent of a student is procedural complexity: the number of steps it takes to solve a problem using a common solution method. Three levels of complexity were defined: low, moderate, and high. Low complexity was defined as a problem that required four or fewer decisions by a student to solve it, using conventional procedures. Moderate complexity was defined as a problem that, using conventional procedures, required more than four decisions by a student to solve it and could contain one subproblem. High complexity was defined as a problem that required more than four decisions by a student, and at least two subproblems, to solve it, using conventional procedures. Across the three levels of complexity, each of the countries, with the

Figure 2. Average percentage of problems per eighth-grade mathematics lesson at each level of procedural complexity, by country: 1999



[1]Japanese mathematics data were collected in 1995.

[2]AU=Australia; CZ=Czech Republic; HK=Hong Kong SAR; JP=Japan; NL=Netherlands; SW=Switzerland; and US=United States.

[3]High complexity: JP>AU, CZ, HK, NL, SW, US.

[4]Moderate complexity: HK>AU; JP>AU, SW.

[5]Low complexity: AU, CZ, HK, NL, SW, US>JP.

NOTE: Percentages may not sum to 100 because of rounding. For each country, average percentage was calculated as the sum of the percentage within each lesson, divided by the number of lessons.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study (TIMSS), Video Study, 1999. (Originally published as figure 4.1 on p. 71 of the complete report from which this highlights summary is drawn, *Teaching Mathematics in Seven Countries: Results From the TIMSS 1999 Video Study* [NCES 2003-013]).

exception of Japan, included, on average, at least 63 percent of problems per lesson of low procedural complexity. At the other end of the scale, up to 12 percent of problems per lesson, on average, were of high procedural complexity, again with the exception of Japan. In Japan, 39 percent of problems per lesson were of high procedural complexity, a greater percentage than in any of the other six countries.

- The relationship between one mathematics problem and the next in an eighth-grade mathematics lesson was different in Japan than in the other countries.

The relationship between the various mathematics problems presented in a lesson is of interest because the clarity and coherence of a lesson may be influenced, in part, by the way in which problems are related to each other. Four kinds of relationships between problems were identified: repetition, mathematically related, thematically related, and unrelated. Each problem presented in a lesson after the first problem was examined for the relationship to the prior problem. A problem was identified as a repetition if it was the same or mostly the same, requiring essentially similar operations to solve as the preceding problem in the lesson. A problem was identified as mathematically related if the problem used the solution to a previous problem for solving this problem, extended a previous problem by requiring additional operations, highlighted some operation of a previous problem by considering a simpler example, or elaborated a previous problem by solving a similar problem in a different way. Analysis of the data revealed that, on average, Japanese eighth-grade mathematics lessons contained a higher percentage of problems per lesson that were mathematically related (42 percent) than lessons in any of the other countries. Moreover, Japanese lessons contained a lower percentage of problems per lesson that were repetitions (40 percent) than those in any of the other countries. In all of the countries except Japan, at least 65 percent of the problems per lesson, on average, were identified as repetitions of the preceding problem.

- Teachers in Hong Kong SAR and Japan presented different types of mathematics problems to their eighth-grade classes than did teachers in the other countries (figure 3).

When mathematics problems were classified into three types of mathematical processes implied by the problem statements—using procedures, stating concepts, or making connections among mathematical facts, procedures, and concepts—lessons in Hong Kong SAR contained, on average, a larger percentage of problems per lesson targeted toward using procedures (84 percent) than the other countries in figure 3, except the Czech Republic.[4] In the other countries, the range was from 41 to 77 percent of problems per lesson, on average. Mathematics teachers in Japan presented a larger percentage of problems per lesson that emphasized making connections (54 percent) than the other countries in figure 3, except the Netherlands. In the other countries, the range was from 13 to 24 percent of problems per lesson, on average.

Using the same information in another way, an examination in each country of the relative emphases of the types of problems per lesson implied by the problem statements shows that in five of the six countries where data were available, a greater percentage of problems per lesson were presented as using procedures than either making connections or stating concepts. The exception to this pattern was Japan, where there was no detectable difference in the percentage of problems per lesson that were presented as using procedures compared to those presented as making connections.

- In Australian and U.S. eighth-grade mathematics lessons, a smaller percentage of making-connections problems were solved in a way that actually made the connections among mathematical facts, procedures, and concepts evident during classroom discussions than in the other countries.

For this analysis, problems were examined and coded twice: the first time according to the way they were stated at the outset, and the second time according to the way they were actually discussed in the eighth-grade mathematics classroom. This double-coding was necessary because problems can be initially stated in one form, and then transformed into a different form as they are discussed in the classroom. Among the six countries where data were available, when problems initially stated as making connections were classified a second time based on the subsequent classroom discussion, mathematical connections or relationships were emphasized least often in the Australian and U.S. eighth-grade mathematics lessons. In these two countries, respectively, on average 8 percent and less than 1 percent[5] of problems per lesson that were initially stated as making connections led to classroom discussion of the problem that actually made the connections. The percentages in the other countries ranged from 37 to 52. Examination of problems

[4]Switzerland was not included in the analyses of mathematical processes associated with mathematics problems.

[5]Rounds to zero.

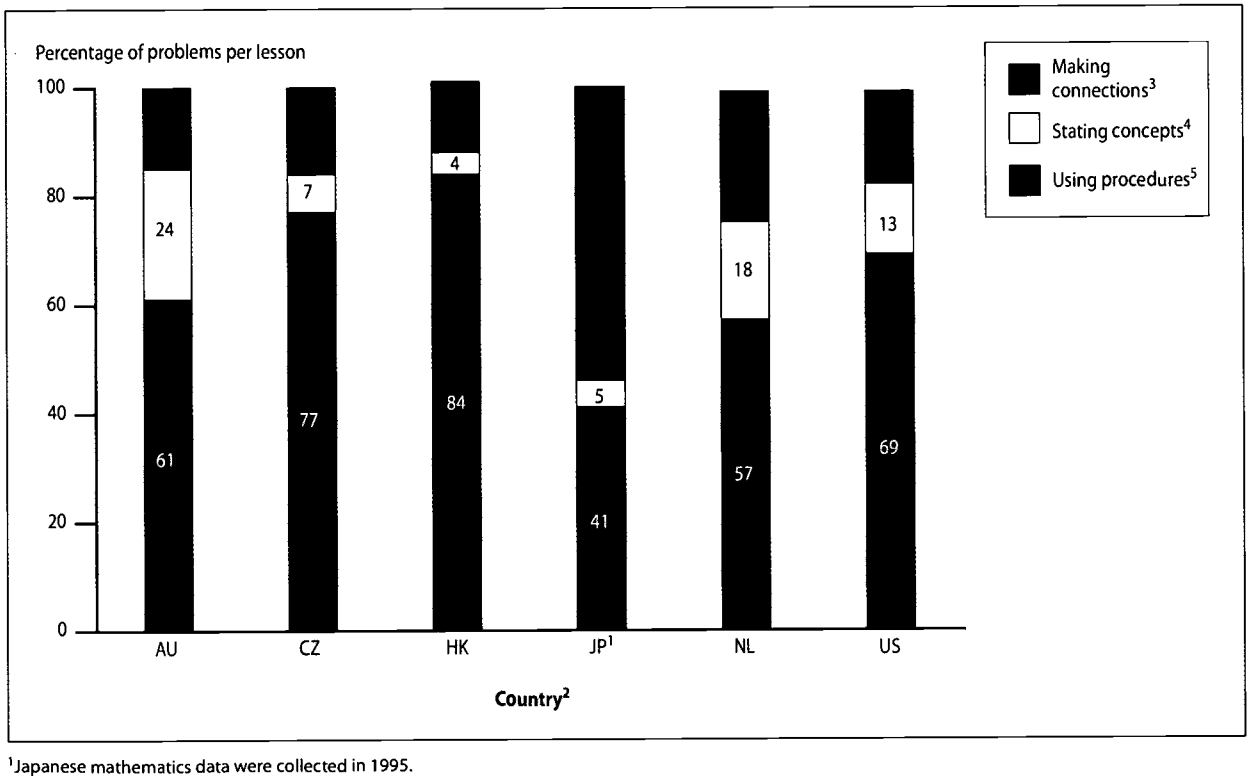
that at the outset seemed designed to focus on using procedures revealed that mathematics problems were more likely to be followed through by actually using procedures in U.S. lessons than in either Czech or Japanese lessons.

- Eighth-grade mathematics lessons in Japan and the Czech Republic employed different methods to summarize the point of a lesson or a mathematical problem than those in almost all of the other countries.

Teachers may employ various techniques to help students recognize the key ideas in either a lesson or a particular mathematical problem or set of problems. One way that teachers can help students identify the key mathematical point of a lesson is to describe the goal of the lesson. To be included in the analysis, a goal statement about a specific mathematical topic to be covered during the lesson had to be explicitly written or said by the teacher. Across all seven countries, a higher percentage of eighth-grade mathematics lessons in the Czech Republic contained goal statements (91 percent) than in all the other countries except Japan. Dutch lessons included the fewest goal statements of any of the countries (21 percent).

A second way to help students recognize key ideas in a lesson is a summary statement at the end of a lesson. For all the countries, summary statements were less common than goal statements. Lesson summaries were identified in at least 21 percent of eighth-grade mathematics lessons in Japan, the Czech Republic, and Hong Kong SAR, and in 10 percent of lessons in Australia. In the other countries where reliable estimates could be calculated, between 2 and 6 percent of lessons included summary statements. After an individual mathematics problem has been solved, teachers might also summarize

Figure 3. Average percentage of problems per eighth-grade mathematics lesson of each problem statement type, by country: 1999



[1]Japanese mathematics data were collected in 1995.

[2]AU=Australia; CZ=Czech Republic; HK=Hong Kong SAR; JP=Japan; NL=Netherlands; and US=United States.

[3]Making connections: JP>AU, CZ, HK, US.

[4]Stating concepts: AU>CZ, HK, JP; NL, US>HK, JP.

[5]Using procedures: CZ>JP, NL; HK>AU, JP, NL, US; US>JP.

NOTE: Analyses do not include answered-only problems (i.e., answered-only problems were completed prior to the videotaped lesson and only their answers were shared). For each country, average percentage was calculated as the sum of the percentage within each lesson, divided by the number of lessons. English transcriptions of Swiss lessons were not available for mathematical processes analyses. Percentages may not sum to 100 because of rounding. The tests for significance take into account the standard error for the reported differences. Thus, a difference between averages of two countries may be significant while the same difference between two other countries may not be significant.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study (TIMSS), Video Study, 1999. (Originally published as figure 5.8 on p. 99 of the complete report from which this highlights summary is drawn, *Teaching Mathematics in Seven Countries: Results From the TIMSS 1999 Video Study* [NCES 2003-013]).

the points that the problem illustrates. On average, mathematics teachers in Japan summarized a higher percentage of problems per lesson (27 percent) than in any of the other countries.

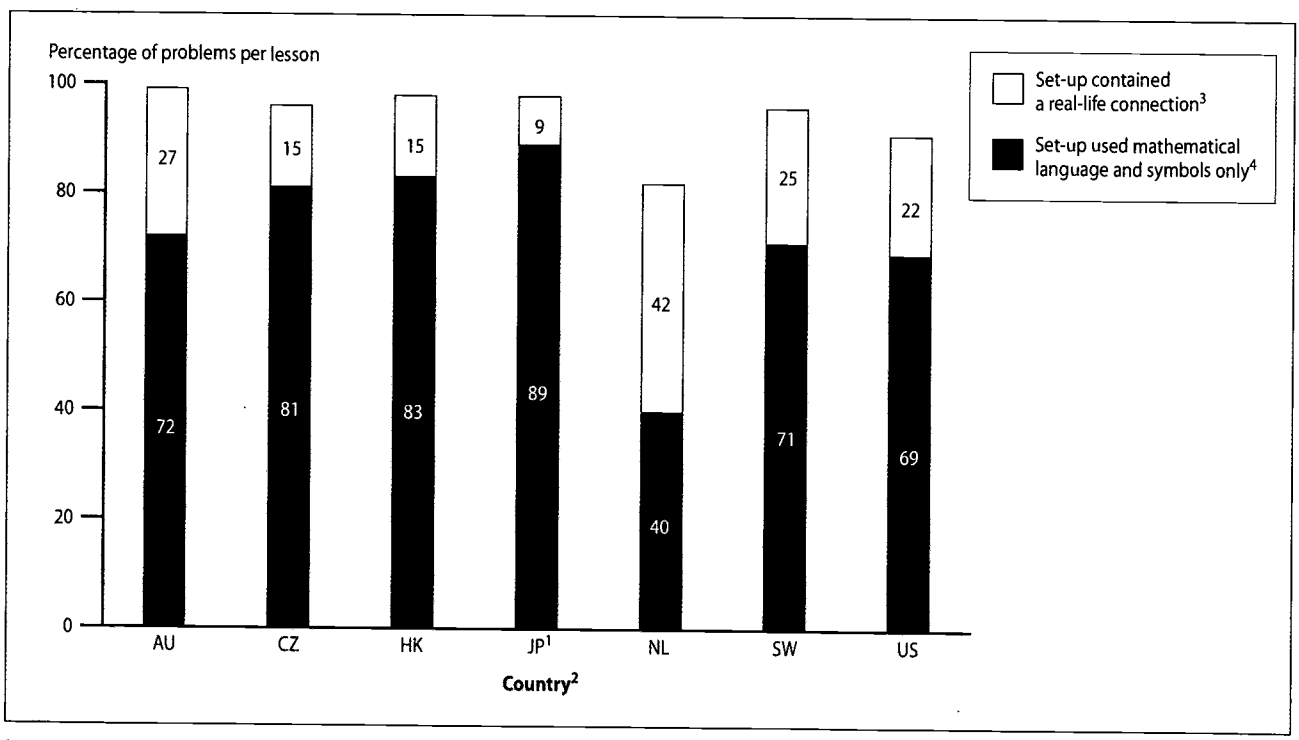
- Mathematics problems in eighth-grade lessons in the Netherlands emphasized the relationships between mathematics and real-life situations to a greater extent than those in most of the other countries (figure 4).

Students in the Netherlands were more likely than their peers in four of the other six countries to encounter problems that included a real-life connection (i.e., word problems or other presentations that place problems in the context of a real-life situation; 42 percent of problems, on average, per lesson). The mathematics problems teachers presented to their students in all of the other countries were more likely to use only mathematical language and symbols than the problems presented in Dutch mathematics lessons (69 to 89 percent of problems, on average, per lesson compared to 40 percent).

- Australian, Dutch, and Swiss eighth-grade mathematics lessons devoted more time, on average, to students working individually or in small groups than did lessons in the other four countries.

Eighth-graders in Australia, the Netherlands, and Switzerland spent a greater percentage of lesson time, on average, working individually or in small groups (rather than engaging in whole-class interaction) and working on mathematics problems assigned as a set than eighth-graders in the other four countries. Moreover, when eighth-graders in Australia and Switzerland were assigned mathematics problems to work on as a set, the problems were less likely to be presented and discussed publicly (i.e., with the whole class) than in two of the four other countries; and these sets of mathematics problems were less likely to be presented and discussed publicly in the Netherlands than in any of the other countries.

Figure 4. Average percentage of problems per eighth-grade mathematics lesson that were either set up with the use of a real-life connection, or set up using mathematical language or symbols only, by country: 1999



[1]Japanese mathematics data were collected in 1995.

[2]AU=Australia; CZ=Czech Republic; HK=Hong Kong SAR; JP=Japan; NL=Netherlands; SW=Switzerland; and US=United States.

[3]Set-up contained a real-life connection: AU, SW>JP; NL>CZ, HK, JP, US.

[4]Set-up used mathematical language or symbols only: AU, CZ, HK, JP, SW, US>NL; JP>AU, SW, US.

NOTE: Percentages may not sum to 100 because some problems were marked as "unknown" and are not included here. For each country, average percentage was calculated as the sum of the percentage within each lesson, divided by the number of lessons.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Third International Mathematics and Science Study (TIMSS), Video Study, 1999. (Originally published as figure 5.1 on p. 85 of the complete report from which this highlights summary is drawn, *Teaching Mathematics in Seven Countries: Results From the TIMSS 1999 Video Study* [NCES 2003–013]).

The emphasis on eighth-grade students working privately on mathematics problems was seen with particular consistency in the Netherlands. In addition to the private-work indicators cited above, students in the Netherlands were assigned a larger number of homework problems per lesson (10 problems), on average, than students in all the other countries except Australia. The range in the other countries was from less than 1[6] to 5 mathematics problems per lesson, on average. Based on estimates, Dutch students appear to have spent, on average, a greater amount of time during the lesson working on these problems (10 minutes) than did students in all the other countries (ranging from 1 to 4 minutes).

- Among the many resources that could be used in mathematics lessons, calculators were used in more lessons in the Netherlands than in the other countries, and computers were used in relatively few eighth-grade mathematics lessons across all the countries.

Eighth-grade Dutch students frequently used calculators for computation during their mathematics lessons. Calculators were used in 91 percent of lessons—a rate higher than in any of the other countries for which reliable estimates could be determined. Use of computational calculators in the other countries ranged from 31 to 56 percent of lessons, with too few cases in Japan to report a reliable estimate. Graphing calculators were rarely observed in the eighth-grade mathematics lessons, except in the United States, where they were used in 6 percent of lessons. Computers were actually used, rather than simply present, in relatively few of the eighth-grade mathematics lessons across the countries. Nonetheless, they were incorporated into 9 percent of Japanese lessons, 5 percent of Hong Kong SAR lessons, 4 percent of Australian lessons, and 2 percent of Swiss lessons. In the other countries, computers were used too infrequently to produce reliable estimates.

A broad conclusion that can be drawn from these results is that no single method of teaching eighth-grade mathematics was observed in all the relatively higher achieving countries participating in this study.

All the countries that participated in the TIMSS 1999 Video Study shared some general features of eighth-grade mathematics teaching. However, each country combined and emphasized instructional features in various ways, sometimes differently from all the other countries, and sometimes no differently from some countries. In the TIMSS 1995 Video Study, Japan appeared to have a distinctive way of teaching eighth-grade mathematics compared to the other two countries in the study (Stigler et al. 1999). One of the questions that prompted the 1999 study was whether countries with high achievement on international mathematics assessments such as TIMSS share a common method of teaching. Results from the 1999 study of eighth-grade mathematics teaching among seven countries revealed that, among the relatively higher achieving countries, a variety of methods were employed rather than a single, shared approach to the teaching of mathematics.

[6]Rounds to zero.

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Data source: The Third International Mathematics and Science Study (TIMSS) 1999 Video Study.

For technical information, see the complete report:

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Invited Commentary: The TIMSS 1999 Video Study and the Reform of Mathematics Teaching

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This commentary represents the opinions of the author and does not necessarily reflect the views of the National Center for Education Statistics.

The report *Teaching Mathematics in Seven Countries: Results From the TIMSS 1999 Video Study* is a significant attempt to describe and analyze the teaching of mathematics in the seven participating countries: Australia, the Czech Republic, Hong Kong SAR,[1] Japan, the Netherlands, Switzerland, and the United States. The authors are to be commended for carrying through such a massive undertaking and providing a detailed analysis on the teaching of mathematics based on data from the Third International Mathematics and Science Study (TIMSS) 1999 Video Study. For this study, numerous eighth-grade mathematics lessons in the participating countries were videotaped and then coded on dozens of dimensions. If nothing else, the report displays the complexity of teaching and the risk one takes in separating the teaching of mathematics from the culture in which that teaching takes place. No easy answers are provided for those seeking explicit direction on how to improve the teaching of mathematics or how to develop better teacher education programs. Nevertheless, there is much to be learned if one is willing to comb through the extensive data and consider the possible relevance of these data. The report has credibility given that the participating teachers felt that their videotaped lessons were typical of the way they teach mathematics.

The Complexity of Mathematics Teaching

The complexity of teaching is particularly evident when one compares the teaching styles in the seven countries that participated in the 1999 video study with the same countries' achievement levels on the TIMSS 1995 and 1999 mathematics assessments. The United States was outperformed by all six of the other countries in 1995 and by most of the other countries in 1999.[2] At the other end of the spectrum, neither Japan nor Hong Kong was outperformed by any of the other countries in either year.

Japan and Hong Kong shared some common elements in teaching yet also differed in fundamental ways. In both countries, 24 percent of lesson time was spent on review and 76 percent on new content (including both introducing and practicing new content). No other country's teachers spent less time on review or more time on new content than teachers in Japan and Hong Kong. In contrast, teachers in the United States spent more time on review and less time on new content than teachers in any other country except the Czech Republic. It is striking that 60 percent of Japanese lesson time was devoted to introducing new content—a higher percentage than in any other country. The second highest percentage was 39 percent (in Hong Kong and Switzerland), compared with 23 percent in the United States. One is reminded of the research by Good, Grouws, and Ebmeier (1983) in which they advocated that teachers spend approximately 45 percent of class time developing new material. Although Hong Kong teachers were relatively high on introducing new content, they also talked more than their Japanese counterparts. Thus, one might get the impression that, although lessons in both countries concentrated on new material, Japanese lessons focused on student thinking, while Hong Kong lessons were very lecture oriented. Yet both Japan and Hong Kong were high-achieving countries.

With regard to the procedural complexity of mathematics problems, Japanese lessons had the highest percentage of high-complexity problems and the lowest percentage of low-complexity problems, although these findings may have been biased because the Japanese teachers were primarily teaching two-dimensional geometry. Even when only two-dimensional geometry problems were considered across all countries, however, no other country had a higher percentage of high-complexity problems or a lower percentage of low-complexity problems than Japan. Considering problems from all topic areas, Japan had not only the lowest percentage of low-complexity problems, but also the lowest percentage of repetition problems for students to solve. One gets the distinct impression that Japanese lessons were forward looking rather than repetitive and review oriented.

The United States had a high percentage of teachers (63 percent) who felt that their assessment of students' interests or needs played a major role in their decisions on how to teach the content. This result is encouraging although in sharp contrast to Senk, Beckmann, and Thompson's (1997) finding

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

[2] U.S. and Czech scores on the 1999 mathematics assessment did not differ significantly, and Switzerland did not participate in the 1999 mathematics assessment.

that there is little support for the notion that teachers base their instruction on students' cognitions, a finding also consistent with that of Wilson, Cooney, and Stinson (2003). One possible interpretation is that teachers in the United States are sensitive to students' needs as youngsters but are not particularly attuned to students' developing mathematical thinking.

Nevertheless, teachers in the United States felt well informed about current issues regarding the teaching of mathematics. Thus, 76 percent of U.S. lessons were taught by teachers who indicated that they were familiar with current ideas in mathematics teaching and learning, compared with only 22 percent of Hong Kong lessons. Consistent with this finding was that 86 percent of U.S. teachers felt that their video lessons were in accord with current ideas about teaching and learning mathematics. (No data were reported for Japan.)

The influence of Hans Freudenthal and his followers (see, e.g., Freudenthal 1991) was evident in the Netherlands, where mathematics problems were more likely to include connections to real-life situations than in most of the other countries. For example, the percentage of Dutch problems per lesson with real-life connections was nearly double the percentage of U.S. problems. The teaching of mathematics in the Netherlands was also characterized by the fact that more lesson time was devoted to students' private work on problems than to whole-class interaction, the only country for which this was true. This finding represented one of the few real differences in teaching styles across countries.

Conservatism and the Role of Reform in Mathematics Teaching

A certain conservatism pervaded most of the lessons across all countries, with the possible exception of Japan and, to some extent, the Netherlands. For example, the ratio of teacher talk to student talk was high in every country. Some variation was evident across countries, however. For example, the ratio was higher in Hong Kong than in the United States, largely because U.S. students contributed more to classroom discussions. A relevant question is whether the ratio of teacher talk to student talk was related to class size (in larger classes, one would expect teacher talk to dominate).

It was disappointing that technology (computers and calculators) did not play a more prominent role in the teaching of mathematics. Dutch teachers made extensive use of computational calculators, whereas in other countries they were less frequently used. Across countries, graphing calculators were rarely used, and computer use was also sparse or virtually nonexistent.

Another conservative characteristic was that alternative solutions to problems were seldom presented publicly. Alternative solutions to problems were presented for a maximum of 5 percent of problems per lesson in all countries except Japan (17 percent). It seems clear that multiple solution methods per se were not viewed as an instructional goal.

This apparent conservatism raises serious questions about the role of reform in the teaching of mathematics. The experience level of teachers in the TIMSS 1999 Video Study was considerable; they had a median of 7 to 21 years' experience teaching mathematics. Also, the teachers were reportedly well trained. It seems reasonable to assume that within each country these teachers were a cut above their counterparts. Yet, in their own way, the teachers were remarkably consistent in conducting what appeared to be primarily teacher-centered lessons. The authors noted this commonality on several occasions. So why is it that the teaching looked so similar, allowing for a few exceptions? If these intelligent teachers were defining the teaching of mathematics in mostly similar ways, what factors led to this circumstance? If society is mandating that mathematics be taught in this rather conservative style, why is this the case? I am not sure what the answers to these questions are, but I am fairly confident that the answers are not implied by intrinsic features of mathematics education per se. This gives me great pause when thinking about efforts to reform the teaching of mathematics.

The National Council of Teachers of Mathematics (NCTM) Standards promote a vision about the teaching of mathematics that entails teachers using technology, emphasizing the processes of doing mathematics, and basing their instructional decisions on students' thinking. Generally, reform in the United States is defined or at least guided by these standards. Not surprisingly, then, most studies of attempted reform have focused on issues within the academic component of mathematics education, such as placing more emphasis on problem solving and students' conceptual understanding, making greater use of technology, and adopting a broader, more open system of assessment. These studies have generally reported mixed results; some teachers embraced certain elements of reform, while others did not. Usually mathematics educators focus on the more academic aspects of reform at the risk of neglecting

the very circumstances that determine the way in which mathematics gets defined and taught. Teachers' shared culture of mind is shaped by these circumstances, yet this culture is rarely addressed explicitly in most teacher education programs. The literature abounds with findings about teachers who subscribe to reform but in the crucible of the classroom often embrace more conservative teaching styles (see, e.g., Wilson and Goldenberg [1998], Lloyd [1999], and Skott [2001]). This raises the question of what should constitute reasonable expectations for classroom reform, especially over an extended period of time; most reported studies take place within a calendar year.

Considerations for Future Research

The TIMSS 1999 Video Study provides a major opportunity for researchers to consider country differences and similarities and to juxtapose their own research with this study's findings. It would be interesting to know, for example, the extent to which beginning teachers (those with 1 or 2 years of experience) differ from their more experienced counterparts. Although the median level of teacher experience was quite high across countries, the within-country variance was considerable. For example, the experience of U.S. teachers ranged from 1 to 40 years. The smallest range (from 1 to 33 years) occurred in the Netherlands. What would the analysis have looked like had only beginning teachers been considered?

At various times when I read the report, I wanted to know what mathematics the authors were really talking about. When low-complexity problems were pitted against high-complexity problems, what were examples of each type of problem? Further, I had trouble with the notion of what were called *application problems*. These problems were apparently defined in terms of the number of steps needed to solve the problems, regardless of whether the problems' contexts involved real-life situations (the usual definition of application). In countries other than the Netherlands, only 9 to 27 percent of problems per lesson involved real-life connections.

Much research in the United States, particularly that conducted prior to the 1990s, has focused on efficient ways of teaching mathematics. For example, McKinney (1986) and Leinhardt (1988) revealed that expert teachers could cover more problems in a given class period than could novice teachers, and they could do so with greater flexibility. However, the lesson pattern, or "signature," for Japanese teachers suggests that the number of problems covered in a given lesson is not as important as the depth with which the content is addressed. Whereas U.S. teachers spent an average of 5 minutes per independent problem per lesson, Japanese teachers spent an average of 15 minutes. Although research in the United States over the past decade has become decidedly more interpretive, researchers would be wise to focus more explicitly on the interplay between what gets taught, how it gets taught, and the depth with which mathematics is taught.

In the United States, the length of mathematics lessons varied a great deal, showing a considerably greater range than in the Czech Republic, Japan, and Switzerland. This finding, juxtaposed with the fact that only 22 percent of problems per U.S. lesson focused on geometry, suggests that some U.S. students may not be getting much geometry, including both two- and three-dimensional geometry. The role of school geometry in the United States, particularly at the middle school level, deserves careful consideration in developing teacher education programs for both preservice and inservice teachers.

A Concluding Thought

It was both exhilarating and exasperating to read *Teaching Mathematics in Seven Countries: Results From the TIMSS 1999 Video Study*. Given the multitude of classrooms observed, there seemed to be a boundless number of strategic research sites. Overall, teachers in the United States appeared more conservative in their teaching styles than did their counterparts in other countries, although not markedly so. One wonders why. We can only conclude that there is much work to be done if the teaching of mathematics in the United States is to bear some family resemblance to the NCTM Standards. The question is, "Where in the world do we begin?"

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Invited Commentary: Lessons Learned From Examining Mathematics Teaching Around the World

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This commentary represents the opinions of the author and does not necessarily reflect the views of the National Center for Education Statistics.

Introduction

National and international assessments of student achievement provide ample evidence that American students learn far less mathematics than is desired. For example, in the most recent National Assessment of Educational Progress (NAEP) mathematics assessment, only about one-fourth of American 4th- and 8th-grade students performed at or above the *Proficient* level, and the percentage was even lower for students in grade 12 (Braswell et al. 2001). Moreover, findings from the Third International Mathematics and Science Study (TIMSS) 1995 and 1999 mathematics assessments indicate that U.S. students at grade 8 performed below the level attained by students in many other developed nations of the world (Beaton et al. 1996; Mullis et al. 2000; Schmidt et al. 1999). In response to findings such as these, a number of initiatives have been proposed to raise the mathematics achievement of U.S. students.

There is widespread agreement that higher student achievement is unlikely to occur unless and until higher quality teaching becomes more prevalent in U.S. classrooms (National Commission on Teaching and America's Future 1996; U.S. Department of Education 2000). Thus, it is common for educators and policymakers to design initiatives aimed at leveraging higher student achievement by enhancing the quality of mathematics teachers and teaching. And the clamor for improving teacher quality is not restricted to professionals within the field of education. A recent survey of American adults regarding education issues found that teaching quality was one of the major concerns of the American public (Educational Testing Service 2002).

Despite the strong desire to improve the quality of mathematics teaching in the United States, designers of educational improvement initiatives lack a complete picture of instructional practices at this time. What is known about instructional practices in American mathematics classrooms comes almost entirely from two types of sources: observational data collected in studies of relatively small numbers of teachers and classrooms, and teacher self-report data collected in large-scale surveys of mathematics teachers. Large-scale surveys, such as those conducted by NAEP (Braswell et al. 2001) and by Horizon Research (Weiss et al. 2001), have been a primary source of information for educators in constructing portraits of mathematics teachers and their instructional practices (e.g., Grouws and Smith 2000). These sources of information are valuable, but they are limited due either to their small samples or to the indirect nature of the evidence provided. Similarly, some other valuable sources of data drawn from large-scale, direct observation in classrooms (e.g., Stake and Easley 1978) are now quite dated. Efforts to improve mathematics instruction (and, ultimately, students' mathematics achievement) are likely to be hampered by this limited corpus of credible data regarding the current nature and quality of teaching.

A notable exception to the general lack of first-hand data on mathematics teaching practices in U.S. classrooms is provided by the TIMSS 1995 Video Study (Stigler et al. 1999; Stigler and Hiebert 1999), in which a relatively large sample of mathematics lessons from Germany, Japan, and the United States were analyzed. This study pointed to distinct styles of mathematics teaching in the three countries considered and identified some differences between mathematics teaching in the United States and in Japan that might be related to the large student performance differential between the two countries.

In addition, the corpus of data on current mathematics teaching in the United States and in many other parts of the world has just been enriched by the release of findings on mathematics teaching from the TIMSS 1999 Video Study, which is a successor to and expansion of the TIMSS 1995 Video Study. The 1999 study expanded the number of countries under consideration from three to seven and included more countries with high achievement on TIMSS assessments in comparison to the United States.

A Few Selected Findings and Some Potential Contributions

Methods and findings of the TIMSS 1999 Video Study are provided in a recently released National Center for Education Statistics (NCES) report, *Teaching Mathematics in Seven Countries: Results From the TIMSS 1999 Video Study*, featured

in this issue of the *Education Statistics Quarterly*. The study involved an analysis of 638 eighth-grade mathematics lessons. One randomly selected mathematics lesson was videotaped in each school in a nationally representative sample of schools in Australia, the Czech Republic, Hong Kong SAR,* the Netherlands, Switzerland, and the United States. In addition, the lessons collected in Japan for the TIMSS 1995 Video Study were reanalyzed as part of the 1999 study. Students from these countries were among the highest performers on the TIMSS assessments of mathematics achievement in 1995 and 1999. In 1995, eighth-graders in all of these countries scored significantly higher than did U.S. eighth-graders. In 1999, U.S. eighth-graders were again outperformed by eighth-graders in all of the countries except Switzerland (which did not participate in the 1999 assessment) and the Czech Republic (which experienced a decline in scores between 1995 and 1999).

The multidimensional analyses of the videotaped lessons revealed not only some similarities in mathematics teaching across the countries but also a number of discernable differences. For example, eighth-grade mathematics lessons were generally organized similarly in all countries to include some public work involving the whole class and some private work, with students usually working individually and occasionally working in small groups. But mathematics lessons varied across the countries in the way that time was distributed to the review of previously learned material, to the introduction of new content, and to practice on new content. Other differences across countries were noted in the way that instructional time was allocated to various kinds of mathematical activities—using procedures, stating concepts, and making connections among facts, concepts, or procedures—and the patterns of transformation that were evident between the original presentation of the task by the teacher and the eventual enactment by the students in the classroom.

The information available in *Teaching Mathematics in Seven Countries* will undoubtedly be useful both to researchers who study mathematics teaching and to the designers of educational interventions intended to transform and enhance current teaching practices, especially when considered in light of findings available from other research studies. For example, the findings of the TIMSS 1999 Video Study supplement and reinforce findings of other analyses of classroom instruction (e.g., Stein, Grover, and Henningsen 1996; Henningsen and Stein 1997) that have pointed to the tendency in U.S. classrooms for teachers to transform intellectually demanding tasks in ways that reduce the cognitive challenge for students. Given that patterns and factors associated with this transformation of cognitive demands have been related to student achievement (Stein and Lane 1996) and to teacher professional development (Stein et al. 2000), the findings of the TIMSS 1999 Video Study with respect to this and other aspects of classroom instruction should be of great interest.

From an international comparative perspective, a major finding of the study is that no single method of mathematics instruction was observed in all of the high-performing countries examined. With respect to most features of instruction—including some that have been hotly debated in the United States, such as using calculators or embedding mathematics problems in applied contexts—there was considerable variation in the teaching observed across the sample of countries with high-performing students on the TIMSS mathematics assessments. The findings of the TIMSS 1999 Video Study might help to quell the so-called math wars, in which proponents of one view of mathematics instructional reform do battle with opponents of that view. A careful examination of the findings of the TIMSS video study report, and a viewing of the video clips available on the accompanying CD-ROM, should instead stimulate a substantive, civil, professional discourse about the nature and qualities of effective mathematics teaching. These findings and images can be a resource to direct attention away from superficial features of instruction and toward a focus on the extent to which different teaching methods can succeed in stimulating serious intellectual engagement on the part of students in a mathematics classroom.

Researchers, in particular, will find much to gain from the report's descriptions of the video survey methodology and the video analysis scheme (which are described more completely in a forthcoming technical report [Jacobs et al. forthcoming]). The report offers a cogent argument for the use of video surveys as a method of analyzing teaching within a country and comparing teaching across countries.

Limitations and Caveats

The foregoing should make it clear that *Teaching Mathematics in Seven Countries* is an indispensable resource for educators, researchers, and policymakers. Yet even the large, exceedingly complex study on which the report is based has some limitations worth noting because they suggest

*Hong Kong is a Special Administrative Region (SAR) of the People's Republic of China.

important types of additional information that the study does not provide.

One limitation worth noting is that the study focuses on "typical" instructional practice rather than "best practice." Knowing what teachers are willing and able to display when their typical practice is captured does not reveal what they might be able to do under optimal conditions.

A second limitation is the analytic focus on commonality rather than variation. One major outcome of the video analysis was the development of a *lesson signature*—a characteristic pattern of instructional features that characterized teaching in a country. To arrive at a lesson signature, the study authors examined typical instructional activities over time across the lessons observed in each country to discern patterns of regularity. As valuable as this analysis may be, it does not attend to patterns of variation across teachers that might be equally interesting and potentially more important.

A third limitation that bears noting is the unit of analysis in the study. The decision to analyze individual lessons rather than coherent sequences of lessons allowed the inclusion of a large number of teachers in the sample, yet it also limited the generalizability of the study's conclusions. Although some variation in student achievement is likely due to factors at the lesson level, it is likely that many other important factors are evident only if one considers larger units of analysis, such as sequences of related lessons or coherent instructional units.

Closing Comments

Teaching Mathematics in Seven Countries: Results From the TIMSS 1999 Video Study is an essential resource for those interested in analyzing, understanding, or improving the teaching of mathematics. By illuminating critical features of mathematics teaching around the world, the findings and methods presented in this report, along with the images of teaching provided on the accompanying CD-ROM, should enrich the work of scholars and practitioners alike.

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EARLY CHILDHOOD EDUCATION

Young Children's Access to Computers in the Home and at School in 1999 and 2000

Amy H. Rathbun and Jerry West

This article was originally published as the Executive Summary of the Statistical Analysis Report of the same name. The sample survey data are from the Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K).

Over the past decade, technology has changed at such a rapid pace that computers and Internet access are fast becoming indispensable features of modern life. Computer literacy and skills are increasingly necessary in a knowledge-based economy. More children are being introduced to computers than ever before, evidenced by the fact that in 2000 65 percent of children had access to a home computer, compared with 32 percent in 1993 (Newburger 1999, 2001). Students' use of computers at school also increased from 61 percent in 1993 to 71 percent in 1997 (Newburger 1999).

As part of the *No Child Left Behind Act of 2001* (NCLB, P.L. 107-110), the Enhancing Education Through Technology (ED Tech) program seeks to improve achievement in elementary and secondary schools through the use of technology, to assist students to become technically literate by the eighth grade, and to ensure that teachers integrate technology into the curriculum to improve student achievement. There are also provisions in the act to provide funding for schools to purchase technology resources to further the program's goals.

As computers become more prevalent and computer skills more necessary, there continues to be a "digital divide" between those with computer access and skills and those without. Already, gaps exist across racial/ethnic groups and

family income levels with respect to computer ownership and Internet usage (Economics and Statistics Administration 2000). For instance, a lower percentage of Black and Hispanic households have Internet access in their homes, compared to the national average (Newburger 2001). These differences are less pronounced in schools, where children's access to computers and the Internet is more prevalent. In a 1999 U.S. Department of Education study, almost all public school teachers (99 percent) indicated that computers were available in their schools, and the nationwide ratio of students to instructional computers was about 6 to 1 (Smerdon et al. 2000). The Department also reported that 95 percent of all public schools had access to the Internet in 1999, compared with only 35 percent in 1994 (Snyder and Hoffman 2002).

Few studies have focused exclusively on kindergartners' and first-graders' access to and use of computers in different settings. Reports that exist on students' computer access and use either focus on upper elementary and high school students (Becker 2000), or combine prekindergarten and kindergarten children into one category and elementary school children (grades 1–8) into a second category (Snyder and Hoffman 2002) when reporting information.

The Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K) provides a unique opportunity to describe children's access to and use of computers in their schools, classrooms, and homes as they begin formal schooling. The computer resources identified in this report include access in schools to computer labs, CD-ROMs, local area networks (LAN), and wide area networks (WAN)/ Internet; access in classrooms to computer areas and teachers trained in using computers and technology; and access in homes to computers and the Internet. The report also looks at the ways in which young children use computers at home and school. For example, information is provided on children's frequency and types of home computer use, and on the frequency with which children use computers in their classrooms for different instructional purposes. In addition, the report examines changes in computer resources and use from kindergarten to first grade and looks at the relationship between computer resources and computer use.

Children's access to and use of computers in their schools, classrooms, and homes are examined overall and in relation to children's sex, race/ethnicity, socioeconomic status (SES),[1] and disability status. In addition, children's use of computers for various instructional purposes is compared by several characteristics of their teachers and classrooms.

Research Questions

Data from the ECLS-K are used to examine 10 questions related to young children's access to and use of computers.

Access to computer resources

1. What computer resources are available in the schools, classrooms, and homes of kindergartners?
2. Are these resources equally available to girls and boys, economically disadvantaged and advantaged students, and minority and nonminority children?
3. What school and classroom computer resources are available to children from homes with various computer resources?
4. Does the level of computer resources that are available in the schools, classrooms, and homes of young children change from kindergarten to first grade?

Use of computer resources

5. How frequently do kindergartners use computers in their classrooms and homes, and for what purposes?
6. Do certain groups of children use computers more often than others in each of these learning environments?
7. Does the frequency of children's use of computers in their homes, classrooms, and schools change from kindergarten to first grade?
8. How frequently do young children use computers over summer vacation?
9. What opportunities do children with and without home computer resources have to use computers in their classrooms?
10. Do children who use computers more often at home also use them more often in their classrooms?

Data Source

The ECLS-K, sponsored by the U.S. Department of Education's National Center for Education Statistics (NCES), is a multisource, multimethod study that focuses

[1]This composite in the ECLS-K database is derived from the following variables: mother/female guardian's education level, father/male guardian's education level, mother/female guardian's occupation, father/male guardian's occupation, and household income.

on children's early education, beginning with a nationally representative sample of kindergartners in the fall of 1998 and following them through the spring of fifth grade. The ECLS-K includes measures of children's health and socioemotional status, their academic achievement, and their family, classroom, school, and community environments. The study collects information directly from the children and their families, teachers, and schools. The full ECLS-K base-year sample is composed of approximately 22,000 public and private school children who attended over 1,200 kindergarten programs during the 1998–99 school year.

Data for this report are from the kindergarten and first-grade waves of data collection. The first set of results on computer resources showed significant differences in kindergartners' computer access by school control (public vs. private). Thus, the majority of the report presents results for public school children so that any variations found in computer access and use related to child and classroom characteristics would not be confounded by school control. The majority of this report is based on 14,666 public school kindergartners and 11,456 public school first-grade children.[2]

Findings

Findings in this report are organized into the two sections identified by the research questions. Part one describes parents', teachers', and school administrators' reports of young children's access to computer resources in their schools, classrooms, and homes. Results are presented for the population of kindergarten and first-grade children and in relation to child and family characteristics. Part two describes ways in which young children were reported to use computers in their classrooms and homes. Results in this section are presented for the population of kindergarten and first-grade children and in relation to child, family, teacher, and classroom characteristics.

Young children's access to computers

Almost all young children had access to computers, either at home or in their classrooms and schools. However, kindergartners' access to computer resources differed by the type of school they attended. Public school kindergartners had greater access to school and classroom resources, whereas private school children had greater access to home computer resources. Focusing on public school children, the findings showed that children's access to most computer resources at school and home increased from kindergarten to first grade (figure A). Changes in children's access to computer resources may be due not only to the change in grade level but also to the general growth in computer resources from the spring of 1999 to the spring of 2000.

School computer resources. For the most part, young children's access to school computer resources did not differ greatly by child and family characteristics. However, in kindergarten some minority children and those from lower SES families were less likely to attend schools that provided Internet access to students than other children. In first grade, children from the lowest SES group continued to have less student access to the Internet in comparison to first-graders in the highest SES group.

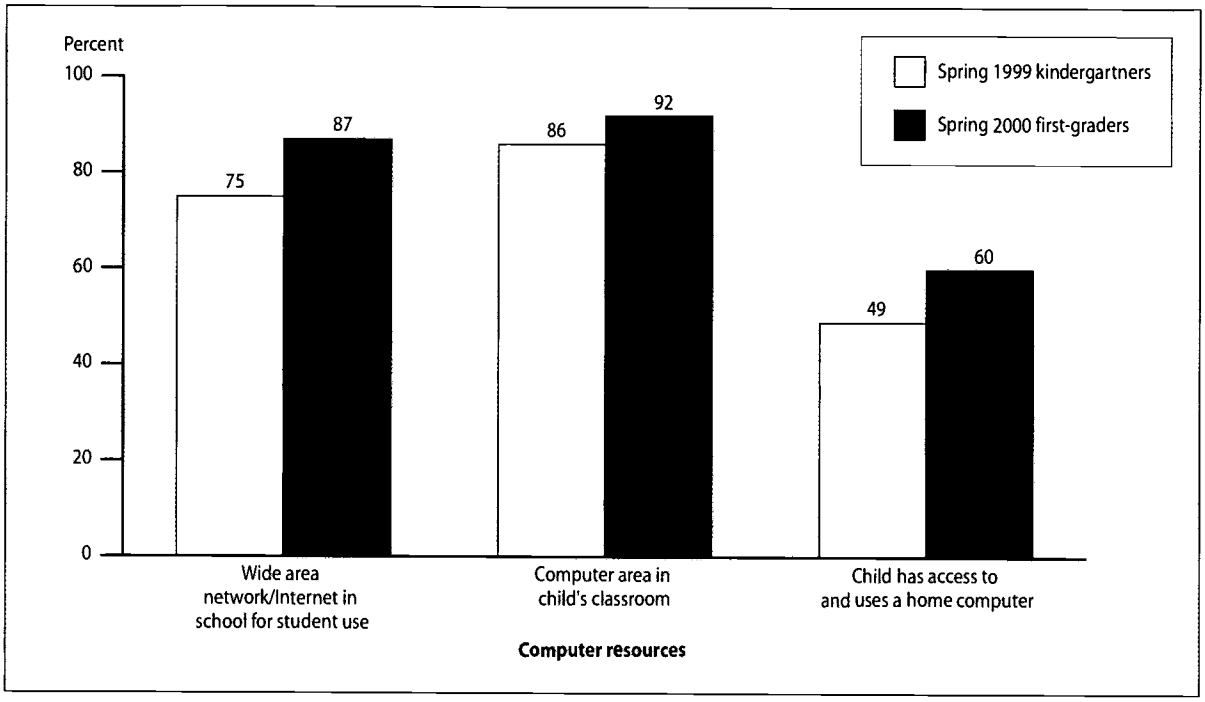
Classroom computer resources. Kindergarten and first-grade children in the lowest SES group were less likely to have a computer area in their classroom than children in the highest SES group. In kindergarten, access to computer areas in the classroom and to teachers who had attended computer/technology workshops did not differ by children's race/ethnicity. In contrast, Hispanic first-graders were less likely than White first-graders to have a computer area in their classroom, and were less likely than White and Black first-graders to have teachers who had attended a computer/technology workshop during the school year.

Home computer resources. In kindergarten and first grade, children from low-SES families were least likely to have access to home computers. Black and Hispanic kindergartners and first-graders were less likely to have home computer access than White and Asian/Pacific Islander children. The same patterns were detected for kindergartners' home access to the Internet. Also, in first grade, children with disabilities were less likely to have access to home computers than children without disabilities.

Relationship between home and school computer resources. For the most part, young children's access to school and classroom computer resources did not differ by their level of home computer resources. However, a higher percentage of kindergartners who had access to and used computers and the Internet at home attended schools that provided Internet access for students, compared to kindergartners without home computer resources.

[2]Children who repeated kindergarten while in the study were not included in the analysis of first-grade data. Approximately 5 percent of kindergartners were not promoted to first grade by the second year of the ECLS-K data collection.

Figure A. Percent of public school children who had access to various computer resources in their schools, classrooms, and homes: Kindergarten of spring 1999 and first grade of spring 2000



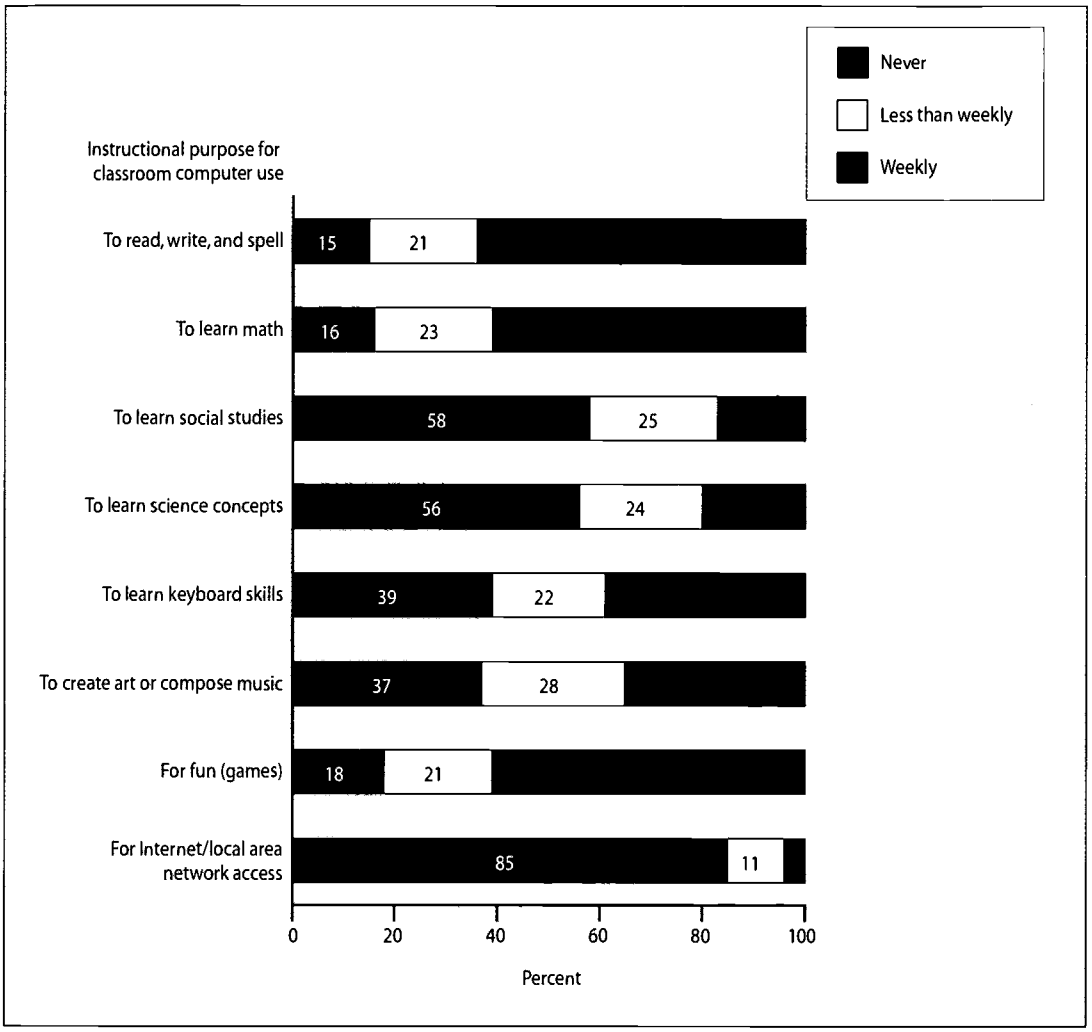
SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), spring 1999 and spring 2000.

Young children's use of computers

Classroom computer use. The majority of young children in public schools were in classrooms where computers were used for instructional purposes on a weekly basis. The most frequent classroom uses for computers were to learn reading, writing, and spelling; to learn math; and for fun (figure B). Classroom Internet use for young children was not prevalent; 4 percent of public school kindergartners and 9 percent of public school first-graders accessed the Internet on a weekly basis in their classes. Young children's use of computers in the classroom for different instructional purposes tended to vary by teacher and classroom characteristics. For instance, kindergartners participating in full-day kindergarten programs and those with computer areas in their classrooms were more likely to be in classes that used the computer on a weekly basis for reading, writing, and spelling; mathematics; social studies; keyboarding instruction; art creation or music composition; and fun than children in part-day kindergarten programs and those without computer areas in their classrooms. Also, kindergartners whose teachers participated in computer/technology workshops and those whose teachers did not spend more than half of the instructional day in teacher-directed, whole-class activities were more likely to be in classes that used the computer on a weekly basis for these purposes than kindergartners whose teachers had not attended computer/technology workshops during the school year or those whose teachers spent more than half of the instructional day in teacher-directed, whole-class activities. These patterns were consistent for first-grade children as well.

Home computer use. Public school children who had access to home computers used them an average of 3 to 4 days a week. Over 85 percent of young children with home computers used them for educational purposes. The frequency with which kindergarten and first-grade children used home computers did not tend to differ by child or family characteristics; however, the purposes for which young children used computers at home varied by children's sex, race/ethnicity, and SES. For example, family SES was positively related to children's use of home computers for educational purposes overall and for those children who had access to home computers. In kindergarten, girls who had access to home computers used them more often for art or drawing programs than boys did. Also, White kindergartners with home computer access were more likely than Hispanic and Asian/Pacific Islander kindergartners to use them to play with educational programs, and more likely than Black or Hispanic kindergartners to use them for art or drawing programs.

Figure B. Percentage distribution of the frequency that public school kindergartners used computers in their classrooms for different instructional purposes: Spring 1999



SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), spring 1999.

In the summer prior to first grade, few public school children used computers in structured summer programs. However, almost three-quarters of children used home computers in the summer on a weekly basis to play games[3] or for educational purposes. The percentage of public school children using computers for different purposes in the summer also varied by children's sex, race/ethnicity, and SES. In the summer, a higher percentage of boys than girls and a higher percentage of White than Hispanic children used home computers. Family SES was also positively related to children's summer computer use.

Relationship between home and classroom computer use. Young children's classroom computer use in public schools did not differ based on whether children had home access to computers or the Internet. In addition, there was no significant relationship between the frequency of home computer use and the frequency of classroom computer use for different instructional purposes for young children attending public schools.

Conclusion

Although almost all young children had access to computers, at home or in their classrooms and schools, the amount of access varied according to children's school type, race/ethnicity, and family SES. Public school kindergartners tended to have greater access to school and classroom computer resources, whereas private school kindergartners

[3]Parents were asked how often their child used the computer for games like Nintendo or Sega over a 1-week time period. No definition of "computer" was provided to respondents; thus, it is possible that some parents may have included other non-computer game devices (e.g., handheld or TV game systems) when responding to the item.

had greater access to home computer resources. Young children's access to most computer resources in public schools did not differ greatly by child and family characteristics; however, in kindergarten some minority children, those from lower SES families, and those without home computer resources were less likely to attend schools that provide student access to the Internet. In terms of classroom computer resources, kindergartners and first-graders from the lowest SES group were less likely to have a computer area in their classroom than children in the highest SES group. In first grade, public school Hispanic children were less likely to have access to computers in their classrooms than White children, and Hispanic first-graders were less likely to have teachers who had attended a computer/technology workshop than White and Black first-graders—findings that did not occur in kindergarten. In terms of home computer resources, public school children's access varied by race/ethnicity and family SES, with minority and disadvantaged children being less likely to have home access to computer resources in kindergarten and first grade. Public school children's access to computer resources at school and home tended to increase as they moved from kindergarten to first grade.

Over half of all public school children attended classrooms where computers were used for various instructional purposes at least once a week. Young children's use of computers in their classrooms differed, however, by several classroom characteristics, including kindergarten program type (part-day vs. full-day), teachers' attendance at computer/technology workshops during the school year, presence of a computer area in the classroom, and the proportion of time classes spent in teacher-directed, whole-class instruction.

For those public school young children with access to home computers, all children used their home computers an average of about 3 to 4 days each week. However, the purposes for which young children used home computers during the school year and over summer vacation (e.g., to access the Internet, play educational games) varied by children's sex, race/ethnicity, and SES.

The ECLS-K provides a wealth of information on children's cognitive, socioemotional, and physical development from kindergarten through fifth grade across multiple contexts, including the home, classroom, school, and community. Since this report shows differences in computer access and use between public and private school children, additional analyses could focus on child and family characteristic differences within private school settings. Based on the findings from this report, future research could also examine how children's access to and use of computers in different settings relate to their academic achievement over time. Also, information on computer resources and use could be further explored at the school and classroom level to identify differences based on characteristics of the schools that young children attend. For example, children's access to school computer resources could be examined in terms of school size, grade range, federal program participation, urbanicity, and region.

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Doto source: The NCES Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), spring 1999 and spring 2000.

For technicol informotion, see the complete report:

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To obtoin the complete report (NCES 2003–036), call the toll-free ED Pubs number (877–433–7827) or visit the NCES Electronic Catalog (http://nces.ed.gov/pubsearch).

Prekindergarten in U.S. Public Schools: 2000–2001

Timothy Smith, Anne Kleiner, Basmat Parsad, and Elizabeth Farris

This article was originally published as the Executive Summary of the Statistical Analysis Report of the same name. The sample survey data are from the Fast Response Survey System (FRSS).

Background

Research on the relationship between children's early care and education and school readiness has shown the potential importance of enriching learning experiences for young children and, in particular, the positive outcomes of early intervention for educationally disadvantaged children (Love, Schochet, and Meckstroth 1996; Barnett 1995; Haskins 1989). In fact, the National Research Council suggests that a finding that young children who are at risk of school failure have a greater likelihood of success if they attend high-quality early childhood programs seems to emerge across studies of early care and education (Bowman, Donovan, and Burns 2001).

In recent years, renewed attention has focused on the role that public schools might play in providing high-quality programs for prekindergarten children (Saluja, Early, and Clifford 2001; Hinkle 2000). Educators and policymakers have considered the possibility of public schools drawing upon existing resources to expand and improve prekindergarten programs and thereby help prepare young children for school (Dwyer, Chait, and McKee 2000; Hinkle 2000). Unfortunately, data on the role public schools play in providing early childhood education are limited and are sometimes clouded by a lack of common terminology. Most of the available data do not differentiate public school programs from other early childhood education programs; the data often include programs offered by private schools, public and private day care centers, and Head Start classes operating outside of the public school system.

In response to the lack of current data on public elementary school prekindergarten programs, the National Center for Education Statistics (NCES) used its Fast Response Survey System (FRSS) to conduct the "Survey of Classes That Serve Children Prior to Kindergarten in Public Schools," FRSS 78, 2001. The survey gathered information on characteristics of prekindergarten classes to answer questions such as the following:

- What percentage of public elementary schools nationwide had prekindergarten classes? What percentage offered general education and special education prekindergarten classes?
- How many children were enrolled in prekindergarten classes at public elementary schools? What were the age, racial, and ethnic characteristics of these children?
- How many prekindergarten classes were offered in public elementary schools, and how were they distributed between general education and special education? What was the average size of these classes?
- How many teachers were responsible for teaching prekindergarten classes, and what was their education level? How did their pay compare with that of other teachers in the school district?
- What percentage of public elementary schools reported that one or more prekindergarten children received transportation, meals, and extended day care services, and what percentage of prekindergarten children received those services?

The results presented in this report are based on questionnaire data from 1,843 public elementary schools in the United States. The data provide national estimates representing all special education and regular public elementary schools in the nation.

Key Findings

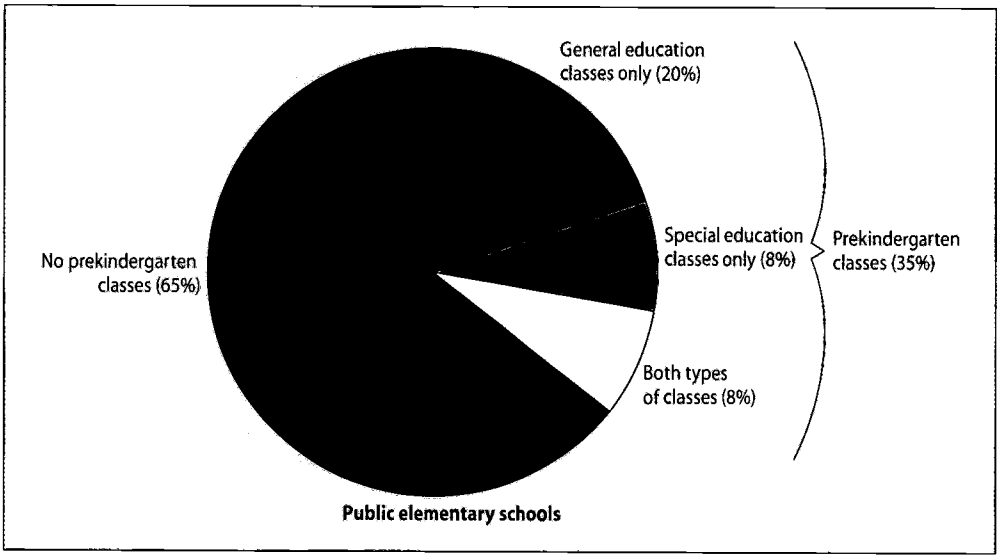
Public schools with prekindergarten classes

During the 2000–01 school year, there were about 19,900 public elementary schools with prekindergarten classes. This represents 35 percent of all regular and special education public elementary schools in the country (figure A). Results from the 2001 FRSS survey indicate the following:

- There was a positive relationship between public elementary schools offering prekindergarten classes and school size,[1] ranging from 28 percent of small schools to 42 percent of large schools.
- Schools in the Southeast were most likely to offer prekindergarten classes. Forty-six percent of these elementary schools offered prekindergarten compared with between 30 and 35 percent of public elementary schools in other regions.

[1]School size is defined as small (enrollments of less than 300 students), midsized (300 to 599 students), and large (600 or more students).

Figure A. Percent of public elementary schools with general education prekindergarten classes only, with special education prekindergarten classes only, with both types of classes, and with no prekindergarten classes: 2000–01



NOTE: Data presented in this figure are based on the estimated number of public elementary schools—56,400. Special education classes are classes prior to kindergarten that serve only children with Individualized Education Programs. General education classes are all other classes primarily for 3- or 4-year-olds—general and combined/inclusive prekindergarten, Title I prekindergarten, Head Start classes that are part of a program administered by the school district, and any other classes primarily for 3- or 4-year-olds prior to kindergarten. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Survey of Classes That Serve Children Prior to Kindergarten in Public Schools," FRSS 78, 2001. (Originally published as figure 1 on p.11 of the complete report from which this article is excerpted.)

- The likelihood that public schools offered prekindergarten classes varied by poverty concentration.[2] About half (51 percent) of elementary schools with the highest poverty concentration offered prekindergarten. One-quarter (25 percent) of elementary schools with the lowest poverty concentration offered prekindergarten. It is important to note that prekindergarten programs have tended to target at-risk children, including children from low-income families.
- General education prekindergarten classes were offered by 28 percent of public elementary schools; 15 percent offered special education prekindergarten classes.

Prekindergarten children in public schools

Responses to the survey revealed that approximately 822,000 children, categorized as younger than 3, 3 years old, 4 years old, and 5 or older, were enrolled in public elementary school prekindergarten classes. As of October 1, 2000, 20 percent of the children were 3-year-olds and 68 percent were 4-year-olds. Larger percentages of children enrolled in special education prekindergarten classes were younger than 3, 3 years old, or 5 or older, compared with those in general education prekindergarten classes.

The survey also asked about the racial and ethnic background of public school prekindergarten children.[3] About half (49 percent) of the children were White, 24 percent were Hispanic, 23 percent were Black, 3 percent were Asian, and 2 percent were American Indian/Alaska Native. Nationwide, 61 percent of all public school students were White, 17 percent were Hispanic, 17 percent were Black, 4 percent were Asian, and 1 percent were American Indian/Alaska Native.[4]

[2]Poverty concentration is based on the number of students eligible to receive free or reduced-price lunch. The categories used in this report are less than 35 percent of students eligible, 35 to 49 percent eligible, 50 to 74 percent eligible, and 75 percent or more eligible.

[3]Race and ethnicity were reported on the questionnaire using five categories: American Indian/Alaska Native; Asian; Black, non-Hispanic; Hispanic; and White, non-Hispanic. To improve readability, the following labels are used throughout the remainder of this report: American Indian/Alaska Native; Asian; Black; Hispanic; and White.

[4]Information for all public school students is based on unpublished tabulations from the following NCES Common Core of Data (CCD) data file: *CCD Public Elementary/Secondary School Universe Survey: School Year 2000–01* (NCES 2002-362), available at http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2002362. Data are based on all public regular and special education, vocational education, and alternative education schools.

Other findings on the racial and ethnic background of public school prekindergarten children include the following:

- In city schools, 28 percent of the prekindergarten children were White, 35 percent were Hispanic, and 33 percent were Black. In contrast, in rural/small town schools, 74 percent of the prekindergarten children were White, 10 percent were Hispanic, and 12 percent were Black. Among all public school students in city schools nationwide, 37 percent were White, 27 percent were Hispanic, and 30 percent were Black. Nationwide, 79 percent of all rural/small town public school students were White, 7 percent were Hispanic, and 10 percent were Black.[5]
- Forty-seven percent of public school prekindergarten children were Hispanic at schools in the West, compared with 9 percent at schools in the Southeast. Thirty-three percent of all public school students in the West were Hispanic, as were 7 percent of students in the Southeast.[6]
- In schools with the lowest level of poverty, 79 percent of the prekindergarten children were White, 8 percent were Hispanic, and 7 percent were Black. In schools with the highest level of poverty, 22 percent of the prekindergarten children were White, 39 percent were Hispanic, and 36 percent were Black. Nationwide, 79 percent of all students in public schools with the lowest level of poverty were White and 8 percent were Black. In schools with the highest level of poverty, 15 percent of students were White and 39 percent were Black.[7]

There are federal and state programs designed to provide limited-English-proficient (LEP) children,[8] low-income children,[9] and children with disabilities with early childhood education experiences, such as Title I programs, Head Start, Even Start, and the Preschool Grants Program. Public school programs for children prior to kindergarten also receive funds from state initiatives for enhancing school readiness.

For this survey, public school officials were asked to report the number of LEP prekindergarten children, low-income prekindergarten children, and prekindergarten children with Individualized Education Programs (IEPs) in their schools. Findings from the FRSS survey show the following:

- Fifteen percent of public elementary school prekindergarten children were LEP (table A). This percentage varied by school size, locale, and region. Nationwide, 9 percent of all public school students received LEP services.[10]
- Sixty-one percent of prekindergarten children were low income. This percentage varied by school size, locale, region, and percent minority enrollment. Forty-five percent of all students attending elementary schools that participate in the National School Lunch Program were eligible to receive free or reduced-price lunch during the 1998–99 school year (Fox et al. 2001).
- Thirty percent of the children enrolled in public elementary school prekindergarten classes had IEPs. This varied by percent minority enrollment and poverty concentration. Nationwide, about 13 percent of all public school students had IEPs.[11]

Prekindergarten classes in public schools

During the 2000–01 school year, about 58,500 prekindergarten classes were offered in U.S. public elementary schools. About two-thirds (67 percent) of these classes were general education classes; 33 percent were special education classes. Study results also indicate the following:

- The percentage of special education prekindergarten classes was higher in schools with the lowest poverty concentration than in schools with the highest poverty concentration (40 percent compared with 23 percent, respectively).
- Overall, public elementary schools that offered prekindergarten averaged 2.9 prekindergarten classes per school. City schools averaged 3.4 classes per school, whereas rural/small town schools averaged 2.4 classes per school. The average also varied by region, minority enrollment, and poverty concentration.

[5]See footnote 4.

[6]See footnote 4.

[7]See footnote 4.

[8]For this study, these children were defined as those "whose native or dominant language is other than English, and whose skills in listening to, speaking, reading, or writing English are such that he/she derives little benefit from school instruction in English."

[9]For this study, these children were defined as those eligible to receive free or reduced-price lunch under the National School Lunch Program.

[10]Information for all public school students is based on unpublished tabulations from the following NCES Common Core of Data (CCD) data file: *Local Education Agency Universe Survey: School Year 2000–01* (NCES 2002–360), available at http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2002360.

[11]See footnote 10.

Table A. Percent of all public elementary school prekindergarten children who were limited English proficient, percent who were low income, and percent with Individualized Education Programs, by selected school characteristics: 2000–01

School characteristic	Percent of prekindergarten children		
	Limited English proficient[1]	Low income[2]	With Individualized Education Programs[3]
All public elementary schools with prekindergarten classes	15	61	30
School size			
Less than 300	10	54	33
300 to 599	12	59	28
600 or more	22	68	30
Locale			
City	22	72	26
Urban fringe/large town	16	55	32
Rural/small town	6	53	32
Region			
Northeast	9	47	28
Southeast	7	71	34
Central	8	51	31
West	30	70	27
Percent minority enrollment			
Less than 6 percent	#	33	36
6 to 20 percent	4	44	38
21 to 49 percent	12	54	31
50 percent or more	26	79	23
Percent of students eligible for free or reduced-price lunch			
Less than 35 percent	5	21	40
35 to 49 percent	10	40	38
50 to 74 percent	11	63	30
75 percent or more	25	87	20

#Rounds to zero.

[1]Or "English language learners."

[2]Eligible for free or reduced-price lunch benefits.

[3]Includes children in special education and general education classes.

NOTE: Data presented in this table are based on the estimated number of schools with at least one prekindergarten class—19,900. Data on the number of prekindergarten children with limited English proficiency were not reported for 8 cases in the sample. Data on the number of prekindergarten children eligible for free or reduced-price lunch were not reported for 44 cases in the sample. Data on the number of prekindergarten children with Individualized Education Programs were not reported for 1 case in the sample. Percent minority enrollment was missing for 11 cases and percent of students eligible for free or reduced-price lunch was missing for 7 cases in the sample. Those cases were included in the totals and in analyses by other school characteristics.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Fast Response Survey System, "Survey of Classes That Serve Children Prior to Kindergarten in Public Schools," FRSS 78, 2001. (Originally published as table 7 on p. 22 of the complete report from which this article is excerpted.)

- The average public elementary school prekindergarten class had 14 children. The average number of children per general education prekindergarten class was higher than the average for special education classes, with 17 children per class among general education classes compared with 9 children per class among special education classes.[12]

[12]Among the sampled schools responding to this survey, the average number of children per prekindergarten class ranged from 2 to 48 for general education classes. For special education classes, the average ranged from 2 to 35 children per prekindergarten class.

- Thirty-two percent of the classes followed full-day schedules, and 68 percent followed half-day schedules. This distribution varied by several school characteristics. For example, 77 percent of the classes in schools in the Southeast were on full-day schedules, compared with 13 percent of the classes in the Central region.

Prekindergarten teachers in public schools

School officials were asked to report the number of teachers who taught prekindergarten during the 2000–01 school year. In addition, they were asked to provide basic information on the teachers' educational backgrounds and the pay scale used to determine their salaries. Results of the FRSS survey indicate the following:

- Approximately 45,900 teachers taught prekindergarten classes in public schools during the 2000–01 school year.
- Eighty-six percent of the prekindergarten teachers had a bachelor's or higher degree. Prekindergarten teachers in city schools, and in schools in the Northeast and Central regions, were more likely than their counterparts in other locales and regions to have a bachelor's or higher degree.
- The majority (82 percent) of public elementary school prekindergarten teachers were paid using the public elementary school teacher pay scale. This likelihood varied by school size, locale, region, and poverty concentration.

Support services offered to prekindergarten children in public schools

Public elementary school prekindergarten children and their families receive various support services. The survey asked about three of these services: transportation, meals,[13] and extended day care. The survey asked schools to report the number of prekindergarten children who received each service during the 2000–01 school year. The study findings indicate the following:

- Seventy-nine percent of schools with prekindergarten classes had one or more prekindergarten children who received transportation services, and 52 percent of all prekindergarten children received this service. These percentages varied by several school characteristics.
- Seventy-four percent of schools with prekindergarten classes provided meals to prekindergarten children, and 64 percent of all prekindergarten children received meals at school. These percentages also varied by school characteristics.
- Extended day care was offered by 18 percent of public elementary schools with prekindergarten classes, and 5 percent of all prekindergarten children received this service.

Prekindergarten funding sources in public schools

Public elementary schools use a variety of funding sources to support prekindergarten classes. The survey gathered information on the use of various sources: state or local education funds; federal or local programs for children with disabilities; Title I, Part A; Head Start; child care funds through a state or local agency; and Title I, Part B. Study findings indicate that 80 percent of public elementary schools used state or local education funds and 51 percent used funds from federal or local programs for children with disabilities. The likelihood that schools used the latter source was higher in rural/small town schools (56 percent) than in city schools (42 percent). Receipt of Title I, Part A funds for prekindergarten classes was reported by 25 percent of public elementary schools with prekindergarten classes, and 13 percent reported receipt of Head Start funds. Eleven percent of schools used child care funds through a state or local agency for prekindergarten classes, and 4 percent used Title I, Part B funds.

Summary

In conclusion, the results from this survey offer an overview of public school prekindergarten classes in the United States. During the 2000–01 school year, approximately 822,000 children were enrolled in 58,500 public elementary school prekindergarten classes nationwide. These classes were offered in about 19,900 public elementary schools, roughly one-third of public elementary schools in the country. Approximately 45,900 prekindergarten teachers instructed these classes. Many characteristics of the prekindergarten classes varied by school characteristics (including school size, locale, region, percent minority enrollment, and poverty concentration). The findings from this FRSS survey provide unique and important contextual information on public elementary schools with prekindergarten classes and the children who are enrolled in those classes.

[13] Schools were instructed to exclude snacks.

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Data source: The NCES Fast Response Survey System, "Survey of Classes That Serve Children Prior to Kindergarten in Public Schools," FRSS 78, 2001.

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Schools' Use of Assessments for Kindergarten Entrance and Placement: 1998–99

Naomi Prakash, Jerry West, and Kristin Denton

This article was originally published as a Statistics in Brief repart. The sample survey data are fram the Early Childhaad Langitudinal Study, Kindergarten Class af 1998–99 (ECLS-K). The technical nates and standard errar table fram the original repart have been amitted.

Introduction

Many schools across the nation administer entrance and placement tests to young children as they enter or are about to enter kindergarten, and schools use the information for several different purposes. They use test information, along with the child's age, to decide whether a child is ready to begin kindergarten. The information from tests may also be used to support a decision on whether to admit a child who is old enough, or who is too young, according to the age cut-off set by the state, school district, or school. Test information is also used to help structure instruction to meet the needs of individual children or groups of children and to identify children who may need additional evaluation and testing.

A survey of state education departments was conducted between October 1999 and January 2000 to collect information on state policies and practices pertaining to the assessment of kindergarten children (Saluja, Scott-Little, and Clifford 2000). According to the findings from this survey, 18 states reported that they had statewide screening or assessment of children beginning kindergarten; 26 states responded that though there was no statewide assessment effort, some local districts were assessing children before or as they entered kindergarten; 16 states said they were working toward a statewide assessment program; and 6 states responded that there was no assessment effort at either the state or local level. The most often cited use of the information from these tests was to improve instruction by providing teachers with information about their incoming kindergarten class (12 states). The data were also used for school improvement purposes by helping to identify high-need schools (7 states) and to identify children with special needs (6 states).

Because many states give local school officials the authority to make decisions about whether or not to assess kindergarten children, how to assess these children, and how to use the information from these assessments, it is important to know more about these practices at the school level. This report uses data from the base-year (kindergarten) collection of the Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), sponsored by the National Center for Education Statistics (NCES), U.S. Department of Education. The report describes the use of entrance or placement tests prior to kindergarten by schools in the United States that offer kindergarten classes. It examines the use of assessment tests by public and private schools, by schools with different concentrations of low-income children,[1] by schools with different levels of instruction (grade levels taught in the school), and by schools with different numbers of children enrolled.

National Data on Entrance and Placement Testing Prior to Kindergarten

The ECLS-K is following a nationally representative sample of children from kindergarten through fifth grade, collecting information from children, their families, teachers, and schools. The ECLS-K includes data from a nationally representative sample of schools offering kindergarten. The "School Administrator Questionnaire" component of the ECLS-K collects information from the principal/headmaster of these schools on a wide range of topics, including school and student body characteristics, school facilities and resources, community characteristics and school safety, school policies and practices, school-family-community connections, school programs for special populations, staffing and teacher characteristics, school governance and climate, and principal characteristics. This report uses the information principals provided about their schools' use of entrance or placement tests for kindergarten-age children in 1998–99.

This report examines schools' use of entrance or placement tests by school type, school level, school size, and school poverty.[2] School type refers to whether the school is a public or a private school (both religious and nonreligious). School level is the instructional level within the school or the grade range taught (i.e., *ends with kindergarten; primary*, in which the highest grade is first, second, or third; *elementary*, highest grade is fourth, fifth, or sixth; and *combined*, in

[1] In this report, low-income concentration is defined by the presence of a schoolwide Title I program. Schoolwide Title I programs in 1998–99 were intended for schools with poverty levels of 50 percent or more.

[2] The ECLS-K sample does not support estimates at the state level. For information on state assessment efforts, see Saluja, Scott-Little, and Clifford (2000).

which the highest grade is seventh through twelfth). School size refers to the number of students enrolled or school enrollment (i.e., *less than 150, 150–299, 300–499, 500–749,* and *750 and above*). In terms of school poverty, low-income schools are identified by the presence of a schoolwide Title I program. In 1998–99, in order to have a schoolwide Title I program, at least 50 percent of the student body had to be from families in poverty. Since this is highly unlikely for private schools, the comparisons by school poverty are limited to public schools.

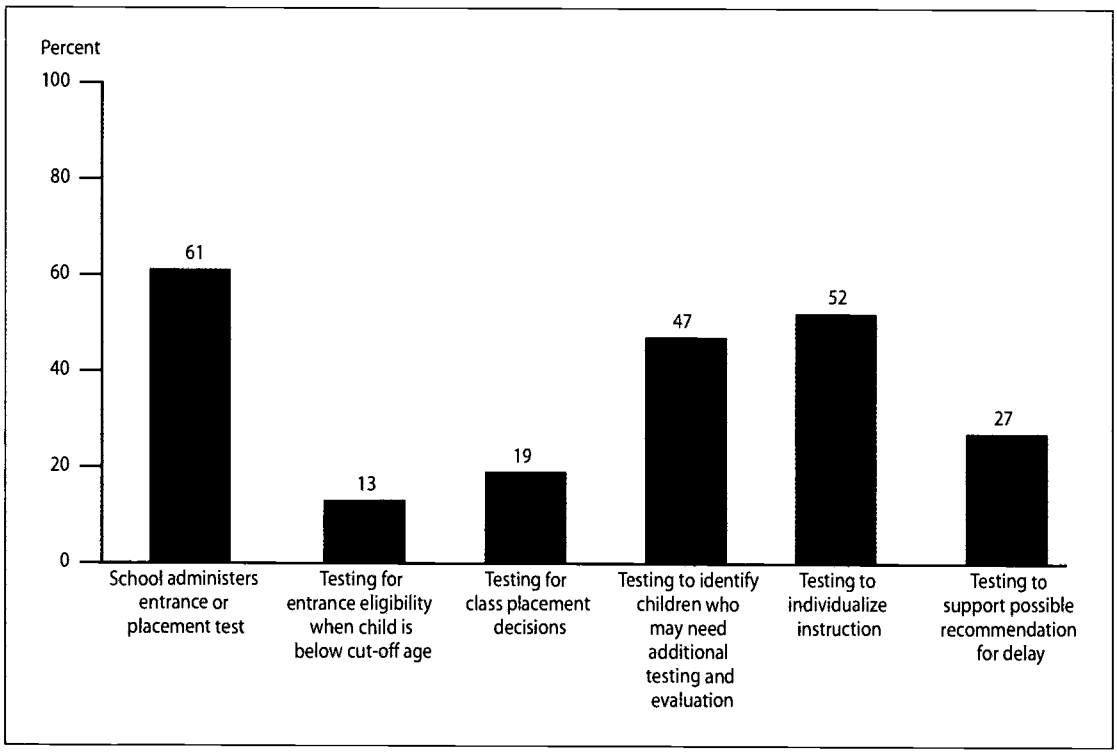
Findings

The ECLS-K data show that 61 percent of schools administer entrance or placement tests prior to kindergarten (figure 1). Schools are more likely to use information from such tests to evaluate the needs of children and to help guide instruction than to make decisions about whether children should be allowed to enter school or not. These findings are described below in greater detail.

Use of entrance or placement testing prior to kindergarten

A higher percentage of public schools (69 percent) than private schools (47 percent) administer entrance or placement tests to children prior to kindergarten (figure 2). Combined (71 percent), elementary (65 percent), and primary (68 percent) schools are more likely than schools that end with kindergarten (21 percent) to administer entrance or placement tests prior to kindergarten (table 1). Schools with larger student enrollments (more than 300 students) are more likely to administer entrance or placement tests (69 to 72 percent) than schools with enrollments of less than 150 students (44 percent). Among public schools, no differences were detected in the use of entrance or placement testing by school poverty.

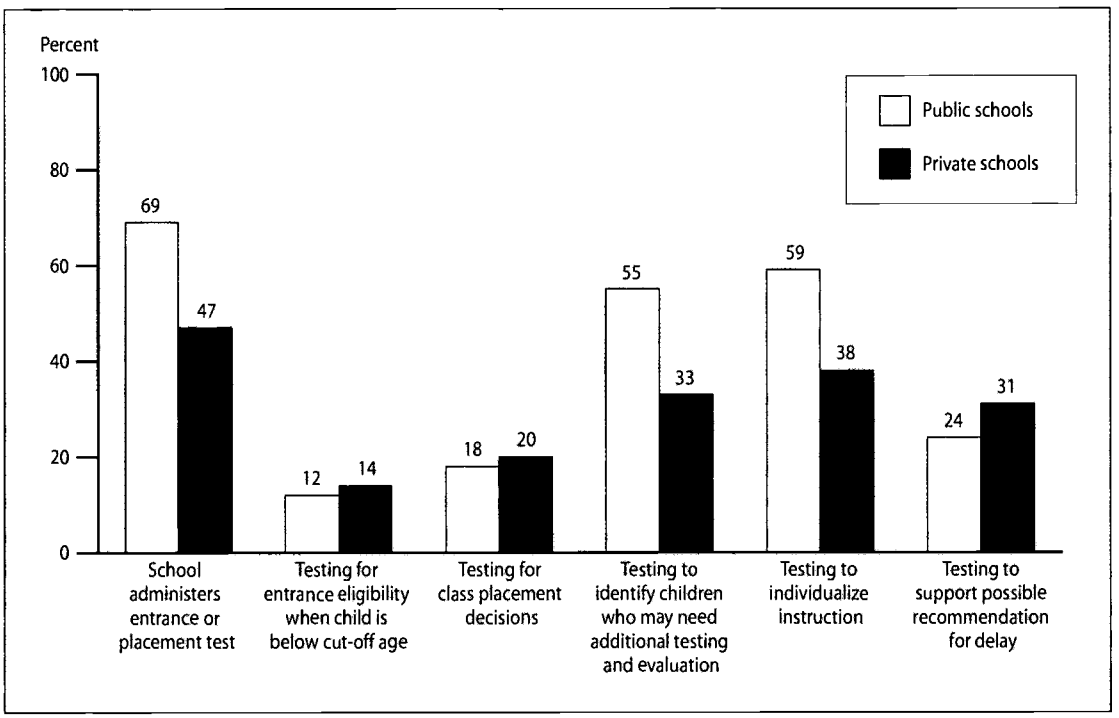
Figure 1. Percent of schools that give a kindergarten entrance or placement test prior to kindergarten and how the test information is used: 1998–99



NOTE: Statistics are for U.S. schools with one or more kindergarten classes.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), Base-Year Public-Use Data File.

Figure 2. Percent of schools that give a kindergarten entrance or placement test prior to kindergarten and how the test information is used, by school type: 1998–99



NOTE: Statistics are for U.S. schools with one or more kindergarten classes.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), Public-Use Base-Year Data File.

Testing to determine eligibility when a child is below the cut-off age

Schools use tests prior to kindergarten to inform admission decisions (Rafoth 1997). For example, if a child is age-ineligible for kindergarten (i.e., younger than the district's kindergarten cut-off age) but the parent wishes the child to attend, a test may be administered to inform the decision regarding whether to admit the child.

Thirteen percent of all schools with kindergarten programs use entrance or placement tests prior to kindergarten to inform entry decisions when a child is below the cut-off age (figure 1). No significant differences were detected in the use of tests for this purpose by school type or level of instruction (table 1). Also, no clear pattern of difference was detected by school size. Among public schools, no differences were detected by school poverty in schools' use of testing to determine eligibility when a child is below the cut-off age.

Testing to determine children's class placement

Testing to determine children's class placement can have two meanings. It can mean that children are assessed prior to entering kindergarten and assigned to homogeneous ability groups in a classroom. Or, it can mean that children are identified early as having special needs and assigned to classrooms that are equipped to serve these children's needs. The latter interpretation may fall more accurately under the use of testing to identify children who need further evaluation or individualized instruction and is discussed later in this report.

School administrators across the country reported that 19 percent of schools administer placement tests to determine children's class placements (figure 1). While no differences were detected in this use of tests by school type or school size, differences were detected by the school's level of instruction (table 1). Combined (23 percent) and elementary (19 percent) schools are more likely to administer entrance or placement tests prior to kindergarten to determine children's class placement compared to schools ending with kindergarten (6 percent). This finding is not entirely unexpected, for schools ending with kindergarten (i.e., preschools terminating with kindergarten) tend to be smaller and may not contain as many kindergarten classrooms; therefore, testing for this purpose may be a

Table 1. Percent of schools that give a kindergarten readiness or placement test prior to kindergarten and how that test information is used, by school characteristics: 1998–99

School characteristics	Total schools	Schools that test prior to kindergarten	Test for entrance eligibility when child is below cut-off age	Test for class placement decisions	Test to identify children who may need additional testing and evaluation	Test to individualize instruction	Test to support possible recommendation for delay
Total	100	61	13	19	47	52	27
School type							
Public	65	69	12	18	55	59	24
Private	35	47	14	20	33	38	31
School level							
Ends with kindergarten	11	21	5	6	22	24	10
Primary	6	68	13	21	57	54	14
Elementary	52	65	14	19	51	57	26
Combined	28	71	14	23	50	54	38
School size (number of children)							
Less than 150	24	44	17	18	35	37	25
150–299	26	62	11	16	45	51	28
300–499	24	72	18	19	57	58	33
500–749	19	69	7	21	54	60	19
750 and above	8	69	4	29	46	58	22
Public schools only							
Low-income school[1]							
Yes	56	73	14	22	60	63	27
No	44	65	11	14	48	54	21

[1]In this report, school poverty is defined by the presence of a schoolwide Title I program. Schoolwide Title I programs in 1998–99 were intended for schools with poverty levels of 50 percent or higher.

SOURCE: U.S. Department of Education, National Center for Education Statistics, Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K), Base-Year Restricted-Use Data File.

nonissue. Public schools with a high percentage of low-income children are more likely than public schools with fewer low-income children to use tests to determine children's class placements.

Testing to identify children who may need additional testing and evaluation

Schools may use placement test information to identify children who need additional evaluation for possible receipt of special services. In fact, the initial purpose of using entrance and placement tests was to identify children with special needs. Developmental assessments are used to help ensure that children with disabilities receive appropriate services (Shepard 1994).

Overall, 47 percent of schools use tests to identify children who may need additional evaluation (figure 1). Public schools (55 percent) are more likely than private schools (33 percent) to administer entrance or placement tests for this purpose (figure 2). Primary (57 percent), elementary (51 percent), and combined (50 percent) schools are more likely than schools that end with kindergarten (22 percent) to administer entrance or placement tests for this purpose (table 1). Also, a higher percentage of schools with between 300 and 499 students (57 percent) use these types of tests to identify children who may need additional evaluation, compared to schools with less than 150 students (35 percent). Among public schools, low-income schools are more likely than non-low-income schools to use tests to identify children who may need additional evaluation.

Testing to help teachers individualize instruction

Tests can help teachers to understand specific children's learning needs and can be used by teachers to individualize instruction. About half of all schools (52 percent) use entrance and placement testing for this purpose (figure 1).

Public schools (59 percent) are more likely than private schools (38 percent) to administer entrance and placement tests to help teachers individualize instruction (figure 2). Primary (54 percent), elementary (57 percent), and combined (54 percent) schools are more likely to administer entrance or placement tests to help teachers individualize instruction than schools that end with kindergarten (24 percent) (table 1). Small schools (less than 150 students, 37 percent) are less likely to administer entrance or placement tests to help teachers individualize instruction than larger schools (300–499 students, 58 percent; 500–749 students, 60 percent; 750 or more students, 58 percent). Among public schools, no differences were detected by school poverty in the use of testing to help teachers individualize instruction.

Testing to support a recommendation for delay of entry

Schools may administer tests prior to kindergarten to support a recommendation to delay a child's entry to kindergarten (May and Kundert 1997). Here, the child meets the age requirement to begin kindergarten, but the child's parents or school, or both, may have a concern about the child's *readiness* for school. About one-quarter of schools (27 percent) use tests to support recommendations that children be held out of kindergarten (figure 1). No differences by school type were detected for this use of testing. Combined schools (38 percent) and elementary schools (26 percent) are more likely than schools ending with kindergarten (10 percent) to administer tests for this purpose (table 1). Schools with enrollments of 300–499 students (33 percent) are more likely than schools with 500–749 students (19 percent) to administer entrance or placement tests prior to kindergarten for this purpose. Among public schools, no differences were detected by school property in schools' use of tests to support a recommendation for delay of entry.

Summary

More than half (61 percent) of our nation's schools use some form of entrance or placement tests for kindergarten-age children. The administration of such tests and how the information from these tests is used varies by several school characteristics, such as school type, the grade levels taught, and school size. For example, schools that end with kindergarten differ from primary, elementary, and combined schools in their use of such tests (e.g., use of test information to individualize instruction). Schools that end with kindergarten are significantly less likely to use entrance and placement tests in general (21 percent vs. 65 to 71 percent). Therefore, it is not surprising that they also differ in how they use the information from these tests.

Whether or not these patterns of use are different from the past is difficult to judge. The 1999–2000 survey results reported by Saluja, Scott-Little, and Clifford (2000) and results from earlier surveys conducted in the mid-1990s (Shepard, Kagan, and Taylor 1996) and mid-1980s (Gnezda and Bolig 1988) focus on the policies and practices of states (not schools). The ECLS-K provides information about schools' use of assessments. However, both at the state level and at the school level, the findings seem consistent. Specifically, it seems that test information is more likely to be used to evaluate the needs of children and to help guide instruction than to make decisions about whether children should be allowed to enter school.

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Doto source: The NCES Early Childhood Longitudinal Study, Kindergarten Class of 1998–99 (ECLS-K).

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Elementary and Secondary Education

The Nation's Report Card: Science 2000

Christine Y. O'Sullivan, Mary A. Lauko, Wendy S. Grigg, Jiahe Qian, and Jinming Zhang

This article was originally published as the Executive Summary of the report of the same name. The sample survey data are from the National Assessment of Educational Progress (NAEP) 2000 Science Assessment.

The National Assessment of Educational Progress (NAEP) is the nation's only ongoing representative sample survey of student achievement in core subject areas. In 2000, NAEP conducted a national science assessment of fourth-, eighth-, and twelfth-grade students. State-level results were also collected at the fourth and eighth grades within participating states and jurisdictions.

Authorized by Congress and administered by the National Center for Education Statistics (NCES) in the U.S. Department of Education, NAEP regularly reports to the public on the educational progress of students in grades 4, 8, and 12. This report presents the results of the NAEP 2000 Science Assessment for the nation and the states. Results in 2000 are compared to results from the NAEP 1996 Science Assessment. Students' performance on the assessment is described in terms of average scores on a 0–300 scale for each grade and in terms of the percentages of students attaining three achievement levels: *Basic*, *Proficient*, and *Advanced*. The achievement levels are performance standards adopted by the National Assessment Governing Board (NAGB) as part of its statutory responsibilities and describe what students should know and be able to do. NAGB is an independent, bipartisan group created by Congress in 1988 to set policy for NAEP.

As provided by law, the Commissioner of Education Statistics, upon review of a congressionally mandated evaluation of NAEP, determined that the achievement levels are to be considered developmental and should be interpreted

and used with caution. However, both the Commissioner and NAGB believe these performance standards are useful for understanding trends in student achievement. They have been widely used by national and state officials as a common yardstick of academic performance.

In addition to providing average scores and achievement-level performance at the national level and state level, this report presents results for subgroups of students defined by various background and contextual characteristics. This report also contains results for a second sample at both the national and state levels—one in which testing accommodations were provided to students with special needs (i.e., students with disabilities or limited-English-proficient students).

The results presented in this report are based on representative samples of students for the nation and for participating states and jurisdictions. In the national sample, approximately 47,000 students from 2,100 schools were assessed. In the state samples, approximately 180,000 students from 7,500 schools were assessed. The national sample included students attending both public and nonpublic schools, while the state samples included only students attending public schools.

Following is a summary of overall results from the NAEP 2000 Science Assessment. Differences between results from 1996 and 2000 or between groups of students are discussed only if they have been determined to be statistically significant.

Overall Science Results for the Nation, Regions, and States

Science results for the nation

- Between 1996 and 2000, there was no statistically significant difference observed in the average science scores of fourth- or eighth-grade students. The average score of students in grade 12, however, declined from 150 in 1996 to 147 in 2000.
- In 2000, the percentage of students performing at or above *Proficient*—identified by NAGB as the level that all students should reach—was 29 percent at grade 4, 32 percent at grade 8, and 18 percent at grade 12. The percentage of eighth-graders at or above *Proficient* was higher in 2000 than in 1996. The percentage of twelfth-graders at or above *Basic* declined between 1996 and 2000.
- The 90th-percentile score at grade 8 was higher in 2000 than in 1996, indicating improvement for the highest-performing eighth-graders. At grade 12, the 50th-percentile score declined between 1996 and 2000, indicating a decline in the performance of middle-performing twelfth-graders.

Science results for the regions

- In 2000, the average scores for fourth- and eighth-graders were higher in the Northeast and Central regions than in the Southeast and West. Among twelfth-graders, average scores were higher in the Northeast and Central regions than in the Southeast.
- Grade 12 students attending schools in the Central region had a lower average score in 2000 than in 1996.

Science results for the states and other jurisdictions

In the NAEP 2000 state-by-state assessment, results were reported for 39 states and 5 other jurisdictions that participated at grade 4, and 38 states and 4 other jurisdictions at grade 8. Only public schools participated in the state-by-state assessment.

At grade 4:

- The top six states in 2000 were Iowa, Maine, Massachusetts, Montana, North Dakota, and Vermont. The average scores for these six states were higher than any other participating state or jurisdiction, but were not found to differ significantly from one another.
- Iowa, Maine, Massachusetts, Montana, and Vermont had percentages of fourth-graders at or above *Proficient* that were higher than the other participating states and jurisdictions, but were not found to be significantly different from one another.

At grade 8:

- The top 10 states and other jurisdictions in 2000 were Idaho, Maine, Massachusetts, Minnesota, Montana, North Dakota, Ohio, Vermont, and the Department of Defense domestic and overseas schools. The state of Montana, however, had an average eighth-grade score that was higher than any other participating state or jurisdiction.
- Between 1996 and 2000, eighth-graders' average scores increased in Missouri and at the Department of Defense domestic and overseas schools. (These results are based on multiple-comparison statistical

significance testing procedures including all states and jurisdictions that participated in both years.)

- Massachusetts, Minnesota, Montana, and Ohio all had percentages of eighth-graders at or above *Proficient* that were higher than the percentages in other participating states and jurisdictions, but were not found to differ significantly from one another.

National Science Results for Student Subgroups

In addition to overall results for the nation and for states and jurisdictions, NAEP reports on the performance of various subgroups of students. Observed differences between student subgroups in NAEP science performance most likely reflect a range of socioeconomic and educational factors not addressed in this report or by NAEP.

Gender

- In 2000, males had higher average scores than females at grades 4 and 8. The apparent gender difference at grade 12 was not statistically significant.
- Between 1996 and 2000, the average score for eighth-grade males increased, while the average score for twelfth-grade males decreased.
- Between 1996 and 2000, the average score gap favoring males over females widened by 3 points at grade 4 and by 5 points at grade 8.

Race/ethnicity

- In 2000, the average scores of White students at all three grades were higher than those of their Black, Hispanic, or American Indian peers, and American Indian students scored higher, on average, than Black students.
- Between 1996 and 2000, average scores decreased for eighth-grade American Indian students and for twelfth-grade White students.
- Between 1996 and 2000, no significant difference was observed in the average score gap between White and Black students and between White and Hispanic students at any of the three grades.

Parents' level of education

- Generally, students in grades 8 and 12 who reported higher levels of parental education had higher average scores in 2000 than did their peers who reported lower levels of parental education. (Information about parental education was not collected at the fourth grade.)
- Between 1996 and 2000, average scores declined among twelfth-graders who reported that their parents' highest level of education was high school graduation and among those who reported that at least one parent had some education after high school.

Type of school

- At all three grades in 2000, students attending nonpublic schools had higher average scores than their peers attending public schools.
- Between 1996 and 2000, the average score for twelfth-grade public school students decreased, while the average score for twelfth-grade nonpublic school students increased.

Type of location

- In 2000, fourth- and eighth-grade students attending schools in central city locations had lower average scores than their counterparts attending schools in urban fringe/large town or rural/small town locations. At grade 12, there was no statistically significant relationship between school location and students' average scores. (Results by type of location are not available from 1996.)

Free/reduced-price school lunch eligibility

- At all three grades in 2000, students eligible for free/reduced-price lunch under the National School Lunch Program administered by the U.S. Department of Agriculture (USDA) had lower average scores than those who were not eligible. Free/reduced-price school lunches are intended for children at, near, or below the poverty line: eligibility is determined by the USDA's Income Eligibility Guidelines (http://www.fns.usda.gov/cnd/IEGs&NAPs/IEGs.htm).
- Between 1996 and 2000, the average score of eighth-graders who were eligible for free/reduced-price school lunch decreased, while the average score of eighth-graders who were not eligible increased. Among twelfth-graders, the average score of students who were not eligible decreased between 1996 and 2000.

Becoming a More Inclusive NAEP

A second set of results from the NAEP 2000 science assessment includes the performance of special-needs students who were provided with testing accommodations. A similar set of results is available from 1996 at the national level only, allowing for comparisons between 1996 and 2000 national results based on administration procedures that permitted accommodations.

Science results for the nation

- In 2000, the difference between "accommodations-permitted" and "accommodations-not-permitted" national average scores was not found to be statistically significant at grades 8 and 12. At grade 4, however, the "accommodations-permitted" average score was 2 points lower than the "accommodations-not-permitted" average score.*
- Between 1996 and 2000, the national average score for twelfth-graders declined when accommodations were not permitted and when accommodations were permitted.

Science results for the states and other jurisdictions

- In 2000, none of the apparent differences between "accommodations-permitted" and "accommodations-not-permitted" average scores were found to be statistically significant at either grade 4 or grade 8 for any of the participating states or jurisdictions. (These results are based on multiple-comparison statistical significance testing procedures including all states and jurisdictions that participated in 2000.)

School Contexts for Learning Science

NAEP collects information about the contexts for student learning by administering questionnaires to assessed students, their teachers, and school administrators. Using the student as the unit of analysis, NAEP examines the relationship between selected contextual variables drawn from these questionnaires and students' average scores on the science assessment. In interpreting these data, readers are reminded that the relationship between contextual variables and student performance is not necessarily causal. There are many factors that may play a role in student performance on NAEP.

*The effects of offering accommodations are examined in greater detail in two NCES reports: *Including Special-Needs Students in the NAEP 1998 Reading Assessment: Part I, Comparison of Overall Results With and Without Accommodations* (Lutkus and Mazzeo 2003); and *Including Special-Needs Students in the NAEP 1998 Reading Assessment: Part II, Results for Students With Disabilities and Limited-English-Proficient Students* (Lutkus forthcoming).

At grade 4:

Computer availability and use

- In 2000, fourth-graders whose teachers reported that they used computers for science instruction scored higher, on average, than fourth-graders whose teachers reported that they did not.
- Between 1996 and 2000, the percentage of fourth-graders whose teachers reported using computers for science instruction increased from 47 to 57 percent.

Coursework

- In 2000, fourth-graders whose teachers reported spending a lot of time or some time on life science and earth science had higher average scores than fourth-graders whose teachers reported spending only a little time on these domains.
- In 2000, 31 percent of fourth-grade students were taught by teachers who reported spending a lot of time on life science and earth science, and 22 percent were taught by teachers who reported spending a lot of time on physical science.
- Between 1996 and 2000, the percentage of fourth-graders whose teachers reported spending a lot of time on earth science increased from 19 to 31 percent.

At grade 8:

Computer availability and use

- In 2000, eighth-graders whose science teachers reported having their students use computers for simulations and modeling or for data analysis and other applications had higher average scores than eighth-graders whose science teachers reported not having students use computers in this manner.
- Between 1996 and 2000, the percentage of eighth-graders whose science teachers reported having their students use computers for data analysis and other applications or for word processing increased.

Coursework

- In 2000, 45 and 47 percent of eighth-graders were taught by teachers who reported spending a lot of time on earth science and physical science, respectively. Twenty-one percent of eighth-graders were taught by teachers who reported spending a lot of time on life science.

At grade 12:

Computer use

- In 2000, twelfth-graders who reported using computers to collect data or to analyze data in their science classes once a month or more had higher average scores than twelfth-graders who reported doing so less frequently.
- In 2000, twelfth-graders who reported never downloading data and related information from the Internet for their science classes had lower average scores than twelfth-graders who reported doing so at least sometimes.

Coursework

- Twelfth-graders who reported that they were currently taking a science course in 2000 scored higher, on average, than twelfth-graders who reported that they were not.
- According to twelfth-graders' reports in 2000 about the types of science courses they had taken since eighth-grade, approximately 92 percent had taken biology, 74 percent had taken earth science, 70 percent had taken chemistry, and 36 percent had taken physics.
- Twelfth-grade students who reported in 2000 that they had taken or were currently enrolled in Advanced Placement (AP) biology, chemistry, or physics had higher average scores than twelfth-grade students who said they had not taken and were not enrolled in these AP courses.

References

Lutkus, A.D. (forthcoming). *Including Special-Needs Students in the NAEP 1998 Reading Assessment: Part II, Results for Students With Disabilities and Limited-English-Proficient Students*. U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Lutkus, A.D., and Mazzeo, J. (2003). *Including Special-Needs Students in the NAEP 1998 Reading Assessment: Part I, Comparison of Overall Results With and Without Accommodations* (NCES 2003–467). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Doto source: The National Assessment of Educational Progress (NAEP) 2000 Science Assessment.

For technicol informotion, see the complete report:

O'Sullivan, C.Y., Lauko, M.A., Grigg, W.S., Qian, J., and Zhang, J. (2003). *The Nation's Report Card: Science 2000* (NCES 2003–453).

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To obtoin the complete report (NCES 2003–453), call the toll-free ED Pubs number (877–433–7827) or visit the NCES Electronic Catalog (http://nces.ed.gov/pubsearch).

Including Special-Needs Students in the NAEP 1998 Reading Assessment, Part I, Comparison of Overall Results With and Without Accommodations

Anthony D. Lutkus and John Mazzeo

This article was originally published as the Executive Summary of the Statistical Analysis Report of the same name. The sample survey data are from the National Assessment of Educational Progress (NAEP) 1994 and 1998 Reading Assessments.

Background

The National Assessment of Educational Progress (NAEP) is the nation's only ongoing survey of student achievement in core subject areas. Authorized by Congress, administered by the National Center for Education Statistics (NCES) in the U.S. Department of Education, and overseen by the National Assessment Governing Board (NAGB), NAEP regularly reports to the public on the educational progress of a representative sample of students in grades 4, 8, and 12.

Because NAEP's purpose is to report on what students know and can do, it is important that its student samples and assessment results represent the performance of all students. This includes the results for special-needs students—students with disabilities (SD) and limited-English-proficient (LEP) students. Although the intent of NAEP has consistently been to include special-needs students in its assessments to the fullest degree possible, the implementation of assessments has resulted in some exclusion of SD and LEP students. In order to participate in the NAEP assessments, some special-needs students require accommodations in the test administration. In 1996, NAEP began offering accommodations on a trial basis and conducting research to explore possible psychometric effects that the inclusion of accommodated special-needs students might have on assessment results in various subject areas.

The *NAEP 1998 Reading Report Card for the Nation and the States* (Donahue et al.1999) included national results for fourth-, eighth-, and twelfth-graders, as well as results for fourth- and eighth-graders in those states and other jurisdictions (i.e., U.S. territories and the District of Columbia) that volunteered to participate in state-level assessments.* In order to allow comparisons with results in 1992 and 1994, when accommodations were not offered, the report card did not incorporate the 1998 results for special-needs students who were tested with accommodations.

Purpose of This Report

There are two purposes to this report. The first is to present NAEP 1998 Reading Assessment results that are recalculated to include results from special-needs students who were tested with accommodations. The second is to examine the impact on NAEP results of the varying exclusion rates of special-needs students, by participating states and other jurisdictions. A follow-up report will explore the patterns of results for accommodated versus nonaccommodated samples separately for students who are SD and LEP, using combined national and state data.

Comparison of Results When Accommodations Were Not Permitted and When Accommodations Were Permitted

Performance results for both the national and state assessments are reported in two ways. The first is in terms of average scale scores on the NAEP reading composite scale, which ranges from 0 to 500. The second is in terms of percentages of students at or above each of NAGB's three achievement levels (*Basic*, *Proficient*, and *Advanced*). The following is a summary of the findings addressed in this report:

- There were no statistically significant differences between the originally reported national average scale scores (where accommodations were not permitted) and the recalculated average scores (including data from the administrations where accommodations were permitted) at any of the three grades (table A). Further, there were no statistically significant differences in the percentage of students at or above the *Basic* or *Proficient* achievement levels for the two samples at any of the grades assessed.
- In contrast to the unchanged results for the national data, at grade 4, average scale scores were higher in nine states for the original samples without accommodations permitted than for the samples with accommodations permitted (table B). At grade 8, there were no statistically significant differences in average scale scores between the two sample types in any state or jurisdiction. At both grades 4 and 8, there were no statistically significant differences in the percentage of students at or above the *Basic* or *Proficient* achievement levels in any state or jurisdiction.

*In this report, the term jurisdiction is sometimes used to refer to both states and other jurisdictions.

Table A. National average reading scores, and exclusion and accommodation rates, when accommodations were not permitted and when accommodations were permitted, grades 4, 8, and 12: 1998

	Average scale scores		Exclusion rates*		Accommodation rates *
	Accommodations not permitted	Accommodations permitted	Accommodations not permitted	Accommodations permitted	
Grade 4	217	216	9	6	3
Grade 8	264	263	6	4	2
Grade 12	291	290	3	2	1

*Combined rate for SD and LEP students.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1998 Reading Assessment. (Originally published as table 2.1 on p. 16 of the complete report from which this article is excerpted.)

- There were no statistically significant differences in national average reading scale scores between the two sample types at any grade for either male or female students.
- At the state level, however, average reading scores at grade 4 were higher for male students in three states when accommodations were not permitted, higher for female students in four states when accommodations were not permitted, and higher for both male and female students in one state when accommodations were not permitted. No statistically significant differences in the sample types by gender were found in grade 8.
- No statistically significant differences were found in the national data between the two sample types for any ethnic group in any grade.
- The state-level results showed statistically significant differences by race between the two sample types in five states at grade 4. In four states, Black students in the accommodated samples had a lower average scale score than their peers in the samples where accommodations were not permitted. In three states, White students in the accommodated samples had a lower average scale score than their peers in the samples where accommodations were not permitted. In two of the five states noted above, both Black students and White students at grade 4 had lower average scale scores when accommodations were permitted. At grade 8, there were no statistically significant differences between the two sample types by ethnic group in any state or jurisdiction.
- In three states, fourth-graders who were eligible for free/reduced-price lunch under the National School Lunch Program had higher average reading scores when accommodations were not permitted than when accommodations were permitted. At grade 8, there were no statistically significant differences in the average scores of students in the two sample types by eligibility for free/reduced-price school lunch.

Relationship Between Exclusion Rates and Results at the State Level

Evolving policies and practices regarding the inclusion of special-needs students pose challenges to the state NAEP program as it strives to monitor accurately trends in academic achievement. As policies and practices have changed, the state NAEP program has seen corresponding changes in the proportion of special-needs students included in its samples. This report provides data on statistically significant differences in exclusion rates when accommodations were not permitted and when accommodations were permitted, and the relationship between those exclusion rates and state average scale scores.

- Allowing accommodations in the reading assessment resulted in decreased exclusion rates for a number of participating states and other jurisdictions (table C). At grade 4, 12 of the 43 states or other jurisdictions that participated in the 1998 reading assessment had exclusion percentages of 10 percent or higher when accommodations were not permitted. In contrast, only five jurisdictions had exclusion percentages as high when accommodations were permitted. Differences in exclusion rates by accommodation were statistically significant in 10 of 43 jurisdictions at grade 4 and 10 of 40 jurisdictions at grade 8.
- While no state or other jurisdiction tested large percentages of students with accommodations, considerable variability was evident. At grade 4, two jurisdictions tested more than 5 percent of students with accommodations, while two jurisdictions tested 1 percent or less. At grade 8, there was

Table B. Average reading scores by state, when accommodations were not permitted and when accommodations were permitted, grade 4: 1998

	Accommodations not permitted		Accommodations permitted	
	Number of students	Average score	Number of students	Average score
Alabama	2,506	211	2,475	211
Arizona	2,432	207	2,423	206
Arkansas	2,580	209	2,573	209
California†	1,722	202	1,713	202
Colorado	2,528	222	2,540	220
Connecticut	2,484	232	2,531	230
Delaware	2,309	212	2,359	207[a]
Florida	2,463	207	2,532	206
Georgia	2,647	210	2,684	209
Hawaii	2,600	200	2,601	200
Iowa†	2,232	223	2,244	220[a]
Kansas†	1,845	222	1,856	221
Kentucky	2,442	218	2,456	218
Louisiana	2,587	204	2,658	200[A]
Maine	2,355	225	2,386	225
Maryland	2,241	215	2,308	212[a]
Massachusetts†	2,306	225	2,325	223[a]
Michigan	2,365	217	2,368	216
Minnesota†	2,271	222	2,292	219[a]
Mississippi	2,552	204	2,554	203
Missouri	2,482	216	2,514	216
Montana†	1,847	226	1,886	225
Nevada	2,597	208	2,613	206
New Hampshire†	1,805	226	1,805	226
New Mexico	2,284	206	2,333	205
New York†	2,221	216	2,256	215
North Carolina	2,514	217	2,552	213[a]
Oklahoma	2,576	220	2,553	219
Oregon	2,396	214	2,351	212[a]
Rhode Island	2,533	218	2,500	218
South Carolina	2,411	210	2,433	209
Tennessee	2,627	212	2,599	212
Texas	2,241	217	2,267	214
Utah	2,678	215	2,642	216
Virginia	2,602	218	2,625	217
Washington	2,378	217	2,340	218
West Virginia	2,518	216	2,531	216
Wisconsin†	2,071	224	2,126	222[a]
Wyoming	2,642	219	2,635	218
Other jurisdictions				
District of Columbia	2,353	182	2,397	179
DDESS	2,647	220	2,628	219
DoDDS	2,609	223	2,623	221
Virgin Islands	1,469	178	1,468	174

†Indicates jurisdiction did not meet one or more of the guidelines for school participation. See the *NAEP 1998 Reading Report Card for the Nation and the States* (Donahue et al. 1999, p.155).

[A/a] = Significantly different from the original sample. [A]= Significance level is adjusted for multiple comparisons across jurisdictions. [a]= Pairwise significance test not adjusted for multiple comparisons.

DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.

DoDDS: Department of Defense Dependents Schools (Overseas).

NOTE: Differences between states and jurisdictions may be partially explained by other factors not included in this table.

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1998 Reading Assessment. (Originally published as table 2.2 on p. 17 of the complete report from which this article is excerpted.)

Table C. Reading exclusion rates by state for special-needs students, when accommodations were not permitted and when accommodations were permitted, grades 4 and 8: 1998

	Grade 4		Grade 8	
	Accommodations not permitted	Accommodations permitted	Accommodations not permitted	Accommodations permitted
National public and nonpublic	9	6	6	4
National public	10	7	6	4
Alabama	8	8	6	6
Arizona	10	10	7	5
Arkansas	5	5	7	5
California	15	14	8	4
Colorado	7	6	5	4
Connecticut	13	10	8	6
Delaware	7	1	6	2
Florida	9	6	5	5
Georgia	7	5	5	4
Hawaii	5	5	6	5
Iowa	8	5	*	*
Kansas	6	4	5	4
Kentucky	9	7	5	3
Louisiana	12	7	10	5
Maine	8	7	7	5
Maryland	10	6	7	3
Massachusetts	8	5	7	4
Michigan	7	6	*	*
Minnesota	4	3	4	1
Mississippi	4	4	7	6
Missouri	7	6	6	4
Montana	4	2	3	4
Nevada	12	11	8	6
New Hampshire	5	3	*	*
New Mexico	11	9	7	8
New York	9	7	10	8
North Carolina	10	7	9	6
Oklahoma	9	9	9	9
Oregon	7	6	4	4
Rhode Island	7	7	5	6
South Carolina	11	8	6	5
Tennessee	4	4	4	6
Texas	14	13	7	5
Utah	5	6	5	4
Virginia	8	6	7	5
Washington	5	5	4	4
West Virginia	9	8	8	7
Wisconsin	10	8	8	5
Wyoming	4	3	2	2
Other jurisdictions				
District of Columbia	11	9	9	5
DDESS	5	4	5	2
DoDDS	4	3	4	1
Virgin Islands	6	5	7	7

*State did not participate at grade 8.

DDESS: Department of Defense Domestic Dependent Elementary and Secondary Schools.

DoDDS: Department of Defense Dependents Schools (Overseas).

SOURCE: U.S. Department of Education, National Center for Education Statistics, National Assessment of Educational Progress (NAEP), 1998 Reading Assessment. (Originally published as table 2.4 on p. 21 of the complete report from which this article is excerpted.)

generally less use of accommodations, although 7 of 40 participating jurisdictions tested 4 percent or more of students with accommodations.

- There is a negative relationship between the change in inclusion rates and difference in average scale scores. States or other jurisdictions that exhibited larger gains in inclusion (i.e., lower exclusion rates) tended to also exhibit larger reduction in their average scale scores when accommodations were permitted. The correlation was –0.72 at fourth grade and –0.52 at eighth grade.

Conclusion

Offering accommodations in state NAEP to students who receive them in their regular classroom assessments increases inclusion in some states and other jurisdictions, but the magnitude of the increase varies across jurisdictions. At grade 4, the increase in inclusion of special-needs students and the provision of accommodations was associated with lower average scale scores in nine states, but not in the nation. At grade 8, there was no pattern of statistically significant differences by accommodation status.

Readers are cautioned not to overgeneralize the results of this study for several reasons. First, within the reading subject area, the lack of difference between samples with accommodations permitted and those without accommodations permitted in the national data in 1998 did not continue in the 2000 fourth-grade national assessment, where a statistically significant difference did appear in favor of the sample without accommodations. Second, patterns may vary depending on the academic subject area. For example, in the present discussion of 1998 state reading assessment results, more states at grade 4 had lower average scale scores for their accommodated samples than at grade 8. However, for the mathematics assessment in 2000, the findings were different—more states at grade 8 had statistically significant lower average scale scores in accommodated samples than at grade 4. Finally, the fact that the reading assessment did not permit a Spanish translation suggests that the findings for LEP students may not generalize to other subjects, such as mathematics, where this accommodation may be offered.

Reference

Donahue, P.L., Voelkl, K.E., Campbell, J.R., and Mazzeo, J. (1999). *NAEP 1998 Reading Report Card for the Nation and the States* (NCES 1999–500). U.S. Department of Education. Washington, DC: National Center for Education Statistics.

Data source: The National Assessment of Educational Progress (NAEP) 1994 and 1998 Reading Assessments.

For technical information, see the complete report:

Lutkus, A.D., and Mazzeo, J. (2003). *Including Special-Needs Students in the NAEP 1998 Reading Assessment: Part I, Comparison of Overall Results With and Without Accommodations* (NCES 2003–467).

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Mathematics Teachers' Familiarity With Standards and Their Instructional Practices: 1995 and 1999

Marisa Burian-Fitzgerald, Daniel J. McGrath, and Valena Plisko

This article was originally published as an Issue Brief. The sample survey data are from the Third International Mathematics and Science Study (TIMSS).

In 1995, half of the states (25) had content standards in mathematics; by 1998, this number had increased to 42 (Council of Chief State School Officers 2000). Forty-five states had student assessments in mathematics in 1994; by 1999, 47 states had such assessments. The existence of standards and assessments at the state level does not guarantee that classroom teachers are familiar with the standards or with the specifications of assessments (Cohen and Hill 2000). Neither does it guarantee that classroom instruction reflects the standards and assessments. In fact, mathematics standards have created significant controversy over the efficacy of different types of instruction for improving student performance (Loveless 2001; see, especially, the chapter by Loveless).

The Third International Mathematics and Science Study (TIMSS) assessments of 1995 and 1999* take a representative sample of eighth-grade students. This Issue Brief draws on surveys administered to these students' mathematics teachers. Using the survey results, this analysis examines the degree of teacher familiarity with various standards and assessments in 1995 and 1999. It then compares teacher reports of their instructional practices in classrooms with teacher reports of their familiarity with standards and assessments. Instruction is compared on the kinds of problem-solving activities advocated by national and state standards during the mid-1990s and on computational skill practice, which received more emphasis in the standards at the close of the 20th century (Loveless 2001).

How Familiar Are Teachers With Standards, Curriculum Guides, and Assessment Specifications?

Teacher familiarity with state education department documents, such as curriculum guides and assessment specifications, appears to have increased between 1995 and 1999 (table 1). In 1999, fewer students had teachers who were not familiar with assessment specifications (44 percent in 1999 compared with 57 percent in 1995). In 1999, students were also less likely to have teachers who reported they were not familiar with their state education department curriculum guides (20 percent) compared with students in 1995 (33 percent).

Table 1. Percentage of public school mathematics students taught in eighth grade, by teachers' level of awareness of mathematics standards, curriculum guidelines, and assessment specifications: 1995 and 1999

Standards, guidelines, and specifications	1995	1999
National Council of Teachers of Mathematics standards		
Not familiar	13.4	15.7
Fairly familiar	47.8	44.1
Very familiar	38.8	40.2
State education department curriculum guides		
Not familiar	33.3	19.9
Fairly familiar	37.9	42.7
Very familiar	28.8	37.5
State education department assessment specifications		
Not familiar	57.4	44.2
Fairly familiar	25.3	35.5
Very familiar	17.2	20.2
School district curriculum guide		
Not familiar	8.4	4.3
Fairly familiar	37.7	32.4
Very familiar	53.9	63.3
School curriculum guides		
Not familiar	8.7	8.3
Fairly familiar	27.9	27.7
Very familiar	63.4	64.0

NOTE: Not all apparent differences in this table are statistically significant because many estimates have large standard errors. Standard errors are available at http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2003022. Teachers who reported "no such document" are not included. There may be overlap among those reporting "no such document" and those reporting "not familiar." In some cases, teachers unfamiliar with standards documents may have incorrectly reported "no such document"; in other cases, teachers may have reported "not familiar" when, in fact, a document existed. The data did not allow checking of these responses for accuracy.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Third International Mathematics and Science Study (TIMSS), 1995 and 1999.

*In other documents, TIMSS 1999 is also referred to as TIMSS-R (TIMSS-Repeat).

Did Teachers Who Reported Greater Familiarity With National, State, and Local Standards Report Different Practices From Other Teachers in 1999?

Students with teachers who were more familiar with national, state, and local standards for practice were more likely to be asked to do problem-solving activities. For example, in 1999, students with teachers who were very familiar with state education department assessment specifications were more likely than students with teachers who were fairly or not familiar with these documents to be asked to represent and analyze relationships using tables, charts, or graphs in most lessons or every lesson (41 percent of those with teachers who were very familiar compared with 22 and 19 percent, respectively, of those with teachers who were fairly familiar and not familiar; table 2). In 1999, students with teachers who were very familiar with these documents were also more likely to be frequently asked to write equations to represent relationships than students with teachers who were not familiar with these documents (69 percent and 44 percent, respectively). Similarly, students with teachers who reported being very familiar with state education department curriculum guides were more likely than students with teachers who were fairly or not familiar to be asked to explain the reasoning behind an idea in most lessons or every lesson in 1999

Table 2. Percentage of public school mathematics students taught in eighth grade by teachers who reported using various instructional practices in most lessons or every lesson, by teachers' level of awareness of mathematics standards, curriculum guidelines, and assessment specifications: 1995 and 1999

	Explain reasoning behind an idea		Represent and analyze relationships using tables, charts, or graphs		Work on problems for which there is no immediately obvious method of solution		Write equations to represent relationships		Practice computational skills	
Standards, guidelines, and specifications	1995	1999	1995	1999	1995	1999	1995	1999	1995	1999
Total	67.0	72.6	12.3	25.3	11.6	19.8	36.4	52.7	59.3	66.5
National Council of Teachers of Mathematics standards										
Not familiar	42.2	67.6	4.6	20.9	3.7	6.3	26.9	31.2	67.6	81.7
Fairly familiar	69.1	66.9	11.3	18.7	13.3	25.9	36.1	50.6	61.3	60.4
Very familiar	73.9	83.1	17.0	32.7	13.1	20.6	41.2	64.3	53.3	70.2
State education department curriculum guides										
Not familiar	57.2	62.3	5.6	13.7	11.9	19.9	47.0	54.5	54.3	74.1
Fairly familiar	70.9	67.7	15.8	26.8	15.0	20.1	29.6	48.7	67.6	66.3
Very familiar	75.5	86.3	17.7	29.6	8.9	22.2	33.4	57.7	54.4	68.3
State education department assessment specifications										
Not familiar	61.3	65.0	10.7	19.4	16.2	14.9	40.9	44.4	64.3	69.7
Fairly familiar	77.6	78.5	10.8	22.2	5.7	26.3	25.6	53.0	65.1	64.7
Very familiar	72.2	81.6	20.1	40.9	8.2	16.6	44.6	68.7	37.9	68.0
School district curriculum guide										
Not familiar	37.6	72.9	6.4	0.5	9.0	13.9	16.2	36.4	52.4	65.8
Fairly familiar	66.6	60.2	10.0	24.7	11.4	22.5	43.0	44.8	67.6	72.4
Very familiar	77.0	80.8	17.0	26.7	14.2	19.6	36.7	57.4	51.0	65.0
School curriculum guides										
Not familiar	74.3	38.9	7.1	5.6	19.8	8.6	42.0	44.2	57.0	86.6
Fairly familiar	51.0	61.9	7.3	16.2	5.2	14.8	27.1	31.7	70.1	69.4
Very familiar	74.4	85.2	15.3	27.6	12.2	23.6	37.9	58.5	56.3	70.0

NOTE: Not all apparent differences in this table are statistically significant because many estimates have large standard errors. Standard errors are available at http://nces.ed.gov/pubsearch/pubsinfo.asp?pubid=2003022. Teachers who reported "no such document" are not included. There may be overlap among those reporting "no such document" and those reporting "not familiar." In some cases, teachers unfamiliar with standards documents may have incorrectly reported "no such document"; in other cases, teachers may have reported "not familiar" when, in fact, a document existed. The data did not allow checking of these responses for accuracy.

SOURCE: International Association for the Evaluation of Educational Achievement (IEA), Third International Mathematics and Science Study (TIMSS), 1995 and 1999.

(86 percent, 68 percent, and 62 percent, respectively). However, there were no significant differences in 1999 in the percentages of students who were asked to practice computational skills in most lessons or every lesson by teacher familiarity with state education department assessment specifications.

Did Relationships Between Teacher Awareness and Classroom Practices Change Over Time?

There were stronger relationships between teacher awareness of standards and assessments and classroom practices in 1999 than in 1995 on several measures. These stronger relationships were especially apparent for students with teachers who were familiar with state education department documents, such as curriculum guides and assessment specifications. Students with teachers who were very familiar with state education department curriculum guides were more likely to have teachers who reported asking their students to work on problems for which there is no obvious method of solution in most lessons or every lesson in 1999 than in 1995 (22 percent and 9 percent, respectively). Students with teachers who reported being very or fairly familiar with these guides were more likely to be frequently asked to write equations to represent relationships in 1999 compared with 1995 (58 percent compared with 33 percent and 49 percent compared with 30 percent, respectively).

Similarly, students with teachers who were very familiar with the state education department assessment specifications were more likely to be frequently asked to represent and analyze relationships using tables, charts, or graphs, to write equations to represent relationships, and to practice computational skills in 1999 than in 1995 (41 percent compared with 20 percent, 69 percent compared with 45 percent, and 68 percent compared with 38 percent, respectively). Students whose teachers were fairly familiar with this type of document were more likely to be frequently asked to work on problems for which there is no obvious method of solution and to write equations to represent relationships in 1999 than in 1995 (26 percent compared to 6 percent and 53 percent compared to 26 percent, respectively).

At the school level, students with teachers who were very familiar with school curriculum guides were more likely to be frequently asked to represent and analyze relationships using tables, charts, or graphs, to work on problems for which there is no obvious method of solution, and to write equations to represent relationships in 1999 than in 1995 (28 percent compared with 15 percent, 24 percent compared with 12 percent, and 59 percent compared with 38 percent, respectively). Students with teachers who reported being not familiar with the National Council of Teachers of Mathematics standards or school district curriculum guides were more likely to be frequently asked to do problem-solving activities, such as explain the reasoning behind an idea, in 1999 than in 1995 (68 percent compared with 42 percent and 73 percent compared with 38 percent, respectively).

Methodological Issues

Change in teachers' instructional practices may not equal change in students' achievement. In fact, researchers are divided on the relative benefits of problem-solving and computation emphases. A cautionary note is also needed on the measurement of classroom instruction. The analysis of instructional practices relied on teachers' reports of the activities in which they engaged their students. Self-reports of instruction may lack a universally understood vocabulary with which to describe practice (Loveless 2001; see, especially, the chapter by Shouse). Measures of frequency, absent indicators of content, quality, and rigor, can provide only limited information to suggest whether teaching is moving in a particular direction.

Conclusion

This analysis shows that teacher awareness of state curriculum guides and state assessments increased between 1995 and 1999. At the end of the last decade, teachers who were very familiar with these policy instruments were more likely than their peers to employ instructional practices that are consistent with the current state curriculum guides and state assessments. In addition, this Issue Brief provides modest support for the existence of a relationship between familiarity with policy instruments and teacher practices (see also Cohen and Hill 2000). In particular, students with teachers who were more familiar with state education department curriculum guides and assessment specifications were more likely to be frequently given various instructional tasks reflecting the problem-solving and computation emphases of the current policies in 1999 than in 1995.

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Characteristics of Undergraduate Borrowers: 1999–2000

Melissa E. Clinedinst, Alisa F. Cunningham, and Jamie P. Merisotis

This article was originally published as the Executive Summary of the Statistical Analysis Report of the same name. The sample survey data are from the National Postsecondary Student Aid Study (NPSAS).

This report describes student borrowing by comparing different groups of undergraduate borrowers. Two sets of borrower groups are examined: 1) high, medium, low, and nonborrowers, as defined by borrowing from all sources in 1999–2000 (excluding federal Parent Loans for Undergraduate Students [PLUS] and loans from family or friends);[1] and 2) Stafford loan maximum borrowers (total, subsidized, and unsubsidized),[2] less-than-maximum borrowers, and Stafford nonborrowers.[3] The analysis of borrower groups explores demographic and enrollment characteristics, risk for not persisting to completion of an educational program, and types of loans and other financial

[1]Borrowers are separated into low, medium, and high categories based on the distribution of total amounts borrowed in 1999–2000 (independent of class level), approximating quartiles. As a result, low borrowers are defined as those undergraduate students who borrowed $2,625 or less (28 percent), medium borrowers are defined as those undergraduates who borrowed more than $2,625 but less than $6,625 (51 percent), and high borrowers are defined as those undergraduates who borrowed $6,625 or more (21 percent). The cut-points that define these groups correspond with federal Stafford and Perkins loan limits but were not chosen for this reason.

[2]For the purposes of this report, Stafford loans include those provided through the Federal Family Education Loan Program (FFELP) and the Federal Direct Loan Program. The Stafford total loan amount includes dollars borrowed under the subsidized program, the unsubsidized program, or both. A subsidized loan is awarded on the basis of financial need. If a student qualifies for a subsidized loan, the federal government pays the interest on the loan until the student begins repayment, and during authorized periods of deferment thereafter. An unsubsidized loan is not awarded on the basis of need. Students who qualify for an unsubsidized loan are charged interest from the time the loan is disbursed until it is paid in full.

[3]Stafford maximum borrowers are those who borrow 100 percent of the federal loan limit under the program in question. This classification is based on the maximum allowed amounts under the subsidized and unsubsidized programs for a given student's class level.

aid received. The final analysis in the report considers all borrowers as a group and explores the likelihood of borrowers with certain characteristics obtaining particular types of financial aid. Twenty-nine percent of undergraduates borrowed from some source to help finance postsecondary education in 1999–2000.

Data from the National Center for Education Statistics (NCES) 1999–2000 National Postsecondary Student Aid Study (NPSAS:2000) were used for this report. These data provide a nationally representative sample of undergraduates enrolled at postsecondary institutions that participated in the federal student aid programs authorized by Title IV of the Higher Education Act.[4] NPSAS:2000 includes information on student demographic and enrollment characteristics, the type (level and control) of the enrolling institution, and dollar amounts borrowed from various sources in 1999–2000.

Profile of Borrower Groups

The profile of borrower groups examines the demographic and enrollment characteristics of high borrowers as a group and in comparison to medium, low, and nonborrowers. It also examines each group of Stafford maximum borrowers (total, subsidized, and unsubsidized) individually and in comparison to their Stafford less-than-maximum and Stafford nonborrower counterparts. Key findings include the following:

High borrowers

- High borrowers tended to be older (29 percent were ages 24–29 and 26 percent were 30 or older), independent students (64 percent). They also were likely to attend exclusively full time (72 percent) and to attend 4-year institutions (34 percent attended private not-for-profit and 38 percent attended public 4-year institutions).
- High, medium, and low borrowers were less likely than nonborrowers to be high income and to work full time.

Stafford maximum borrowers

- Stafford total maximum borrowers and subsidized maximum borrowers tended to be young, single, financially dependent students. In addition, they were more likely to have each of these characteristics than Stafford nonborrowers. Each group of maximum borrowers tended to be enrolled exclusively full time.
- Stafford maximum borrowers tended to work 1–20 hours (total and subsidized) or 1–20 hours and 35 hours or more (unsubsidized). All maximum borrowers were less likely than nonborrowers to work full time.

Persistence/Attainment Risk

A common method of characterizing undergraduate students is to separate students into "traditional" and "nontraditional" categories. In a 1996 NCES study, a broad definition of nontraditional was used that included seven characteristics: delaying enrollment; attending part time; being financially independent; having dependents other than a spouse; working full time while enrolled; having no high school diploma; and being a single parent. Nontraditional status was defined on a continuum based on the number of these characteristics. The nontraditional status index ranges from minimally nontraditional (one characteristic) to moderately nontraditional (two or three characteristics) to highly nontraditional (four or more characteristics) (Horn 1996). The same characteristics that define a nontraditional student have also been termed risk characteristics because they have been shown to be negatively associated with persistence and attainment (Horn 1996; Horn and Premo 1995).

This report uses the index to examine the percentage of each type of borrower group with different numbers of risk characteristics and applies the same continuum used to define nontraditional to characterize the degree of risk from minimal to high. Because research has shown that students who do not attain degrees are more likely to default, the analysis focuses on those with high risk. Key findings include the following:

High borrowers

- With the exception of students at private not-for-profit 4-year institutions, high borrowers most often had moderate risk of not persisting (public 4-year institutions, 39 percent; and private for-profit institutions, 52 percent) or moderate and high risk (public 2-year institutions, 46 and 33 percent, respectively)(table A). High borrowers at private not-for-profit 4-year institutions were more likely to have zero risk characteristics (42 percent).

[4]Beginning with NPSAS:2000, institutions must have signed a Title IV participation agreement with the U.S. Department of Education, making them eligible for the federal student aid programs, to be included in the institutional sample.

Table A. Percentage distribution of undergraduates by sector of institution attended and borrower status, according to number of persistence/attainment risk characteristics: 1999–2000

	Private not-for-profit 4-year				Public 4-year			
	Non-borrower	Low borrower	Medium borrower	High borrower	Non-borrower	Low borrower	Medium borrower	High borrower
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Zero risk characteristics	35.8	59.0	63.1	42.4	36.4	54.1	46.1	23.6
Minimal risk (1)	14.2	18.6	18.4	16.6	19.6	22.2	24.5	19.6
Moderate risk (2–3)	25.9	13.0	10.9	25.6	27.5	15.6	20.8	39.2
High risk (4+)	24.2	9.4	7.6	15.3	16.6	8.1	8.6	17.7
	Public 2-year				Private for-profit			
	Non-borrower	Low borrower	Medium borrower	High borrower	Non-borrower	Low borrower	Medium borrower	High borrower
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Zero risk characteristics	8.9	17.8	12.4	7.7	6.9	17.6	10.6	6.4
Minimal risk (1)	14.3	19.1	11.4	13.0	15.1	22.2	12.6	14.1
Moderate risk (2–3)	40.1	31.9	43.5	46.3	40.0	27.9	35.9	51.9
High risk (4+)	36.7	31.2	32.7	33.0	38.0	32.3	40.9	27.6

NOTE: The risk index includes seven characteristics known to be negatively associated with persistence and attainment (Horn 1996; Horn and Premo 1995). The characteristics are: delaying enrollment; attending part time; being financially independent; having dependents other than a spouse; working full time while enrolled; having no high school diploma; and being a single parent. Borrowers are those undergraduates who received loans from federal, state, institutional, or private sources, excluding federal Parent Loans for Undergraduate Students (PLUS). Low borrowers had total annual loan amounts of $2,625 or less in 1999–2000; medium borrowers had more than $2,625 but less than $6,625; and high borrowers had $6,625 or more. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1999–2000 National Postsecondary Student Aid Study (NPSAS: 2000), Data Analysis System. (Originally published as table 2 on p.16 of the complete report from which this article is excerpted.)

- The proportion of high borrowers with a high risk of not persisting varied by institution type. At both private not-for-profit 4-year institutions and public 4-year institutions, high borrowers were more likely to have high risk than medium and low borrowers (table A). At private for-profit institutions, however, a lower percentage of high borrowers (28 percent) had high risk than medium borrowers (41 percent).

Stafford maximum borrowers

- The highest proportion of Stafford maximum borrowers (total, subsidized, and unsubsidized) at private not-for-profit 4-year institutions and public 4-year institutions had zero risk characteristics (were traditional students). At public 2-year institutions, they primarily had moderate risk (unsubsidized) or moderate and high risk (subsidized). Those at private for-profit institutions primarily had moderate risk.
- At all four institution types, Stafford total maximum and unsubsidized maximum borrowers were less likely to have high risk of not persisting than their less-than-maximum borrower and nonborrower counterparts.

Types and Sources of Financial Aid

Many borrowers also received other types of financial aid (loans, grants, and work-study). Thus, this report also looks at the other types of aid that were received by each borrower group as well as average amounts received. It explores the various ways in which borrowers finance college attendance in addition to borrowing. Key findings include the following:

High borrowers

- High borrowers received an average of $9,680 in loan aid (table B). Ninety-eight percent of high borrowers received Stafford loans, and about one-quarter received private loans (27 percent).
- Compared to medium and low borrowers, high borrowers were most likely to have received both Stafford subsidized loans and Stafford unsubsidized loans as well as private loans (table B).
- Seventy-one percent of high borrowers received some form of grant aid in 1999–2000, averaging $4,667 (table B). High, medium, and low borrowers were more likely to have received some form of grant aid

Table B. Percentage of undergraduates who received financial aid from various sources and average amount received, by borrower status: 1999–2000

	Nonborrower		Low borrower		Medium borrower		High borrower		All undergraduates	
	Percent received	Average amount received	Percent received	Average amount received	Percent received	Average amount received	Percent received	Average amount received	Percent received	Average amount received
Loans (excluding PLUS)	†	†	100.0	$2,043	100.0	$4,581	100.0	$9,680	29.0	$5,229
Federal (excluding PLUS)	†	†	94.0	2,078	98.0	4,421	98.2	7,685	27.9	4,643
Stafford (either)	†	†	91.0	2,092	97.4	4,232	98.2	7,352	27.6	4,492
Stafford subsidized	†	†	71.5	1,914	81.1	3,412	88.9	4,016	23.2	3,214
Stafford unsubsidized	†	†	30.1	1,778	47.0	2,888	83.4	4,374	14.9	3,328
Perkins	†	†	4.4	1,129	12.9	1,598	15.7	2,010	3.2	1,695
Nonfederal	†	†	8.6	1,243	10.7	2,499	31.8	7,089	4.6	4,766
State	†	†	1.0	1,127	0.9	2,765	3.4	5,260	0.5	3,852
Institution	†	†	1.4	871	2.0	1,860	3.1	3,848	0.6	2,424
Private sources	†	†	6.3	1,328	8.0	2,594	26.9	7,313	3.6	5,100
Grants	34.4	$2,673	67.5	3,488	69.2	4,919	70.6	4,667	44.4	3,476
Federal[1]	14.8	1,879	43.6	1,999	42.1	2,247	46.5	2,391	23.1	2,063
Pell	14.5	1,790	42.7	1,872	41.2	2,019	45.6	2,139	22.6	1,910
FSEOG	2.9	500	11.6	600	13.1	828	16.2	823	5.9	678
Nonfederal	31.2	2,266	46.9	3,237	52.7	4,808	50.1	4,516	36.7	3,086
State	9.3	1,340	24.4	1,702	25.3	2,096	22.4	2,172	13.6	1,681
Institution	11.5	2,833	23.7	3,551	32.9	4,995	29.7	4,614	16.7	3,722
Private sources	6.3	2,138	12.8	1,749	14.0	1,950	12.9	2,253	8.3	2,062
Work-study	2.1	1,692	10.9	1,505	16.2	1,639	12.6	1,764	5.4	1,653

†Not applicable.

[1]Federal grant aid primarily includes Pell Grants and Federal Supplemental Educational Opportunity Grants (FSEOG), but also includes Robert Byrd Scholarships and any other federal grants, fellowships, or traineeships received during 1999–2000.

NOTE: Borrowers are those undergraduates who received loans from federal, state, institutional, or private sources, excluding Parent Loans for Undergraduate Students (PLUS). Low borrowers had total annual loan amounts of $2,625 or less in 1999–2000; medium borrowers had more than $2,625 but less than $6,625; and high borrowers had $6,625 or more.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1999–2000 National Postsecondary Student Aid Study (NPSAS: 2000), Data Analysis System. (Originally published as table 3 on p.18 of the complete report from which this article is excerpted.)

and to have received higher average amounts compared to nonborrowers.

Stafford maximum borrowers

- In 1999–2000, 80 percent of Stafford total maximum borrowers received subsidized loans, and 59 percent received unsubsidized loans. Stafford maximum borrowers also received private loans (total maximum borrowers, 13 percent; subsidized maximum borrowers, 11 percent; and unsubsidized maximum borrowers, 11 percent).
- Each group of maximum borrowers was more likely to have received private loans and to have received higher average amounts than less-than-maximum borrowers and nonborrowers.
- Most maximum borrowers received some form of grant aid (total maximum borrowers, 67 percent; subsidized maximum borrowers, 80 percent; and unsubsidized maximum borrowers, 54 percent).

Who Receives Financial Aid

All borrowers as a group were examined to determine whether borrowers with certain demographic and enrollment characteristics were more likely to have received specific types of loans and other aid or differing average amounts in 1999–2000. The main differences are related to federal Stafford loans (subsidized and unsubsidized) and private loans. Three multivariate analyses were conducted to examine the independent association of certain characteristics with receipt of each of these types of loans by adjusting for covariation among the characteristics examined. Key findings include the following:

Stafford loans

- Borrowers who were financially independent (vs. dependent), who attended private for-profit institutions (vs. private not-for-profit 4-year institutions), and who attended exclusively full time (vs. less than half time) were more likely to have received both federal Stafford subsidized loans and Stafford unsubsidized loans.

Private loans

- Borrowers who attended less than half time (vs. exclusively full time), who attended a private not-for-profit 4-year institution (vs. a public 4-year institution or a private for-profit institution), and who were high or middle income (vs. low income) received private loans at a higher rate.

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Doto source: The NCES 1999–2000 National Postsecondary Student Aid Study (NPSAS:2000).

For technicol informotion, see the complete report:

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Descriptive Summary of 1995–96 Beginning Postsecondary Students: Six Years Later

Lutz Berkner, Shirley He, and Emily Forrest Cataldi

This article was originally published as the Executive Summary of the Statistical Analysis Report of the same name. The sample survey data are from the Beginning Postsecondary Students Longitudinal Study (BPS).

Introduction

This report describes the enrollment, persistence, and degree attainment of students who began postsecondary education for the first time in the 1995–96 academic year. It covers the experiences of these first-time beginners over a period of 6 academic years, from 1995–96 to 2000–01, and provides information about the rates at which students attained degrees, transferred to other institutions, and left postsecondary education without attaining degrees.

The report is based on the 1996/01 Beginning Postsecondary Students Longitudinal Study (BPS:96/01), a National Center for Education Statistics (NCES) survey that provides data describing a nationally representative sample of first-time students who entered postsecondary education during the 1995–96 academic year. The students were initially interviewed in 1996, at the end of their first year in postsecondary education; interviewed again in 1998, 3 years after they had started; and interviewed for the last time in 2001, 6 years after they had started.

Types of Institutions Attended

When they first entered postsecondary education in 1995–96, the largest proportion of beginning students (46 percent) enrolled at public 2-year institutions (community colleges). About one-fourth (26 percent) started at public 4-year institutions, 15 percent at private not-for-profit 4-year institutions, 10 percent at private for-profit institutions offering vocational programs of less than 4 years, and 3 percent at all other types of institutions.

However, over the 6 years covered in this report, 40 percent of students who began in 1995–96 were also enrolled in at least one postsecondary institution other than the institution at which they started. About one-third (32 percent) of the beginners transferred from their first institution to a different one, and 11 percent were sometimes coenrolled, taking courses at more than one institution at the same time. About one-fourth of the students who began at 4-year institutions and 42 percent of those who began at public 2-year institutions transferred during the 6 years.

Degree Completion Among Students Beginning at Public 2-Year Institutions

Public 2-year institutions serve a diverse body of students who enroll with a variety of educational goals. Associate's degree completion rates are only partially valid as a measure of student success at public 2-year institutions, because it is not necessary to complete an associate's degree before transferring to a 4-year institution. During their first year, about one-half of the beginning students at public 2-year colleges said that they intended to attain an associate's degree, and another one-fourth intended to transfer to a 4-year institution and complete a bachelor's degree. In the following years, about one-fourth of the beginners at public 2-year institutions did transfer to a 4-year institution.

Of the three-fourths of beginners at public 2-year institutions who intended to complete either an associate's or a bachelor's degree, 31 percent did so within 6 years: 23 percent completed an associate's degree, and 13 percent completed a bachelor's degree (these percentages include the 5 percent who completed both). Among those students who actually did transfer to a 4-year institution, 36 percent attained a bachelor's degree within 6 years of starting community college.

Types of Bachelor's Degree Completion Rates for Students Beginning at 4-Year Institutions

Rates of completion at the first institution attended versus at any 4-year institution

When 4-year colleges and universities report their graduation rates, they are reporting the percentage of first-time freshmen who completed a bachelor's degree at that institution within a certain time period. Institutions usually do not know what happened to the students who left without a degree. When students leave an institution, they may either leave postsecondary education permanently or transfer somewhere else. From the institutional perspective, all students who leave before completing a degree at that institution are considered to be dropouts. From the perspectives of students as well as of the postsecondary education system as a whole, transfers are not dropouts: they are persisting students who have decided to attend a different

institution. In this report, the term *institutional completion rate* is used to describe bachelor's degree attainment of students at the first institution they attended, and the term *student completion rate* is used to describe bachelor's degree attainment anywhere, regardless of whether or not students stayed at the original institution.

Among all beginners at 4-year institutions in 1995–96, 51 percent completed a bachelor's degree within 6 years at the first institution attended (table A). However, when those who transferred out of the first institution are also included, the percentage of beginners who actually completed a bachelor's degree within 6 years (at any 4-year institution) increases to 58 percent.

Rates based on different subcategories of students

Bachelor's degree completion rates differ not only by whether they reflect the institutional or student perspective, but also by which subcategories of beginning students are included when calculating the rates (table A). For example, if the calculation includes only those beginners with a bachelor's degree goal (90 percent of all beginners at 4-year institutions), then the rate of completion at the first 4-year institution attended was 55 percent. Including only first-time beginners who were enrolled full time when they started and also had a bachelor's degree goal (83 percent of all beginners), the bachelor's degree completion rate at the first 4-year institution was 58 percent.

Sometimes interest centers on recent high school graduates (those who started college immediately after high school, who made up 83 percent of the beginners at 4-year institutions). Among all the beginners at 4-year institutions who were recent high school graduates, the rate of bachelor's degree completion at the first institution was 55 percent, while it was 64 percent at any 4-year institution. But including only those first-time beginners who were recent high school graduates, had a bachelor's degree goal, and also started as full-time students (73 percent of all beginners at 4-year institutions), the 6-year completion rate at the first institution attended was 61 percent, and it was 69 percent at any 4-year institution.

Focus on Students With a Bachelor's Degree Goal at 4-Year Institutions

This section describes only the beginners at 4-year institutions who had a bachelor's degree goal (90 percent of the total), including those who started as part-time students and those who did not start college immediately after finishing high school.

Degree completion and transfer from the first institution attended

Among students beginning at 4-year institutions with a bachelor's degree goal, the cumulative percentage who had left their first institution and transferred to a different one was 10 percent by the end of the first year, 18 percent by the

Table A. Percentage of students beginning at 4-year institutions in 1995–96 who had completed a bachelor's degree at the first institution attended or at any 4-year institution by June 2001, by subcategories of beginning students

		Bachelor's degree completion rate after 6 years	
	Percent of total	Institutional completion rate at first 4-year institution	Student completion rate at any 4-year institution
Total beginners at 4-year institutions	100.0	50.7	58.2
Subcategories of beginners			
Enrolled full time first year	90.4	54.1	62.0
Had a bachelor's degree goal	90.3	55.3	62.7
Had a bachelor's degree goal and enrolled full time first year	82.9	58.0	65.6
Recent high school graduates (did not delay entry)	83.2	55.1	63.7
Recent high school graduates with a bachelor's degree goal	76.5	59.2	67.4
Recent high school graduates with a bachelor's degree goal and enrolled full time first year	73.0	60.6	68.8

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1996/01 Beginning Postsecondary Students Longitudinal Study (BPS:96/01).

end of the second year (including the 10 percent who had already left by the end of the first year), 22 percent by the end of the third year, and then about 23 percent through the end of the sixth year (since there were few additional transfers in the fifth and sixth years) (figure A).

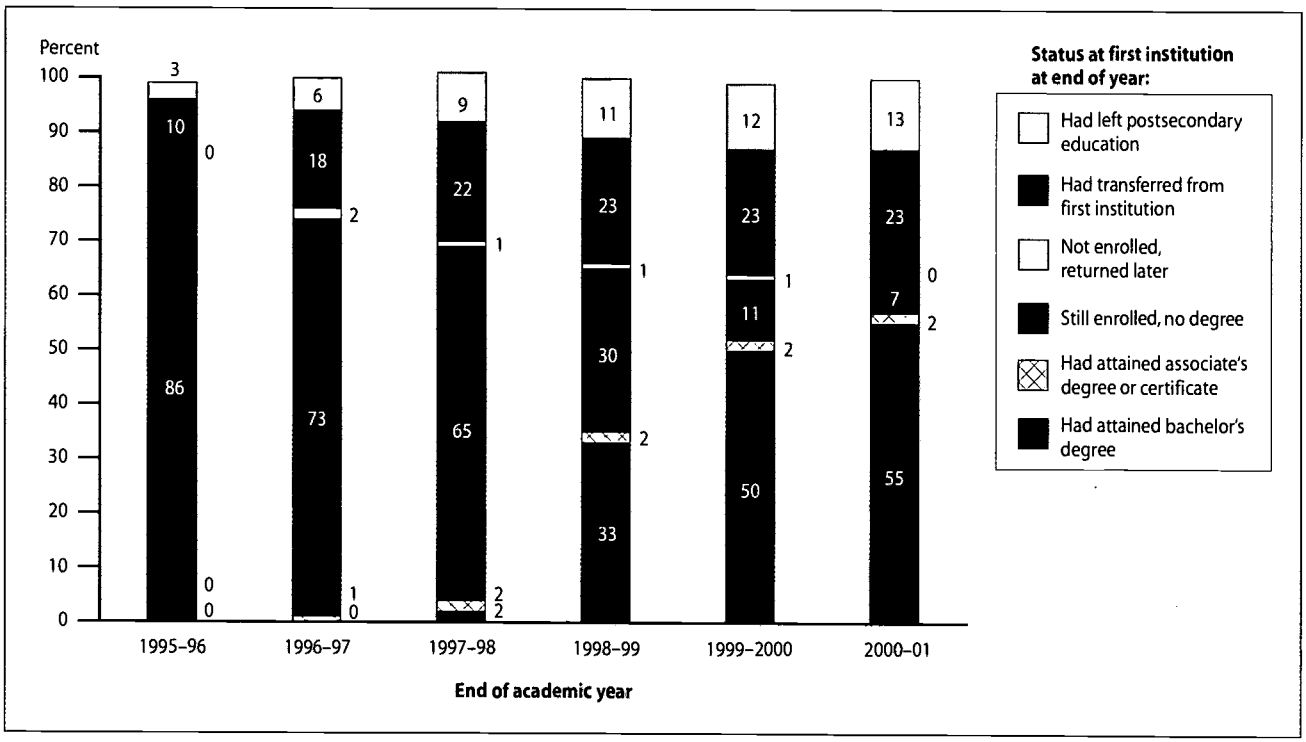
The cumulative percentage of beginning students who were not enrolled at the first institution at the end of the academic year and never enrolled anywhere else by June 2001 was 3 percent at the end of the first year, 6 percent at the end of the second year (including the 3 percent who were not enrolled at the end of the first year), 9 percent at the end of the third year, and so on. By June 2001, at the end of the sixth academic year, 13 percent had left postsecondary education directly from the first institution without a degree, a smaller percentage than the 23 percent who had transferred elsewhere.

Some students who transferred from their first institution later left postsecondary education without a degree, while others were still enrolled in June 2001 or had already attained a degree at another institution. In figure B, the numbers in the arrows indicate the percentages of students who transferred and then had various outcomes at any postsecondary institution. For example, 6 percent of students who began at a 4-year institution with a bachelor's degree goal transferred from their first institution and then left postsecondary education without a degree after attending the transfer institution. Seven percent, however, transferred and then completed a bachelor's degree at a different 4-year institution.

Number of years to complete a degree at different types of institutions

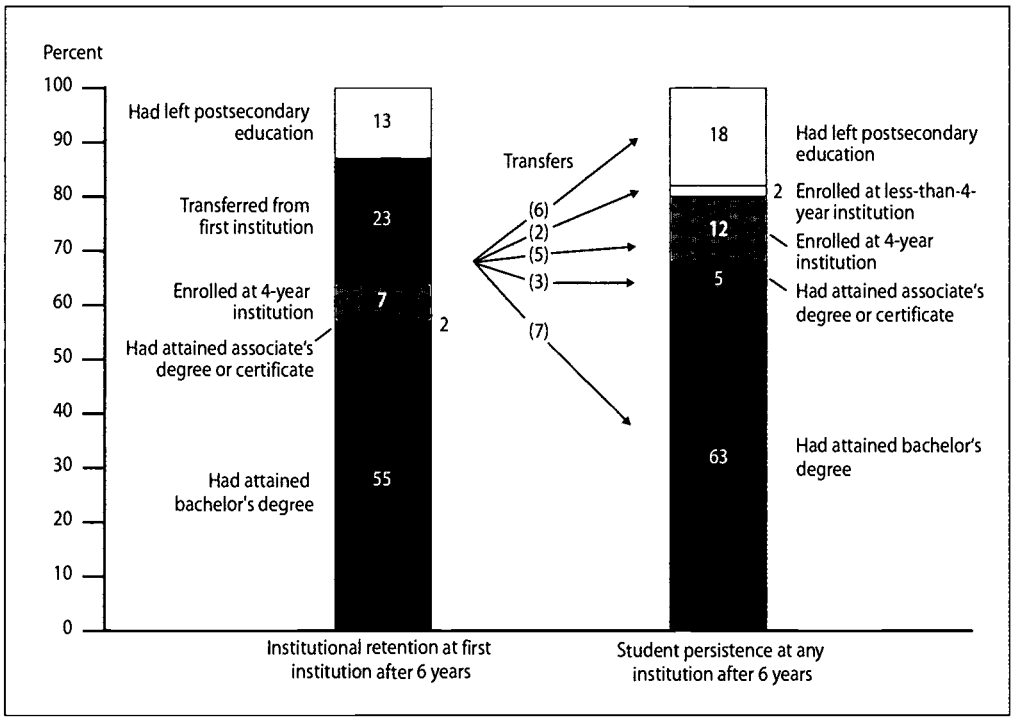
Thirty-four percent of beginners with a bachelor's degree goal completed that degree at their first institution within

Figure A. Percentage distribution of students with a bachelor's degree goal who were first-time beginners at a 4-year institution in 1995–96, by their enrollment status or degree attainment at the first institution attended, at the end of each academic year through 2000–01



NOTE: Detail may not sum to totals because of rounding. Students who transferred after attaining a degree are only included in the attainment categories.
SOURCE: U.S. Department of Education, National Center for Education Statistics, 1996/01 Beginning Postsecondary Students Longitudinal Study (BPS:96/01).

Figure B. Percentage distribution of students with a bachelor's degree goal who were first-time beginners at a 4-year institution in 1995–96, by their enrollment status or degree attainment at the first institution attended and anywhere in postsecondary education, as of June 2001



NOTE: Detail may not sum to totals because of rounding. Students who transferred after attaining a degree are only included in the attainment categories.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1996/01 Beginning Postsecondary Students Longitudinal Study (BPS:96/01).

4 years, and another 21 percent finished in 5 to 6 years, for a total of 55 percent completing a bachelor's degree at the first institution within 6 years of starting there (table B). Those who began at a private not-for-profit institution were more likely to complete their bachelor's degree at that institution than those who began at a public institution (65 percent vs. 50 percent) and were more likely to have finished in 4 years (52 percent vs. 24 percent).

Differences in completion rates by enrollment patterns and student characteristics

Among beginners with a bachelor's degree goal, student rates of completion at any 4-year institution varied by enrollment patterns (table B). Students who did not transfer, were always enrolled full time, or were continuously enrolled without a break had higher 6-year completion rates (72–74 percent) than other students, and about 45 percent graduated within 4 years.

Students who entered college with good academic preparation—those who received mostly A's in high school, took two or more Advanced Placement (AP) tests, or had high SAT scores—also had higher completion rates than others. About 80 percent completed a bachelor's degree within 6 years, and more than one-half (55–61 percent) graduated within 4 years.

Among beginners with a bachelor's degree goal, women had higher completion rates than men and were more likely to finish in 4 years. Hispanic and Black, non-Hispanic students had lower completion rates than Asian/Pacific Islander and White, non-Hispanic students. Low-income dependent students had lower completion rates than high-income dependent students.

Profile of 1995–96 Beginners Who Completed a Bachelor's Degree by June 2001

A number of factors have been shown to put students at risk of not completing their degree programs. Two of the most important ones are part-time enrollment and delaying entry into postsecondary education after high school. Other factors are not having a regular high school diploma, having

Table B. Percentage of students beginning at 4-year institutions in 1995–96 with a bachelor's degree goal who completed a bachelor's degree at the first institution attended or at any 4-year institution by June 2001, and the number of years to complete the degree, by type of first institution, enrollment patterns, academic preparation, and student characteristics

	Bachelor's degree completion rate					
	At first 4-year institution			At any 4-year institution		
	4 years or less	More than 4 years*	6-year total	4 years or less	More than 4 years*	6-year total
Total beginners with a bachelor's degree goal	34.2	21.1	55.3	36.5	26.1	62.7
First institution type and highest offering						
Public 4-year	24.3	25.7	50.0	26.3	31.0	57.3
Non-doctorate-granting	18.6	21.7	40.3	20.9	28.0	48.9
Doctorate-granting	27.4	27.8	55.2	29.2	32.6	61.8
Private not-for-profit 4-year	51.5	13.8	65.3	54.6	18.4	73.0
Non-doctorate-granting	48.2	13.8	62.0	50.8	18.8	69.6
Doctorate-granting	57.6	13.8	71.4	61.5	17.8	79.3
Enrollment patterns						
Never transferred	44.7	27.7	72.4	44.7	27.7	72.4
Always full time	42.2	22.8	65.0	45.0	27.8	72.8
Continuously enrolled	41.7	24.4	66.1	44.2	29.4	73.6
Good academic preparation						
Mostly A's in high school	52.3	21.5	73.8	55.3	26.8	82.0
Took two or more Advanced Placement tests	57.3	17.5	74.8	60.9	21.4	82.3
SAT combined score in high quartile (1030–1600)	53.0	19.0	72.0	56.5	23.1	79.6
Gender						
Male	29.5	22.5	52.0	31.0	27.7	58.7
Female	38.1	20.0	58.0	41.1	24.9	66.0
Race/ethnicity						
White, non-Hispanic	37.8	21.2	59.0	40.5	26.3	66.8
Black, non-Hispanic	19.8	21.1	40.9	20.8	24.9	45.7
Hispanic	22.7	18.6	41.3	24.7	22.6	47.3
Asian/Pacific Islander	40.0	23.8	63.8	41.5	28.9	70.5
Dependent family income in 1994						
Less than $25,000	23.5	23.3	46.8	25.6	28.1	53.7
$25,000–44,999	32.1	20.2	52.3	33.8	25.4	59.1
$45,000–69,999	36.8	23.0	59.7	38.8	28.8	67.6
$70,000 or more	45.9	21.5	67.5	49.7	27.0	76.6
Delayed postsecondary enrollment						
Did not delay	36.3	22.9	59.2	38.9	28.4	67.4
Delayed	22.9	11.3	34.2	23.5	13.4	36.8

*Up to 6 years.

NOTE: These completion rates are based on the number of months between the date of first enrollment and bachelor's degree completion. The 4-year rate includes those who completed in 48 months or less after they first enrolled. These rates may differ slightly from bachelor's degree attainment percentages based on status at the end of an academic year, such as those in figure A. Detail may not sum to totals because of rounding.

SOURCE: U.S. Department of Education, National Center for Education Statistics, 1996/01 Beginning Postsecondary Students Longitudinal Study (BPS:96/01).

children, being a single parent, being financially independent of parents, and working full time while enrolled. In prior studies, a persistence risk index was developed based on the number of these adverse characteristics (Horn 1996). All of these risk factors are also associated with "nontraditional" students, and the more risk factors a student has, the more nontraditional the student may be considered to be. Conversely, students with none of the risk factors may be considered to be highly traditional students: they enroll immediately after receiving a high school diploma, attend full time in the first year, are financially dependent on their parents, and work part time or not at all while enrolled.

Beginners who started at 4-year institutions in 1995–96 were predominantly traditional students: most of them had entered college without delay after high school, and most had none of the characteristics associated with a high risk of not completing a degree. This pattern is reflected in the profile of those college graduates who started at a 4-year institution in 1995–96 and had completed a bachelor's degree by June 2001: 91 percent had entered college immediately after high school, and 86 percent had no persistence risk factors when they first enrolled in 1995–96.

Students who graduated with a bachelor's degree within 4 years were well prepared when they entered college. More than one-half had received mostly A's in high school (62 percent) or had SAT test scores in the highest quartile among college freshmen (56 percent), and 30 percent had taken two or more AP tests. Women represented a majority (62 percent) of the college graduates who started at a 4-year institution in 1995–96 and completed a bachelor's degree in the expected 4-year period.

Students who began at public 2-year institutions were more likely to be nontraditional students than those who began at 4-year institutions. Almost one-half of the beginners at public 2-year institutions had delayed starting college after high school, and about one-half had two or more persistence risk factors when they started. Traditional students (those with no risk factors when they began) represented about one-half (56 percent) of the bachelor's degree recipients who had transferred from public 2-year institutions. The other half were nontraditional students who began their education in 1995–96 with a higher risk of not completing a degree at all, but had been able to enter a bachelor's degree program via a community college.

Summary and Conclusion

Differences in the bachelor's degree completion rates of students who began at community colleges and those who began at 4-year colleges and universities reflect differences in the degree goals, academic preparation, enrollment patterns, and demographic characteristics of these students. Compared with students who started at 4-year institutions, those who started at public 2-year institutions were less well prepared for college and were less likely to be continuously enrolled. Beginners at public 2-year institutions were also more likely to enroll part time, to have delayed enrolling after high school, and to be nontraditional students starting postsecondary education with one or more persistence risk factors.

Beginners at 4-year institutions were predominantly traditional students with no persistence risk factors when they started college, and they were usually enrolled full time. Among those with a bachelor's degree goal, 55 percent of the beginners at 4-year institutions completed a bachelor's degree at the institution where they had started. When transfer students who completed their degrees at a different institution are also included, a total of 63 percent of the students who began at a 4-year institution with a bachelor's degree goal completed that degree within 6 years.

Although the expected length of time required to complete a bachelor's degree is 4 years, 37 percent of the students with a bachelor's degree goal who started at a 4-year institution in 1995–96 actually finished their degree in that period of time. The characteristics of the students who were most likely to graduate within 4 years with a bachelor's degree fit a commonly held perception of what a college student looks like—he or she receives good academic preparation in high school, enters college immediately after high school, enrolls in college full time, and is continuously enrolled.

Reference

Horn, L. (1996). *Nontraditional Undergraduates: Trends in Enrollment From 1986 to 1992 and Persistence and Attainment Among 1989–90 Beginning Postsecondary Students* (NCES 97–578). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Data source: The NCES 1996/01 Beginning Postsecondary Students Longitudinal Study (BPS:96/01).

For technical information, see the complete report:

Berkner, L., He, S., and Cataldi, E.F. (2002). *Descriptive Summary of 1995–96 Beginning Postsecondary Students: Six Years Later* (NCES 2003–151).

Author affiliations: L. Berkner, S. He, and E.F. Cataldi, MPR Associates, Inc.

For questions about content, contact Aurora D'Amico (aurora.d'amico@ed.gov).

To obtain the complete report (NCES 2003–151), call the toll-free ED Pubs number (877–433–7827) or visit the NCES Electronic Catalog (http://nces.ed.gov/pubsearch).

Data Products, Other Publications, and Funding Opportunities

Data Products

CD-ROM: Beginning Postsecondary Students Longitudinal Study Second Follow-up Data Analysis System (DAS) BPS:96/01

Featured on this CD-ROM are data from the 1996/01 Beginning Postsecondary Students Longitudinal Study (BPS:96/01). BPS:96/01 includes data for students who started their postsecondary education during the 1995–96 academic year and were surveyed in 1996, 1998, and 2001. BPS data pertain to persistence, progress, and attainment from initial time of entry into postsecondary education through leaving and entering the workforce.

In addition to the BPS:96/01 data, this CD-ROM also contains all the other NCES data sets that have been made available for public use through the Data Analysis System (DAS) as of December 2002. These data sets do not allow users direct access to the data, but do allow them to design and run basic analyses specific to their needs. Visit the DAS home page (http://nces.ed.gov/das) for a list of available surveys as well as access to the latest DAS updates, several of which can be run directly from the web.

For questions about this CD-ROM, contact Aurora D'Amico (aurora.d'amico@ed.gov).

To obtain this CD-ROM (NCES 2003–159), call the toll-free ED Pubs number (877–433–7827).

Other Publications

Weaving a Secure Web Around Education: A Guide to Technology Standards and Security

Web Standards and Security Task Force, National Forum on Education Statistics

The purpose of this guidebook is to assist education agencies and organizations (which include state education agencies or state departments of education, school districts, and schools) in the development, maintenance, and standardization of effective web sites. Also included is a detailed examination of the procedures necessary to provide adequate security for the Internet *node* (or connection point) and the network that sends information from computer to computer in the education agency. This guidebook was produced by a task force of the National Forum on Education Statistics (an entity of the National Cooperative Education Statistics System) and funded by NCES.

Author offiliotions: The Web Standards and Security Task Force of the National Forum on Education Statistics included state and local education professionals, as well as consultants from education associations, NCES, and the Education Statistics Services Institute.

For questions obout content, contact Ghedam Bairu (ghedam.bairu@ed.gov).

To obtoin this publication (NCES 2003-381), call the toll-free ED Pubs number (877-433-7827), visit the NCES Electronic Catalog (http://nces.ed.gov/pubsearch), or contact GPO (202-512-1800).

Planning Guide for Maintaining School Facilities

Tom Szuba, Roger Young, and the School Facilities Maintenance Task Force, National Forum on Education Statistics

This guidebook is designed to help staff at the local school district level better understand why and how to develop, implement, and evaluate a facilities maintenance plan. It provides practical advice on a range of topics, such as conducting a facilities audit, planning for maintenance that will ensure smooth operations and avoid costly surprises, managing staff and contractors, and evaluating maintenance efforts.

The *Planning Guide for Maintaining School Facilities* was developed through the National Cooperative Education Statistics System and funded by NCES. It is the product of a collaborative effort between the National Forum on Education Statistics and the Association of School Business Officials International.

Author offiliotions: T. Szuba, consultant; and R. Young, Chair of the School Facilities Maintenance Task Force of the National Forum on Education Statistics. Task force members included state and local education professionals and facility management professionals.

For questions obout content, contact Lee M. Hoffman (lee.hoffman@ed.gov).

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Highlights From the TIMSS 1999 Video Study of Eighth-Grade Mathematics Teaching

James Hiebert, Ronald Gallimore, Helen Garnier, Karen Bogard Givvin, Hilary Hollingsworth, Jennifer Jacobs, Angel Miu-Ying Chui, Diana Wearne, Margaret Smith, Nicole Kersting, Alfred Manaster, Ellen Tseng, Wallace Etterbeek, Carl Manaster, Patrick Gonzales, and James Stigler

The Third International Mathematics and Science Study (TIMSS) 1999 Video Study examines classroom teaching practices through in-depth analysis of videotapes of eighth-grade mathematics lessons. The study provides rich descriptions of mathematics teaching as it is actually experienced by eighth-grade students in the United States and six other countries: Australia, the Czech Republic, Hong Kong SAR, Japan, the Netherlands, and Switzerland. Students in these six countries were generally among the top-performing students on the TIMSS 1995 mathematics assessment and, in particular, outperformed their U.S. counterparts.

This 12-page publication presents highlights of results, based on the full report *Teaching Mathematics in Seven Countries: Results From the TIMSS 1999 Video Study* (NCES 2003–013). This report focuses only on mathematics lessons; the report on science lessons will be released at a later date.

Author offiliotions: J. Hiebert and D. Wearne, University of Delaware; R. Gallimore and J. Stigler, UCLA and LessonLab; H. Garnier, K.B. Givvin, H. Hollingsworth, J. Jacobs, and A.M.-Y. Chui, LessonLab; M. Smith, Iona College; N. Kersting, UCLA; A. Manaster, University of California, San Diego; E. Tseng, Open University of Hong Kong; W. Etterbeek, California State University, Sacramento; C. Manaster, Christian Albrechts Universitaet, Kiel, Germany; and P. Gonzales, NCES.

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Funding Opportunities

The AERA Grants Program

Jointly funded by the National Science Foundation (NSF), NCES, and the Institute of Education Sciences, this training and research program is administered by the American Educational Research Association (AERA). The program has four major elements: a research grants program, a dissertation grants program, a fellows program, and a training institute. The program is intended to enhance the capability of the U.S. research community to use large-scale data sets, specifically those of the NSF and NCES, to conduct studies that are relevant to educational policy and practice, and to strengthen communications between the educational research community and government staff.

Applications for this program may be submitted at any time. The application review board meets three times per year. The following are examples of grants recently awarded under the program:

Research Grants

- Marigee Bacolod, University of California, Irvine—Equalizing Educational Opportunities: Who Teaches and Where They Choose to Teach
- Sharon Judge, University of Tennessee—Resilient and Vulnerable At-Risk Children: What Makes the Difference?
- Xiaofeng Liu, University of South Carolina—Professional Support, School Conditions, and First-Year Teacher Attrition
- Ann O'Connell, University of Connecticut—Factors Associated With Growth in Proficiency During Kindergarten and Through First Grade
- Therese Pigott, Loyola University Chicago—Correlates of Success in Kindergarten
- David Post, University of Pittsburgh—Academic Achievement by Working Eighth-Grade Students in Ten Nations
- Catherine Weinberger, University of California, Santa Barbara—High School Leadership Skills and Adult Labor Market Outcomes

Dissertation Grants

- Doo Hwan Kim, University of Chicago—My Friend's Parents and My Parent's Friends: Impact of Parental Resources on Student's Competitiveness for College
- Natalie Lacireno-Paquet, George Washington University—Charter School Responses to Policy Regimes and Markets: The Effect on Service to Disadvantaged Students
- Kate Mahoney, Arizona State University—Linguistic Influences in Differential Item Functioning for English Learners on the NAEP Mathematics, 1996
- William Mangino, Yale University—Adolescent Peer Networks as Social Capital: The Academic Implications of Openness
- Zena Mello, Pennsylvania State University—Across Time and Place: The Development of Adolescents' Educational and Occupational Expectations in the Context of Parental and Neighborhood Socioeconomic Status
- Colin Ong-Dean, University of California, San Diego—Parents' Role in the Diagnosis and Accommodation of Disabled Children in the Educational Context
- Marjorie Wallace, Michigan State University—Making Sense of the Links: From Government Policy to Student Achievement

For more information, contact Edith McArthur (edith.mcarthur@ed.gov) or visit the AERA Grants Program web site (http://www.aera.net/grantsprogram).

The NAEP Secondary Analysis Grant Program

The NAEP Secondary Analysis Grant Program was developed to encourage education researchers to conduct secondary analysis studies using data from the National Assessment of Educational Progress (NAEP) and the NAEP High School Transcript Studies. This program is open to all public or private organizations and consortia of organizations. The program is typically announced annually, in the late fall, in the *Federal Register*. Grants awarded under this program run from 12 to 18 months and awards range from $15,000 to $100,000. The following grants were awarded for fiscal year 2002:

- Henry Braun, Educational Testing Service—Using State NAEP Data to Examine Patterns in Eighth-Grade Mathematics Achievement and the Efficacy of State Education Policy Initiatives

- Hua-Hua Chang, University of Texas at Austin—Improving the DIF Detection Procedures for NAEP Data Analysis
- Kendrick Curry, United Negro College Fund Special Programs Corporation—The Trickle Down Effect: How Teacher Quality and Recruitment Practices Affect the Achievement of African American Students in a Three-State Metropolitan Area
- Matthias von Davier, Educational Testing Service—A Tool for Improved Precision Reporting in Secondary Analysis of National and State Level NAEP Data
- Laura Desimone, Vanderbilt University—Preparation, Professional Development, and Policy in Mathematics: Does It All Add Up?
- Claudia Gentile, Educational Testing Service—Reading Test Design, Validity, and Fairness: A Re-Analysis of Data From the 2000 Fourth-Grade Reading Assessment
- Susan Lubienski, Iowa State University—A Closer Look at Mathematics Achievement and Instructional Practices: Examinations of Race, SES, and Gender in a Decade of NAEP Data
- Laura O'Dwyer, Boston College—Estimating the Full NAEP Population Distribution: Imputing Scores for Excluded SD and LEP Students Using Hierarchical Linear Modeling Techniques
- Norman Webb, University of Wisconsin—Informing State Mathematics Reform Through State NAEP

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