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ABSTRACT

This study examined the conduct of academic tasks in six secondary classrooms, focusing specifically on assigments requiring some higher level cognitive operations, with attention to how management strategies and classroom conditions associated with these assignments affect their cognitive demands on students. Analysis of tasks in these six classes was designed to answer the questions: (1) How often were higher level tasks attempted and what was the nature of these tasks? (2) What management strategies and conditions were associated with conduct of higher order tasks? and (3) What impact did these management strategies and conditions have on student engagement in the tasks and on their use of intended or other cognitive operations. All classes were under the direction of experienced teachers, and three classes were designated honors sections. Each of the classes was observed for six or seven weeks, and teachers were interviewed at the beginning and end of the study in each class. Tables present descriptions of the tasks in each class, and notes on how the class was managed. A catalog of management strategies describes ways in which safety nets were provided for students to reduce the risk of failure. It was concluded that the teachers were not equally or consistently successful in engaging their students in higher level tasks. Other studies have suggested that many secondary teachers avoid or mismanage higher level tasks. (JD)

Comprehension-level Tasks in Secondary Classrooms

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This study examines the conduct of academic tasks in six secondary classrooms in three subject areas: science, English, and social studies. It focuses specifically on assignments that require some higher level cognitive operations, with attention to how management strategies and classroom conditions associated with these assignments affect their cognitive demands on students.

Perspective: Secondary School Work and Student Understanding

The development of higher level cognitive skills is recognized as a central goal of the secondary school curriculum (Boyer, 1983; The College Board, 1983). Secondary instruction is expected to provide students with opportunities to reason, to understand complex concepts, to go beyond basic skills and memory work. A number of studies of classrooms and schools, however, suggest that opportunities for practicing higher level operations in classrooms may be scarce. Boyer (1983), Stake and Easley (1978), Ward and Tikunoff (1982), and others have reported observing a narrow range of routine activities affording little opportunity for most students to master challenging work or important concepts.

Another current line of research, focusing mainly on science and mathematics instruction, suggests that in many classrooms students have little understanding of their work and the content (see Hackling & Treagust, 1984; Helm & Novak, 1983; Tasker, 1981). There is evidence that class work is often designed and managed in such a way that it masks students' lack of understanding of concepts, because students are not required to do comprehension-level tasks. For example, an

experiment by Coulter, Williams, and Schultz (1981) supports their contention that in process-oriented science classes, teachers' use of tests students can complete through recall and algorithms hides the fact that many students do not really understand the targeted cognitive processes. Davis (1983) reviews recent research on mathematics learning to present an excellent case that our current practices of teaching mathematics only as routine algorithms (i.e., using tasks that require students only to produce correct answers in routine ways) results in superficial or inaccurate understanding and prevents diagnosis of students' understanding. Stewart and Dale (1981) also demonstrate how students' success at routine genetics problems masks lack of understanding of critical concepts.

Research on Academic Tasks

Recently some research has begun to focus on academic work in different secondary school subjects, using the academic task framework proposed by Doyle (1983). This line of research is built on the assumption that students encounter content in the form of assignments for which they are held accountable. The nature of the work and how it is managed by teachers determines in large measure what students attend to and how they process information, thus what skills they practice, what kind of performance they are evaluated on, and in the final analysis, what they learn.

Studies in this vein to date have demonstrated that while much secondary school academic work is routine, familiar to students and thus easily conducted by teachers, managing comprehension-level tasks (i.e., work intended to require students to go beyond rote learning, to organize and apply what they know, to demonstrate understanding of a

principle, or to use knowledge flexibly) is complex, making maintenance of smooth activity flow and steady student engagement very difficult (Doyle, in press; Doyle, Sanford, Clements, French, & Emmer, 1983). Furthermore, tasks that are announced or initiated as comprehension-level assignments may during the course of classroom events be accomplished by means other than what teachers originally intended. Doyle and Carter (1984) describe how writing assignments in English classes they studied tended to get narrowed, more predictable, and less demanding of students' creative efforts across several days of work in class. In response to student questions and pressures to maintain order and activity flow, teachers gave students prompts, clarified and/or changed requirements, and softened accountability by using extra credit points and extension of time limits. In addition, in grading writing assignments, teachers tended to grade routine grammar elements more stringently than content of compositions.

In a study of 11 junior high science classes by Mitman, Mergendoller, Packer, and Marchman (1984), the authors noted that only a very small proportion of observed tasks required higher level, creative or expressive skills and that on tasks having the highest level of accountability (i.e., tests) problem levels were generally even lower than on worksheets and other assignments. In addition, nontest tasks consisting of worksheets and lab assignments were very often graded not for accuracy but only for completion. The authors speculated about the effects of this management strategy:

> One would predict that they [students] came to value accurate performance on exams foremost, followed by the most expedient methods to producing lab sheets and worksheets that appeared complete. (page 4.36)

Mitman et al. (1984) emphasize commonalities in task types and management strategies across their 11 teachers. Differences where noted seem usually to be tied to differences in topics or time of year. In contrast, recent work by Doyle, Sanford, and their colleagues (Doyle et al., 1983; Sanford, 1984) suggests that classes vary greatly not only in type of tasks that are attempted or eventually accomplished, but also in the nature of task systems in place. Some systems emphasize meaning, relationships among different tasks and instruction; others do not. This difference would appear to have some impact on how students complete their work (e.g., whether they apply what they learned in a previous assignment to a current task) and how they understand it. Some task systems feature large numbers of short term, separate, and even interchangeable tasks. Such a system is predictable, routine, and easy to manage. Other systems are characterized by longer term tasks or close linkages across tasks, requiring more careful planning and management. In some systems comprehension-level tasks are prominent; in others such tasks may be almost non-existent, or peripheral.

Objectives

This study utilizes data and preliminary analyses that were collected and prepared as part of the Managing Academic Tasks Study at the Research and Development Center for Teacher Education (Doyle et al., 1983; Doyle, Sanford, Nespor, & French, in press). It aggregates data across six classes, in three different subject areas (science, English, social studies) and four grades levels (7-10) to compare patterns of occurrence and management of higher level tasks among these classes and with reports from other, related studies. Specifically, analysis of

tasks in these six classes was designed to answer the following questions:

1. How often were higher level tasks attempted in these classes, and what was the nature of these tasks?

2. What management strategies and conditions were associated with conduct of higher order tasks?

3. What impact did these management strategies and conditions have on student engagement in the tasks and on their use of intended or other cognitive operations?

Methods

Sample

The present study used a subsample of classes observed in the MAT. Included were six classes: two junior high science classes, two high school biology classes, one combined social studies and English class, and one junior high school English class. Two junior high mathematics classes in the MAT were not included in the present study because of the great predominance of routine tasks and use of algorithms in these classes. Two other remaining MAT English classes were not used because task descriptions (preliminary analyses) were not available for all tasks in these classes.

Teachers selected for the MAT were experienced teachers chosen on the basis of classroom management and organization competency and their use of a variety of tasks, including some tasks addressing higher cognitive objectives. Nominations were solicited from school district curriculum coordinators, school principals, and university coordinators of student teaching. Final selection was made by the research team after interviewing the teachers and observing their classes.

Three of the six classes in this study were designated honors sections, special classes for high achieving students. These classes were included in the MAT because of the study's special focus on higher order tasks. Curriculum guidelines of the district participating in the study required that work in honors sections focus on higher cognitive skills.

Description of classes. All of the classes in the sample were from a large urban school district in the Southwest. Under a court-ordered integration program, the classes were integrated but predominantly Anglo.

Class A was an eighth-grade combined life/earth/physical science class, including 25 students, 13 males and 12 females. The class was heterogeneous with regard to prior academic achievement. It met in a large, well equipped room which included both a regular classroom desk arrangement and six laboratory tables for student lab activities. During the observation period instruction focused on two related units: (a) the Metric System and laboratory measurement, and (b) scientific research methods.

Class B was an eighth-grade general science class containing 28 students in a large classroom equipped and arranged for laboratory activities. Instructional units on human circulatory and digestive systems were observed in this class, and students completed independent research projects.

Class C was a 2-hour, seventh-grade combination English and social studies honors class. The 31 students in the class had been identified by school district officials as high ability students, based on achievement scores, past grades, and teacher recommendations. Course

objectives included the acquisition of content information and process skills, such as distinguishing fact from opinion, identifying different points of view, and analyzing cause and effect relationships. Students completed a number of long term, independent and group projects, integrating social studies and English content. Social studies topics in general were state history, state geography and current events; English topics focused on expository and creative writing, literature, vocabulary and grammar.

Class D was a seventh-grade English class, including 29 students (17 females). There was a wide range of ability in this average level class. During the 6 weeks of observation, instruction focused on English grammar, spelling, punctuation, and paragraph writing.

Class E was an honors section of first-year biology. There were 20 students in the class, including 7 freshmen and 13 sophomores; 12 of the students were females. Students' standardized achievement tests from the previous year ranged from the 69th to the 99th percentile, with half of the students scoring at the 90th percentile or above. The teacher of Class E participated in the development of the school district's honors biology curriculum. During the 6 weeks that this class was observed, students completed a unit on genetics and worked on independent research projects.

Class F was also a high school biology class designated an honors section, but it had a relatively heterogeneous student composition. There were 24 students, including 11 freshmen, 12 sophomores, and 1 junior. Students' standardized achievement test scores from the previous year ranged from below the 50th to the 99th percentile, with 9 students having reading scores below the 75th percentile. During the 7

weeks in which this class was observed, students completed a unit on genetics, worked on independent research projects, and also conducted a long term, in-class, genetics experiment using fruit flies. The teacher for Class F was an experienced teacher who participated in the design of the honors curriculum for the school district.

Data Sources

Each of the classes in the sample was observed for 6 or 7 weeks. A classroom observer took notes of all classroom events and instruction, concentrating primarily on circumstances that defined the nature of students' products and the conditions under which they were produced. Such information included teachers' introduction of and directions for assignments; resources made available to the students during work periods; teachers' responses to students' questions about work; models or examples provided to students; assistance, prompts, guidance, or feedback provided by the teacher while students worked; statements about grading policies, extra credit, or accountability; and teacher comments about relationships among different tasks. In addition, observers kept a record of time and a running account of classroom events focusing on such dimensions as student participation and engagement (general estimates), teacher location and movement in the room, sources and focus of student-initiated questions, and other indications of the flow of work in the room. Work-related interactions among students were noted. In Classes C, E, and F audiotapes were also made during teachers' explanation of tasks and during content instruction. After observation, the observer used notes (and audiotape when available) to generate a narrative description of the class.

Copies of assignment sheets, worksheets, textbooks, and other materials used by the teacher and students were collected. Student products were examined after they had been graded by the teacher. Information concerning the content and grading of this work was recorded or copies of the products were obtained to determine what students actually did in accomplishing a task and how the teacher actually evaluated the product.

In addition, teachers were interviewed at the beginning and end of the study in each class. Interviews focused on objectives and planning for the observed units and teacher perceptions of how successful students were. Student interviews were also conducted. Six to eight students in each class were selected for interviews focusing on their understanding of the academic work system in the class as well as on their perspectives and understanding of specific tasks.

Additional information about data collection procedures and observer training as well as examples of narratives, task analyses, and task system descriptions can be found in Doyle et al. (1983) and Doyle, Sanford, Nespor, and French (in press).

Analysis Procedures

Preliminary analysis of data for the MAT classes consisted of mapping out the contents of the observed class periods and identifying tasks in each class. First, all narratives were read and topic lists were produced, specifying for each session the topics and activities, with time allocations. Next, academic task lists were prepared, specifying for each task the date(s) it was assigned and handed in, the number and dates of sessions involved, the total class time used, notes of closely related or contributing tasks, and whether the task was a

major or minor task, on the basis of class time use and weight in the accountability system.

Next, a separate analysis of each observed task was undertaken. Using information from the narratives, instructional materials, student products, and teacher and student interviews, observers completed a detailed analysis of each task or, in the case of routine, repetitive tasks such as spelling tests, each type of task. The task analysis consisted of the following components:

(a) a general description or overview of the task and its place in the content unit and work system;

(b) all requirements for the task, including any changes in requirements during the time it was worked on;

(c) an account of class time use on the task;

(d) a description of all the resources and prompts that students appeared to use in completing the task, including a description of content instruction;

(e) a general account of "how it went" from initial assignment to turning in of the task, including major events, work flow, student interactions about the task;

(f) an analysis of accountability aspects of the task, including teacher's comments about how the task would be graded, how the task and different aspects of the task actually were graded, and grades or credit received by individual students; and

(g) an analysis of cognitive operations, both as the teacher intended (according to announcements, interview comments, and instructional materials) and as students appeared to use, in light of information collected about resources, classroom events, student

products and performance. Included in this section are summaries of students' reports of how they completed tasks, and their perception of relative difficulty level of various aspects of the assignment.

Using these task descriptions, a survey was made of the comprehension-level tasks in the six classes in the present sample. Tasks were included in the higher order or comprehension-level category when they included at least some components which by design students could not complete by (a) simple memory, (b) routinely or automatically applying an algorithm, or (c) search and match (find the answer by matching similar elements and copying). Each comprehension-level task was identified by topic, announced requirements, and intended cognitive operations. Notes were made of the management strategies or conditions associated with each task, noting particularly those strategies or conditions that seemed to have some impact on cognitive operations students used or on their understanding of their work.

Results

Occurrence of Higher Level Tasks

Table 1 summarizes information about the classes in the sample, numbers of tasks observed, and incidence of higher level tasks, based on the announced or intended objectives and requirements of tasks. In different classes, the proportions of observed tasks that were categorized as comprehension-level ranged from less than one-third to over one-half. These counts can be misleading, however. First, they do not differentiate among minor and major tasks. Several of the tasks included in the count of comprehension-level tasks, for example, were major assignments on which the class worked for several class periods and which counted heavily in students' 6-weeks term grades. Others were

short homework or classwork assignments which were only loosely inspected by the teacher and which had no impact on student grades. In addition, the totals include required, extra credit, and optional tasks, as well as tasks that were higher level by design but as managed by the teacher and performed by students appeared to make no comprehension-level demands on students.

Tasks and Their Management in Each Class

Tables 2 through 7 provide a more accurate survey of comprehension-level tasks observed in these classes. The following section discusses these tables, briefly describing higher level tasks and their management in each class in turn.

Class A. Table 2 summarizes the topics, operations, and management strategies and conditions associated with comprehension-level tasks in Class A. In this class, a relatively small number of tasks of any type were attempted in 7 weeks. There were several major, long term assignments which included laboratory activities and associated problems, questions, and class discussions, emphasizing problem-solving and reasoning skills. Teacher A provided whole group instruction before, during, and after students worked on tasks, and she closely monitored and assisted students individually and in small groups during work sessions. Work time in this class was not always used efficiently by students. Activities were not typically smooth and orderly.

All students were required to complete core assignments, but for A or B grades, students were required to select from several optional assignments, most of which were completed independently and outside of class. Thus, 4 of the 10 comprehension-level tasks included in Table 2

were attempted by relatively few students. Both the A and the B options included one choice which did not require higher level operations.

For the most part, students in Class A were held accountable for performance on higher level tasks, but they were provided with many resources, plenty of time, and much assistance. Many of the major, comprehension-level assignments were lab assignments in which students worked together on procedures and on lab questions, although students were supposed to answer questions in their own words and were sometimes penalized for copying other students' work. The teacher provided individuals and groups with prompts, assistance, or hints when students requested help, but she usually stopped short of giving them answers.

For assignment 7 on Table 2, the three students who attempted this task negotiated persistently with the teacher for clarification and assistance. The teacher had to provide more and more guidance until relatively little work was left to the three students. By using the teacher's assistance and the help of his two peers, one boy completed the task and received a passing grade on it, but later demonstrated on a test that he had no understanding of the task at all.

After major assignments were turned in, they were discussed in detail, and these discussions were important resources for tests, which were open note. Tests were designed to include challenging thought questions that tapped students' understanding of classwork, but the teacher reported that she designed and scored tests in such a way that any student who listened during discussions, corrected their work, and took notes could pass.

Class B. In Class B students completed a large number of short term, self-contained tasks, the majority requiring only search and match

or recall operations. The class was very orderly, and student engagement was steady. Careful reading of Table 3, summarizing comprehension-level tasks and their management in this class, reveals that although 11 of the assignments were announced or designed as at least partly higher level tasks, students were seldom held accountable for anything other than procedural aspects of the work. Comprehension-level aspects of tasks were either never graded or inspected, or any student answer was accepted. On almost all work, students worked together or shared answers, with little teacher assistance or monitoring.

Task 5 on Table 3 was an exception to the general pattern for Class B. This was a major assignment requiring students to design, carry out, and report an experiment, development of a model, or a research paper. The teacher gave the students some group instruction (most preceding the period of observation), some individual assistance and guidance, and many warnings and reminders of the weight of the assignment in the grading system. Student products were graded by outside judges, using a variety of criteria. Judges' marks (on a scale of 100) were low, but Teacher B provide a safety net by adding together two judges' marks for each project to produce an inflated grade.

Class C. Table 4 summarizes information about 24 comprehension-level tasks completed in the combined English-social studies class. These included a variety of expository and creative writing assignments, persuasive and informative group presentations, research projects, and a few grammar assignments. Several assignments were long term and complex. The teachers provided direct instruction

and practice on complex operations, assistance to individuals during work, and sometimes models for students to follow.

In this class accountability was not suspended for comprehension tasks or for comprehension components of tasks. Assignments were graded thoroughly and generally stringently. Grades on some major writing assignments were low. However, students who did poorly on an assignment were allowed (or required) to do it over, utilizing feedback from the teacher, with no grade penalty. Accountability was also cushioned somewhat by availability of extra credit and by the fact that students completed such a large number of tasks that individual assignments, even major ones, had relatively little impact on the total grade. On minor comprehension-level assignments, such as homework assignments on English topics, students were not always held accountable for content, but merely for completion.

Class D. Students in Class D (Table 5) completed what appeared to be a carefully planned sequence of tasks and lessons with ample direct instruction and practice on components of tasks before they completed major assignments. Relatively few tasks were completed, however, and most were not substantially comprehension-level tasks. When comprehension-level tasks were completed, many students' grades were low. Teacher D did not usually suspend accountability for these tasks and she did not use extra credit or bonus points.

Writing instruction in this class tended to be taught as a matter of following formulas or specific outlines. Thus, higher level demands on students were somewhat limited. Not reflected in Table 6 was a series of lessons (including group practice exercises) on writing

comparison/contrast paragraphs. During the period observed, students never completed such a writing task, however.

Class E. Table 6 shows that the comprehension-level tasks in Class E included tests and quizzes that included some higher level questions, some homework assignments, a laboratory activity, and an individual research project. Students in this class were generally held accountable for challenging work. However, test scores were usually weighted toward memory level items, and quizzes over less familiar content were balanced or padded with very familiar content. Daily work (with or without comprehension-level components) was frequently checked only for completion or attempt rather than for content or accuracy. However, students usually did not know ahead of time whether their work would receive an "effort" check or be graded thoroughly.

Extra credit assignments and extra credit items on some quizzes provided softening of accountability. In addition, the teacher used a flexible grading system: Any test or assignment could count any number of points from 5 to 100. On one occasion the teacher, seeing that many students were having difficulty on a test, announced that the test would count fewer points than originally intended and that an additional test over the same content would be provided later that week. Finally, the teacher routinely presented critical content instruction/review immediately prior to tests, usually in connection with answering students' last minute questions.

Task 2 on Table 6 was a higher level task that counted approximately 25% of students' grades for three 6-weeks grading periods. The teacher provided a great deal of individual assistance and feedback to students who requested it, however, and the accountability system

used with this task provided a substantial safety net for students willing to attempt the work. The research project was graded in a series of sequential steps, including four to six steps each 6 weeks. Students turned in each step as they completed it. Each step was either accepted or turned back to the student for revisions, with changes indicated on the paper or directions to confer with the teacher. Each step was required to be turned in and graded before the next step was accepted. Students were allowed to submit each step as many times as necessary, and acceptance of each step brought full credit for that step. A few students submitted some steps as many as five times, and a few solicited so much guidance from the teacher (e.g., frequent answers to questions such as, "What do I do now?" and "Is this what you want for this paragraph?") that they appeared to do little thinking on their own. Other students worked quite independently. Final products receiving full credit represented a range of expertise and effort.

A few modifications in the system were noted. At the end of the second 6-weeks grading period, Teacher E softened the requirements for a grade of B. The B requirement was to "organize results in concise table form on notebook paper". The day before the last day to turn in any steps, the teacher told several students in a voice that could be heard by all that even if they had no results yet they could go ahead and set up their charts and tables with no data recorded, and they would receive a B. In addition, one student who would have received an F for the project in the third 6 weeks was allowed to abandon the task and substitute a library report on another topic for a grade of C.

Class F. Of the 28 tasks in the genetics unit observed in Class F (Table 7), 13 were partly or mostly comprehension-level tasks, including

an independent research project, a long term genetics experiment, genetics problems and worksheets, and tests that included some higher level questions. Students were generally very task oriented and cooperative in this class and a lot of work was accomplished. With the exception of quizzes, the independent research project, and one homework assignment, higher level tasks were completed by students working in pairs or groups. Some of the group work was structured to require cooperative efforts. Each group submitted a single common product, or individual group members were held to some extent accountable for performance and learning of individual members (e.g., see Task 8 on Table 7). This strategy, used only with minor tasks, seemed to be one way Teacher F coped with the relatively wide range of student achievement levels in this honors section.

On major tasks students worked independently, with the exception of Task 2, the fruit fly cross. However, Teacher F provided not only ample whole class instruction and practice, but also a great amount of individual assistance, guidance, and feedback to students. She frequently gave private assistance and prompts to students during tests, and she helped individual students with other tasks, especially research projects, before, during, and after class. Teacher F's patience and energy in assisting students individually appeared to be limitless. Many students in this class came to her classroom for help during a 30-minute activity period that preceded the class.

A critical aspect of the work system in Class F was that as long as the teacher judged that students' initial products showed some effort, students could correct, complete, and resubmit almost any minor task after the initial grading, and receive full credit. This was true (for

minor tasks, not tests) even after graded tasks were discussed in class and correct answers were announced by the teacher. In addition, students were on several occasions encouraged to correct their papers by getting answers from other students, then resubmit for full credit. (This strategy was used more with lower level tasks than with higher level tasks.) On one major task, the independent research project, students were encouraged to submit parts of the paper for checking and revision before the final product was turned in.

Discussion

Occurrence of Comprehension-level Tasks

The proportion of observed tasks that were higher level (or at least potentially higher level) in this study far exceeds proportions reported by other researchers. For example, Mitman et al. (1984) reported that 30 of the 31 seventh-grade science laboratory activities they observed were low level ("observational or exploratory") and worksheets (the most frequent task type in most classes they studied) required only copying of answers from resource to worksheet in 75% of the cases during one observation period and 95% in another. Observation periods in that study ranged from 4 to 12 days. Few long-term tasks were examined, and extra credit or optional assignments were not considered, as they were in the present study.

These discrepant findings (and there are other studies of instruction in junior high/middle school classes that present as bleak a picture as the Mitman et al. study) strongly suggest that classes observed in the MAT are not representative of most secondary classrooms, at least in the variety of tasks students are assigned. This fact is not surprising, since the MAT teachers were specifically selected based

on reputations of effectiveness and use of a variety of tasks in their classes. Furthermore, three of the six classes in the present sample were honors sections with curriculum goals specifically targeting higher level skills. They were taught by outstanding teachers who were involved in design of the honors curriculum in their district. In one class, two experienced, energetic teachers were teamed to work with 31 high achieving students in a two-hour block. Thus, the present sample affords opportunity to observe the conduct of higher level tasks under the best of conditions.

Even in those circumstances, this study demonstrates that planning and conducting comprehension-level tasks in secondary schools is not easy. In the six classes we observed, higher level tasks were hard work for teachers and sometimes distressing for students. Results often fell short of curricular goals. Commenting on the difficulty of conducting the research project assignment, Teacher E explained,

> They find it so painful to do that it really wears a teacher out. You have to be a very patient person to be willing to do something like this, because half of the class comes to you at some point and says, "I can't think of a project." And you have to be able to deal with that. You have to be able to deal with people dropping by your room at all times of the day with all sorts of problems with every step. . . . This class is supposed to begin and here are three kids clustered around your desk saying, "I just don't understand the discussion [section]." Or "I just don't know how to pick a problem." That's very exciting to have kids that involved in their class, but it's also very frustrating and confusing if you're a teacher who wants things to go just like you planned it every day and you can't handle all this extraneous activity.

Of the six classes in this study, one teacher (B) had little success in engaging students in higher level tasks. In fact, in the final analysis, most tasks in Class B were similar to those described by

Mitman et al. (1984). In another class, Teacher D's English class, comprehension-level components of tasks were limited, and despite what appeared to be ample, well conducted, direct instruction, student success on comprehension-level tasks was low. The other four teachers in the group were more successful in getting students through some comprehension-level tasks, and complete suspension of accountability for higher level tasks, as noted by some researchers, was not characteristic of this sample.

Managing Comprehension-level Tasks

When teachers in this sample engaged students in work that was supposed to be comprehension-level, it seemed very often to be accomplished by (a) creating an aura of accountability around the task to force students to attempt it, and (b) by providing a variety of safety-net devices to keep students from failing at the task. Both of these phenomena, in general, have also been noted by Doyle and Carter (1984) in English classes.

Accountability

Especially for longer-term, comprehension-level tasks, in which students had to apply sustained effort, teachers raised the price of noncompliance and reminded students frequently of this price. Some teachers made some tasks count 25% or more of term grades; one reminded students frequently that certain assignments counted twice in her gradebook; some sent failure warnings home to parents of students not making progress on research reports; some gave students detention as well as zeros for failure to hand in work. For some tasks, public accountability was added to gradebook accountability when teachers required students to present their work to the class. Some minor tasks

were not graded or were checked only for completion; however, with the exception of Class B, accountability was maintained with sufficient regularity that students expected to be held accountable. In Class E students sometimes were given only completion grades; at other times work was actually graded or a pop quiz covering the content was administered. Students seldom knew ahead of time and most seemed to assume they would be held accountable.

Safety Nets

This study provides a rather extensive catalog of management strategies that appeared to have the effect of providing safety nets for students once they attempted comprehension-level tasks. These strategies included a wide variety of ways that individual student's risk of failure was reduced, either because the work (thinking) they had to perform on their own was reduced or accountability for that work or difficult aspects of that work was softened. The safety-net strategies we saw in this study include:

1. Group work or paired work, particularly in laboratory activities in science classes or group assignments as in Class C. Group work allows students to pool their efforts. Group work in Classes C an F was often structured, and students had to collaborate on a common product. In contrast, in group or paired work in most science lab tasks students worked together on procedures and on content to varying extents, but they turned in individual reports or lab worksheets. Either way, the burden of individual performance is softened when students are grouped to work on tasks.

2. Peer assistance. In some classes students are allowed to get help from other students on a variety of assignments.

3. On tests, balancing difficult or unfamiliar content with easy or very familiar content; and a related strategy,

4. Grading tasks in such a way that higher level components count less than memory or procedural components, so that lack of success on higher level components does not result in failing grades. (This is not the same thing as suspending all accountability or accepting any response to higher level tasks.)

5. Allowing students to revise products after they have handed them in and received benefit of teacher comments, with little or no grade penalty.

6. Peer review before products are turned in. This strategy was observed in two classes, but according to observers' comments and student interviews students seldom made much revision based on comments of their peers.

7. Teacher assistance, prompting, and responses to student requests for feedback during work sessions. Also, assistance by lab assistants or teacher aides.

8. Extra credit assignments and to a lesser extent extra credit questions on tests. These may compensate for poor student performance on comprehension-level tasks.

9. Less exacting grading (on essay or explanation questions) for low achieving students.

10. On minor tasks, grading on completion (effort grades), not accuracy, especially when students' ability to perform tasks with accuracy is unlikely.

11. Providing models of products and other very explicit resources such as outlines for students to follow in producing a paragraph.

12. No-risk pop test: Students receive extra credit for perfect papers or for every correct answer, and receive no penalty for incorrect answers.

13. Presenting last-minute instruction or review of key content immediately prior to a test; and

14. Using a flexible grading system which makes it easy to devalue assignments on which the class scores poorly.

It should be noted that these strategies are not necessarily used by teachers specifically for the purpose of cutting risk to students or preventing too many failing grades. For example, Teacher E insisted that the step-by-step, feedback, revision, and grading system she used with student research projects was designed purely to spread her job of grading and commenting on these papers across 18 weeks, rather than having to grade and comment on all of them in several days at the end of the semester. She also said she provided extra credit work not to provide deserving students with a cushion, but (a) to compensate for the fact that she realized some of her test items were likely to be less than perfect or fair, and (b) to give the faster students something challenging to do while they waited on slower students.

Teacher E's reasoning may reflect the fact that she works with high achieving students in an honors section. Other teachers in this sample and other studies have spoken more directly about the problem of getting most of their students to succeed at difficult tasks or having too many failing grades. In Aikenhead's (1984) case study of decision making by high school science teachers, teachers appeared to counterbalance strict standards, with resulting low achievement and discouragement of

students, against softened standards, with a resulting high motivation for students. Aikenhead described one teacher's strategy:

> Mr. Appelt felt that if he gave an open-book exam replete with application-level questions, one third of the students would achieve "in the 90's" but the rest would do miserably and would give up. Poor marks would lead to poor motivation. He insisted that he needed to control the arrangement of marks. He did so by having a range of question difficulty. (page 174)

One teacher in the present study raised all students' total scores by 2 points at the end of the 6-weeks grading term. For some this resulted in report grades one letter higher. The teacher said she made the adjustment because grades were too low.

Whatever the reasoning behind teachers' use of different strategies in managing students' work, the strategies themselves often have impact on whether and how students engage in comprehension-level tasks. The question of impact on task demand is addressed in the following section.

Effects on Task Demand

In considering effects of different management strategies on task demands in this study, it is clear that some strategies reduce tasks in critical ways more than others do. Some may also reduce students' understanding of tasks or teacher's ability to monitor students' understanding. Decisions about managing tasks can make a great difference.

For example, allowing (or requiring) students to revise and resubmit poorly done writing assignments provides better work experience for students than does narrowing the assignment in the first place by giving students a very explicit outline or model to follow. The latter strategy may be more efficient than the former, but it provides less real opportunity for students to attempt higher level work. In a sense, this argues for providing less direct instruction before tasks and more

feedback and instruction during and after tasks, and this general strategy was sometimes seen in several classes in this study. It should be noted, however, that inadequate instruction before tasks is not warranted. For example, the teachers in Class C provided careful instruction and modeling before major writing tasks, but they did not give their students specific formulas to follow for major tasks, as seen in Class D.

While group work assignments have important merits, routinely allowing group work or peer assistance greatly reduces individual students' accountability to grapple with comprehension-level tasks. It can make it difficult for teachers to monitor individual students' performance and understanding, and it sometimes perpetuates misinformation and misconceptions, as students share their confusion with one another. Examples of these problems are easy to find. Students in Class F worked with lab partners in a long term, high level task, the fruit fly cross. Interviews with students revealed in more than one case that one partner did more of the work and had good understanding, while the other partner (though a capable student) had little understanding and some serious misconceptions about procedures or content. In Class B, where students did virtually all work together, either collaborating informally or working in formal lab groups, students routinely copied other students' work with little apparent attention to meaning. Finally, in several different classes during observations of laboratory tasks, students were sometimes noted providing other students with inaccurate, misleading or incomplete explanations or directions. These potential problems with allowing

students to work together need to be considered and compensated for by teachers.

A management strategy that seems to put higher level tasks at risk is routinely suspending accountability for students' comprehension-level work, grading consistently on only procedures or completion. This does not appear to encourage students to take comprehension-level work seriously. To illustrate, lab reports in Class B were checked only for format and loosely for completion, and students' mid-year work suggests students were well aware that the content of their lab reports made little difference. A lab question requiring comparison of digestive systems in frogs (dissected in class) and humans elicited the following kinds of responses: "the size"; "things are in different places"; "human digestive system is larger"; and "the frog's digestive system." A number of students skipped this question altogether.

On the other hand, occasionally giving completion or effort grades, before discussing these tasks in class, does not have such negative effects, especially when students expect to be held accountable for serious effort.

Student expectations seem to play an important role. For example, Teacher F usually graded and commented on content of lab reports, demanding thoroughness and some thought. In her interview she noted that year after year in her classes there was usually a noticeable increase in quality of students' lab reports across the first month of school, as students realized from the grades and comments received on lab work that it really did make a difference what they wrote in their lab books. Their experience in previous science classes did not seem to give them such an expectation.

Conclusion

This study of work in six secondary classes has provided a look at management of a variety of higher level tasks in three content areas. Even under the best of circumstances, conducting comprehension-level work with junior and senior high students appears to be complex and demanding. Teachers in this study were not equally or consistently successful in engaging their students in such work, and other studies suggest that many secondary teachers avoid or mismanage higher level tasks. Decisions about managing academic work would appear to deserve more direct attention than they receive from teachers and teacher educators.

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Table 1

Tasks Observed in Six Classes

Teacher #, Subject	Grade, Level	No. Wks. Observed	Tasks* Observed	Comprehension-Level Tasks*
Class A Science	8 Regular	7	20	10
Class B Science	8 Regular	6	30	11 (1)**
Class C English & Social Studies (2 hour block)	7 Honors	6	58	24
Class D English	7 Regular	6	19	5
Class E Biology	9-10 Honors	6	24	10
Class F Biology	9-10 Honors	7	28	13

* Including optional and extra credit assignments.

** Number in parenthesis indicates number of tasks on which students were held at all accountable for comprehension-level operations. See Table 3.

Table 2

Summary of Comprehension-level Tasks, Class A

Description of Task	Management Notes
1. Three labs on scientific methods: Does gas have mass and weight? Does an object weigh more or less in water than air? Is alcohol more dense than water? Ss conducted procedures, recorded data, answered comprehension-level questions about experimental design, procedures, results, and concepts.	Group work and related instruction over 5 days. Individual T assistance and feedback during work. Peer assistance. Graded thoroughly, on content, accuracy and form. Major grade.
2. Test over scientific methods and related lab assignments. Focus on comprehension.	Open-note test. Major grade. Less exacting grading of essay or explanation answers for lower achieving Ss. Preceded by several days of class discussion of relevant assignments.
3. Lab assignment on metric system and measurement. Activities and questions combined observation, recall, and some comprehension operations.	Group work over 6 days. Much individual assistance and feedback from T. Peer assistance and sharing of information. Graded thoroughly; major grade.
4. Report on metric system and metrics in U.S., including Ss opinion and reasons for it.	Option for B grade. Structured by T questions and resources. Graded on content and form. Independent work.
5. Lab assignment illustrating necessity for standardization of measurements. Procedural and comprehension operations.	Option for B grade. Independent work. Some individual T assistance. Graded on content and procedures.
6. Assignment requiring Ss to critique in paragraph form experimental designs in four experiments described in a text.	Option for A grade. Independent work. Attempted by three Ss. Graded on accurate reasoning.
7. Lab requiring Ss to design and carry out an experiment to answer the question, "Does density have an effect on the bouyance force exerted by a liquid?"	Option for A grade. Attempted by one group of three Ss. Great amount of T assistance and quidance required. Final product graded on content, reasoning and form.

Table 2 (continued)

Description of Task	Management Notes
8. Original rationale statements for each of six steps of scientific method (minor assignment preceding instruction).	Classwork; daily grade. Any answer accepted, but T inspected and commented on Ss reasoning.

Table 3

Summary of Comprehension-level Tasks, Class B

Description of Task	Management Notes
1. Lab activity on diffusion, Ss write a brief report including hypothesis, procedures, observations, inferences.	Graded only for form, format, not content. Any student answer accepted. Most Ss simply restated the given experimental question to produce hypothesis and inference statement. Group work, peer assistance. Little T assistance, monitoring, or feedback. Minor grade.
2. Lab activity on blood typing and centrifuging. Ss perform procedures and write a brief report as in #1 above, and answer memory-level question.	Same as #1 above, but T also assisted individuals and groups on centrifuging, and a nurse confirmed some student results during work. Minor grade.
3. Lab activity on blood pressure and heart sounds. Ss perform procedures and write a brief report as in #1 above.	Same as #1, but T took each student's blood pressure and provided answer to "experimental" question before Ss did the lab. Minor grade.
4. Lab activity, dissection of earthworm, with questions requiring Ss to compare earthworm and human systems. Ss perform procedures, answer questions, and write brief report, including answer to comparison question and a drawing.	Graded for form and format only, not content. Any student answer accepted. No penalty for skipping comparison question, which many Ss did. Group work, peer assistance, and student sharing. No T assistance or feedback during work. Minor grade.
5. Science fair project and notebook. Ss design, carry out, and report (in a notebook) an experiment, a model, or a research paper. Long-term, independent assignment, several days in-class work time.	T provided instruction and detailed handout on requirements, procedures, possible project ideas, model of notebook for an experimental project, and example of project displays for Science Fair. Also, individual assistance, guidance, and feedback by T. Some peer assistance. Major grade; failure warnings sent to parents of Ss not making progress on projects. Graded by two outside (Science Fair) judges, but T's subsequent grade computation had effect of padding grades.

Table 3, continued

Description of Task	Management Notes
6. Lab activity on effect of exercise on heart rate. Ss perform procedures and make brief report of hypothesis, procedures, observations, inferences, and explanation of observed effects.	Graded on form, format, and completeness only. Any student answer (including inaccurate ones) accepted. Ss rephrased experimental question to form hypothesis and inference. Group work. Peer assistance. Little T assistance or feedback during work. Minor grade.
7. Class work: questions over description of digestion in textbook. Total of 16 questions, 2 of which were comprehension level questions.	Graded in class (Ss exchanged papers) and handed in. The two comprehension questions were omitted in grading/checking. Peer assistance and sharing. Minor grade.
8. Lab activity on taste. Ss perform procedures and make brief report of hypothesis, procedures, observations, inference, including answer to four specific questions.	Identical to #1 above.
9. Lab activity on digestion. Ss perform procedures and make brief report of hypothesis, procedures, observations, inference, including answer to questions.	Like #1 above, but most (not all) answers/inferences were accepted. Minor grade.
10. Written summary of digestive process, following apple through digestive system.	T presented review of content before making assignment. Whispered peer assistance allowed during 11 minutes work period. Papers taken up but never returned; no grades recorded.
11. Frog dissection lab with questions requiring Ss to contrast human's and frog's systems. Ss perform procedures, answer questions, and write brief report.	Group work; peer assistance. Not graded by end of observation period. Little T assistance or feedback during work. Directions emphasized procedures only.

Table 4

Summary of Comprehension-level Tasks, Class C

Description of Task	Management Notes
1. Indian project creative writing: poem, legend, story, or prayer reflecting culture of chosen Texas Indian tribe. Outline and rough draft required.	Part of major, long-term project. Independent work. Peer review. Content instruction provided on writing/researching, not on Indian tribes. Individual T assistance during in-class work. T provided resource books. Graded on content and form. Ss could rewrite after grading, no penalty. Extra credit for extra work for some Ss, not others.
2- Two descriptive paragraphs (word 3. pictures) illustrating aspects of chosen Indian tribe.	Part of major, long-term project. Independent work. Peer review. Content instruction provided on writing/researching, not on Indian tribes. Individual T assistance during in-class work. T provided resource books. List of topics provided. Graded on content and form. Ss could rewrite after grading, no penalty. First paragraph: seven F's, two zeros. Second paragraph: seven F's, five zeros.
4. Analytical paragraph based on selected tribe, showing either cause/effect, comparison/ contrast, or differing viewpoints or interpretation of a culture.	Part of major, long-term project. Independent work. Peer review. Content instruction provided on writing/researching, not on Indian tribes. Individual T assistance during in-class work. T provided resource books. Graded on content and form. Ss could rewrite, no penalty. Fourteen F's, one zero.
5. Topic sentence assignment: given four paragraphs, Ss write topic sentence for each.	Minor grade. Independent work in class. T provided instruction and one model. Graded on form and content. Half of Ss' work was returned with feedback, to be redone, no grade penalty.

Table 4 (continued)

Description of Task	Management Notes
6. Clincher sentence homework assignment. Find or write two paragraphs exemplifying two types of clincher sentences. Discuss in class.	Minor grade. Extra credit for finding third type. Several Ss were told to rewrite paragraphs, no grade penalty.
7. Paragraph Plan and Descriptive Paragraph based on notes from T. lecture over a (fictitious) Indian culture. Ss had to turn in notes, outline and final paragraph.	Minor grade. All Ss graded on original paragraph and on rewrite following T feedback/correction and group critique of some papers. Independent work. T assistance during rewrite, not original. Graded on content and form.
8. Ss researched, planned and produced a promotional pamphlet featuring a region of the state.	(Refers to 7. & 8.) Small group project. Major grade. T provided resources, books, and models (previous Ss work). Private T assistance during classwork. Graded on content, form, originality, persuasiveness, and groupwork skills. Oral report due date was extended.
9. Oral group presentation. Small group had to plan and present a description and promotion of a region of the state using a variety of media and formats.	
10. Book report. Minimum 200 words. Summary of a book, to be an understandable account of content and/or events in book, using good sentence structure.	T announced that reports would be graded on how summaries "sound" and on sentence structure. After turn in, T told Ss grades would not be recorded or returned, but that she took notes on how well they did.
11- 16. Six written, weekly homework assignments, each consisting of summaries of four or more newspaper articles categorized by level of government focus. Mount article, underline main ideas, summarize.	Independent work. Kept in notebook, checked every 2 weeks. T provided instruction and practice on summarizing and levels of government. Graded on summarizing, identification of main idea, and accurate categorizing. Extra credit given for more articles or exceptional work. Taken together these amounted to a major grade.

Table 4 (continued)

Description of Task	Management Notes
17-18. Two oral, small group presentations. 7-minute newscast based on news summaries above (Task 10). Group selected articles, focused on a single level of government, decided on format, planned, presented, answered questions about topics.	T assistance during preparation time. T provided maps if needed by Ss. Feedback after 1st newscast. Institution of eight-item minimum content for 2nd newscast. This task not graded. (May have influenced participation grade?)
19. Ss' written evaluation of their group presentation: group processes, problems and strengths in one of their own group newscasts, above.	No grade given, but Ss not bringing it in served detention time.
20. Homework assignment on abstract/concrete nouns and plurals. Ss had to make up list of abstract and contrete nouns, recognize them in different contexts, form plurals. Largely procedural (algorithms) but some comprehension-level aspects.	Independent work. Individual T help during classwork time. Ss exchanged and corrected papers in class, except for one comprehension part. Papers collected. No grades recorded.
21. Homework: character summary based on a story. Ss read story and produced notes in paragraph form on character of protagonist.	Minor grade (10 points with additional 10 points extra credit for exceptional work). Checked by T in class. Five Ss with no work got zero and detention.
22. Journal writing assignment on personal standards and goals. Write as much as possible in 10 minutes.	Private T assistance and systematic monitoring during work. Journals kept in notebook, which was checked for completion and organization only.
23. Homework: personal letter to a real or fictitious person about things of interest to the reader. Use correct block form and address envelope.	T provided instruction focusing on content as well as form. Independent work. Minor grade.

41

Table 4 (continued)

Description of Task	Management Notes
24. Grammar test, mostly procedural (algorithmic) but some comprehension-level components.	Major test grade. Independent work. Some private T assistance during work. Graded in class, Ss exchange papers. Checked by T afterwards. Comprehension-level questions relatively small part of grade.

Table 5

Summary of Comprehension-level Tasks, Class D

Description of Task	Management Notes
1. Reasons and examples paragraph. Ss outlined, then wrote a paragraph stating an opinion, supported by at least three reasons with examples.	Major grade. Worked part of 3 class days. T provided specific outline of form, including transition words. Feedback and suggestions during work. Two rounds of peer editing using T checklist of criteria. No extra credit, no bonus points. Penalty for no paragraph: detention and zero. T graded content and form. Six zeros, three F's.
2. "Changes" writing assignment. 20 lines of verse (not necessarily rhyming) explaining 10 ways a S has changed. Ss also required to bring childhood photo and to read poems to class.	T gave specific formula and model. Content instruction: initial class discussion on ways people change. Some class time to work, then homework. T assisted individuals during work time. Counted as major grade. Public reading of poems before handed in for grading. Graded on completeness, content and form. Penalty for not also bringing childhood photo. Eight zeros and two F's.
3. Comma test. Ss applied all comma rules studied, plus external punctuation rules, to punctuate 10 dictated sentences. Largely procedural content, but Ss had to select appropriate rules and apply them to different situations.	Major grade. No T or peer assistance. A 5 minute study time in which the T answered some questions of individuals was allowed immediately before test. Entire sentence had to be correct or no credit. Direct instruction and practice similar in format to test for several days leading up to test. One third of Ss received failing grades.
4. Classwork/homework Sentence Diagramming Assignment # 1. Ss diagrammed five sentences, including subjects, verbs, adjectives, adverbs, omitting underlined words.	Minor grade. Individual T assistance and monitoring. T verified Ss' answers during work in class. Ss could refer to text or other sources of help at home. Graded and discussed in class. Entire sentence correct or no credit. Two thirds of Ss received failing grades.

Table 5 (continued)

Description of Task	Management Notes
5. Classwork/homework Sentence Diagramming Assignment # 2. Ss diagrammed five sentences, including subjects, verbs, adjectives, adverbs, subject complements, linking verbs.	Minor grade. Models left on board from previous day's direct instruction/practice. T refused to give assistance to Ss during work. Ss could refer to text or other source of help at home. Entire sentence correct or no credit. Graded in class; papers picked up but no grades recorded.

Table 6

Summary of Comprehension-level Tasks, Class E

Description of Task	Management Notes
1. First test on genetics: terminology, probability problems, pedigree problems. Mixture of recognition, procedural and comprehension questions.	Major grade. Open-book/notes. T reviewed terms/definitions immediately before test. Some private and public prompts during work. Graded in class. Two fifths of points were for recognition of terms (matching), three fifths for problems. No extra credit.
2. Independent research project. Ss design, conduct, analyze and report (written) an experimental study. 18-week project, mostly out of class.	Instruction on requirements, form, statistics. T provided models, resources, individual assistance and feedback. Self-paced accountability system: Ss submit parts in sequence; receive mark of Accept or Revise, with feedback, no penalty. Major grade. Failure warnings to parents of students not making progress.
3. Second genetics quiz: pedigree problems/questions in a variety of forms. Largely comprehension level, but content similar to first open-book test.	Major grade. Open-book/notes. No T assistance. No extra credit.
4. Major genetics quiz: structure and function of DNA, associated terminology, pedigree problems, single and dihybrid crosses. About half memory-level, half comprehension, much was similar to previous genetics tests, but the dihybrid problem was unfamiliar, required Ss to use their own resources.	Many resources provided, but no instruction on dihybrid cross. 2 days in-class review. 12 minutes of directly related instruction immediately preceding test. Some private T assistance during test. Scoring weighted toward memory-level items. All Ss attempting dihybrid problem (worth 10 of 100 points) received at least part credit.
5. Quiz on statistics, dihybrid cross, and terms. Cognitive level questionable: could have been done as combination memory/algorithms or somewhat at understanding level.	Major grade. Test of unfamiliar content (statistics) padded with very familiar content. T provided all formulas. Two extra credit problems in genetics (unfamiliar content).

Table 6 (continued)

Description of Task	Management Notes
6. Probability lab activity: one- and two-penny toss. Procedures, recording data, answering questions, inference of probability principles.	Group work, peer assistance. Some individual T and lab assistant assistance with questions. At end of period T led discussion/recitation over questions. No grades taken.
7. Homework assignment: six-finger pedigree. Given complex story partly describing incidence of six fingers in several generations of large family, Ss prepare two possible pedigrees, assuming dominant, then recessive trait.	Independent work. Minor grade. Some individual T assistance. "Effort grade" only: Ss received full credit for any attempt at two pedigrees, part credit for one.
8. Homework: two Chi Square problems and one T-test. Cognitive operations mostly complex algorithm, but Ss had option of applying T-test to their own research project.	Minor grade. "Effort grade" only. Full credit for attempt, not accuracy.
9. Pop quiz on Huntington's Disease inheritance and Punnett Squares. Mostly memory, some comprehension questions.	Graded in class. Only perfect papers collected and these counted as extra credit assignment.
10. Pop quiz on population genetics, related to content of an optional, extra credit homework assignment. Difficult, understanding-level questions over content not discussed in class.	Announced as extra credit, but all Ss required to attempt it. Graded and discussed in class. Ss received extra credit for every correct answer, no penalty for incorrect answers.

Table 7

Comprehension-level Tasks, Class F

Description of Task	Management Notes
1. Independent Research Project. Ss were to design, conduct, analyze, and report (written) experimental study. Eighteen-week project, mostly on outside of class time.	Self-paced task. T provided instruction and practice on requirements, form, statistical procedures, research design. T provided individual assistance and resources. Work in progress was collected periodically, and feedback given for revisions. Major grade.
2. Lab activity. Ss did fruit fly crosses demonstrating different inheritance patterns. Ss wrote reports, stating purpose for doing the lab, and recorded, analyzed (using probability principles), and interpreted the data collected. Seven-week task. Largely a complex procedural task but included analytical and expressive demands on students.	Ss worked in pairs. T instruction on requirements, form, genetics content, and statistical procedures. Individual and group assistance provided. Work in progress was collected periodically, and feedback given for revisions. Major grade.
3. Test on structure and replication of DNA/RNA. Fill-in-the-blank, multiple choice, short answer, and diagrammatic representation questions. Mainly memory with a few comprehension-level questions.	T provided oral review, calling on Ss for answers to a large number of the questions found on the test. Numerous private T/Ss and Ss/Ss interactions during testing time. Ss received 3-4 automatic points. Major grade.
4. Worksheet on gametogenesis and genetic traits. Ss made diagrams and answered comprehension-level questions. Classroom and homework.	Ss worked alone, not grouped. Graded for completion only, then discussed in detail while Ss checked/corrected their own work. No late work accepted on this assignment (unusual for this T).
5. Test on mitosis and meiosis. Included questions on life stages of fruit flies (related to fruit fly lab activity, #2). Mixture of memory and comprehension-level questions.	Numerous private Ss/Ss and some T/Ss interactions during testing time. Major grade. 3-4 automatic points given.

Table 7, continued

Description of Task	Management Notes
6. Monohybrid genetics problems. Procedural (algorithm) task with comprehension components, as taught here.	Individual and group work. T formed problem-solving groups of 3-4 Ss each. Ss corrected their papers within their problem-solving groups, discussing and explaining work as they did so. Papers were collected from one member of each group. All Ss within the group received the same grade. 2 points extra credit given to each group with completed homework assignments before the group met. Minor grade.
7. Dihybrid genetics problems. Procedural (algorithm) and comprehension-level task.	Ss worked in problem-solving groups, correcting problems after they were completed as homework assignments, as in #7 above. Group accountability. Products collected from one member of each group. Minor grade.
8. Quiz on dihybrid genetics problems. Procedural (algorithm) and comprehension-level task.	Independent work, but Ss lost 1 point from this unannounced quiz (total 10 points) if all members of their group did not do it correctly. Some Ss/Ss private interactions during testing time. Minor grade.
9. Genetics problem-solving test. Multiple choice, matching, and short answer questions requiring mono- and dihybrid problem solving. Procedural and comprehension task.	T provided oral review immediately preceding the test. Major grade.
10. Genetics problems involving sex-linked traits. Procedural and comprehension task.	Ss completed work individually as homework and then corrected answers in their problem-solving groups on the following day as in #7 and #8. Extra credit points to group members in all groups with completed assignments from each member. Some T/group interactions during work.

Table 7, continued

Description of Task	Management Notes
11. Lab activity. Ss determined their own genotypes and phenotypes for a variety of traits, based on handouts describing traits and patterns. Limited higher level demand.	Ss worked in pairs. Minor grade.
12. Probability problems. Monohybrid crosses analyzed with Chi square. Procedural and some comprehension demand.	Ss worked individually or in groups. Products were collected, checked, and returned to Ss to be corrected. T provided further content instruction and Ss re-did products with group members. Revised products collected several days later, no grade penalty.
13. Genetics Unit Test. Multiple choice and short essay questions over all material covered in the genetics unit. Comprehension to memory level items.	T provided a brief review of probability problem solving immediately before the test. Many T/Ss and some Ss/Ss private interactions took place during testing time. Major grade.