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Teaching Behaviors, Academic Learning Time, and Student Achievement: An Overview

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INTRODUCTION

The purpose of the Beginning Teacher Evaluation Study[1] (BTES) was to identify teaching activities and classroom conditions that foster student learning in elementary schools. The study focused on instruction in reading and mathematics at grades two and five. During the multi-year series of substudies comprising BTES, a variety of issues were addressed, and data from several samples of teachers and students were collected and analyzed. Depending on the question being asked, various data collection techniques were used, including: ethnography, stimulated recall, interviews, teacher and student self-report, objective observation, and testing. As the study progressed, a model of classroom instruction and student learning evolved and provided the conceptual framework that guided the final empirical stage of the study. The development of the model is in itself one of the more important outcomes of the study.

The following discussion[2] will present (1) a brief description of the model as it applies to the acquisition of reading and mathematics skills in elementary schools; (2) an overview of the methods used in the final field study; (3) the major findings of the study; and (4) some implications of the study for the practice of teaching.

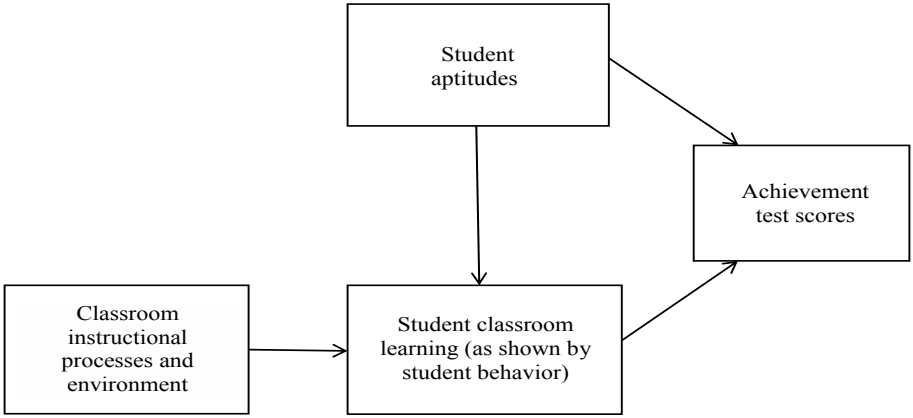
A MODEL OF CLASSROOM INSTRUCTION

This model of classroom instruction states that, for a given student, certain instructional processes lead to classroom learning, which is then reflected in achievement test scores (Figure 1). In this model, student aptitudes have a direct impact on both student classroom learning and achievement test scores.

The general model specifies and distinguishes two measures of student learning: student classroom behavior and student achievement test scores. Learning takes place

[1]Although the title of the overall research program specifies "beginning" teachers, it is important to note that the empirical work was carried out in classrooms of teachers who had several years of teaching experience. Hence, the results reported here are based on information from experienced teachers.
[2]The summary draws on approximately three dozen technical reports and notes that document various aspects of the BTES.

Figure 1. A model of classroom instruction



over time in the mind of the student. Test scores are one useful indicator of learning, but they are not learning itself. The model proposed here implies that learning can also be measured more directly and immediately by looking at student behavior in the classroom. Hence, the central element in Figure 1 is student classroom learning. The model further implies that classroom instruction and environment effect student learning by first effecting the observable classroom learning behaviors of the student.

ACADEMIC LEARNING TIME

During the study, we developed a measure of student classroom learning using observable student behavior. This measure of student learning is called Academic Learning Time (ALT) and is defined as the amount of time a student spends engaged in an academic task that s/he can perform with high success. The more ALT a student accumulates, the more the student is learning.

A concrete understanding of the Academic Learning Time concept can be facilitated by considering a practical example.[3] In second-grade mathematics it is common to teach addition. For each pupil, a certain portion of the school day is available for working on addition problems. There is clearly an upper limit on the time available during school hours for the student to work on addition. We refer to this quantity as time allocated to addition. The time may be structured as one continuous block or several segments.

For some of the allocated time, the student will be actively engaged in work on addition; that is, s/he will be paying attention to the addition task. For some of the time, the student will be off task, or unengaged, for a variety of reasons. Since a student can learn only when s/he is in some way paying attention, a measure of learning time should include only time during which the student is engaged. Hence, engaged time represents a somewhat more refined measure of student classroom learning than the time allocated to addition. It includes that part of allocated time during which the student is paying attention.

The match between the task and the student's current knowledge level will also influence the amount learned. If the particular addition task is very difficult for the student and s/he produces few correct responses during the task, the activity will not yield much learning for that student. On the other hand, if the student produces

[3]The focus of this study is on student acquisition of basic skills in reading and mathematics; hence the addition example. However, in prinicple, student learning time relevant to other goals of schooling could be defined and measured.

many correct responses on the task, we hypothesize that learning is occuring. Thus the student's success rate on the task will partially determine the amount of learning.

In the fieldwork, three broad levels of success on a task were identified. High success describes situations where the student has a good grasp of the task and only makes occasional careless errors. If a student does not understand the task and makes correct responses at a chance level, the situation is labeled as low success. Situations that fall between low and high success are defined as medium success. Medium success involves partial understanding, where the student understands enough to produce some correct responses but also commits errors due to limitations in his/her understanding of the task.

The Academic Learning Time (ALT) model proposes that more time spent working with high success leads to increased achievement. However, it does not necessarily imply that all a student's time should be spend in the high success condition, nor does it imply that high success corresponds to little effort on the part of the student. In fact, high success will be attained sometimes with relatively little effort and sometimes with considerable effort. Generally, it is expected that some balance between high and medium success tasks, with somewhat more activities at a high success level, will produce the most student learning. Low success tasks would always be detrimental to learning.

To summarize, time spent by a student engaged on a task that s/he can perform with high success and that is directly relevant to an academic outcome constitutes a measure of student classroom learning. We refer to time spent under these conditions as ALT. The basic components of ALT are allocated time, student engagement, and student high success (balanced with some medium success). The ALT model states that the accumulation of Academic Learning Time will lead to gains in achievement.

INSTRUCTIONAL PROCESSES

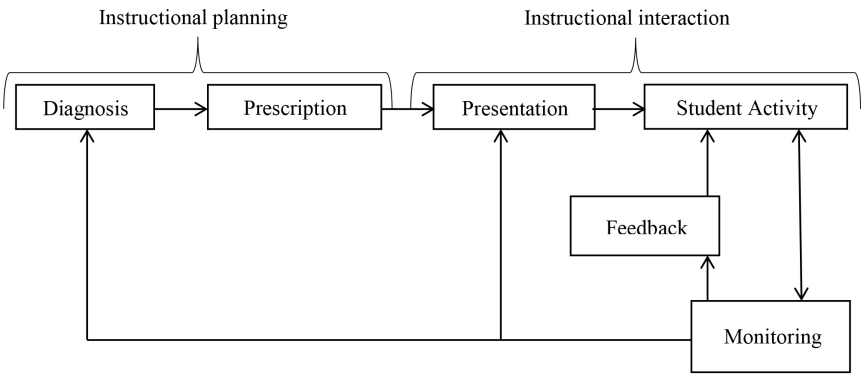
The teaching behaviors that influence student learning can be conceptualized as serving five interrelated functions. These are diagnosis, prescription, presentation, monitoring, and feedback. These functions occur through time in a roughly cyclical fashion, as shown in Figure 2.

The cycle of functions begins with a planning phase. The teacher as organizer and decisionmaker assesses the current knowledge, skill levels, and strengths and weaknesses of the student (diagnosis). S/he can then decide on appropriate instructional goals and activities, grouping and scheduling (prescription). These decisions set the stage for the interaction phase.

The interaction phase begins with the presentation of concepts or learning tasks to the student. The student works on the task, and the teacher monitors the student's responses to know whether the instructional goal is being achieved. Monitoring tells the teacher about the student's state of knowledge or skill during and following an instructional activity. Guided by information from monitoring, the teacher might provide feedback to the student, give additional explanation, or cycle back to the beginning for further diagnosis and prescription.

It is important to realize that each of these functions can be fulfilled by a wide range of different specific behaviors, depending on the classroom organization, the curriculum, or teacher preferences. For example, diagnosis may be accomplished by listening to a child read, talking to a child about what s/he is interested in, watching the way a student works during an independent seatwork assignment, giving formal tests, etc. What all these activities have in common is that they give the teacher information about the student. In this study we did not compare the effectiveness of different behaviors within each function: we did not, for example, look for the best way to diagnose. Instead

Figure 2. Instructional functions in the academic learning time model of classroom instruction



we looked more generally at whether these functions were fulfilled. We considered whether the teacher knew the skill levels of individual students and whether s/he used that information to make reasonable program decisions. We looked at how often the teacher made presentations, monitored, and gave feedback. The model implies that it is important for these functions to be fulfilled, but that there are many acceptable ways to carry them out.

CLASSROOM ENVIRONMENT

Classes may differ widely in such dimensions as enthusiasm, warmth, competitiveness, cooperation, and task orientation. These variables and many others, which are globally referred to as classroom environment, play an important role in instruction. The functional model of teacher processes, depicted in Figure 2, operates within particular classroom environments. Differences in environmental variables may influence Academic Learning Time directly. For example, some teachers value academic pursuits very highly and, hence, provide a classroom environment that has high academic press. This press may tend to raise the general level of engagement in the classroom.

Differences in environmental variables may also affect the relationship between teaching process variables and facets of Academic Learning Time. For example, the specific behaviors constituting feedback might be very different in classrooms where the climate differs in warmth. The behaviors themselves might change, or they might be interpreted differently by students. The difference in warmth would then affect the relationship between feed back and student engagement.

SUMMARY

ALT is an observable measure of ongoing student learning in the classroom. The ALT model of instruction states that the accumulation of ALT represents learning taking place and, therefore, results in increased student achievement. The model also states that teaching behaviors have an impact on student achievement by influencing the facets of Academic Learning Time (time allocation, engagement rates, and success rates). In the model, teaching behaviors are categorized according to the instructional function they fulfill - diagnosis, prescription, presentation, monitoring, or feedback. These functions occur in a cyclical pattern during instruction and each function may be fulfilled by a

number of different behaviors. The model also recognizes the impact of student aptitude and classroom environment on student learning (See Figure 1).

OVERVIEW OF THE FIELD STUDY

The research portion of the Beginning Teacher Evaluation Study culminated in an extensive examination of the Academic Learning Time model.[4] Student achievement in many areas of reading and mathematics was assessed in October and again in December and May. During the interest periods a wide variety of data on teaching behaviors, classroom environments, and student classroom learning behaviors were collected.

SUBJECTS

Volunteer teachers in schools serving middle to lower middle social class communities were recruited for the study. The initial sample included 50 second grade and 50 fifth grade teachers. A specially selected set of subscales from the BTES achievement battery was administered to students in these classes. Classes were selected for the final study sample if six students in the class (usually three boys and three girls) were in the range from the 30th to the 60th percentile in reading and mathematics, based on the total distribution of scores in this sample of classes. The selected students were predicted to show some academic growth but not reach ceiling on the subscales used in the full battery of achievement tests designed for this study (Cahen, 1977). These six target students within a class were subjects of intensive data collection throughout the academic year.

The final sample of teachers included 25 second-grade and 21 fifth-grade teachers, mostly female (about 75 percent), ethnically mixed (over 20 percent nonwhite), and varied in age, years of experience, and teaching style. Attrition, mostly from student mobility, reduced the final sample of target students to 139 in grade two and 122 in grade five. Nonwhite students constituted 40 and 30 percent of the student sample in second and fifth grade, respectively. Target and nontarget students did not differ in measures of socioeconomic status. Approximately half of the sample comprised children of skilled or semiskilled parents; another 16 percent were children of unskilled or unemployed parents.

INSTRUMENTATION AND PROCEDURES

Achievement of the target students in each class was measured with a comprehensive achievement battery in reading and mathematics (Filby & Dishaw, 1976). Each administration of the battery was carried out in four 45-minute sessions, completed over 3 schooldays. Most of the items were of the multiple choice format. Many different content areas of the reading and mathe matics curriculums were represented in the 50 subtests of the second- and fifth-grade batteries. The subtests were combined and reduced to a set of 26 scales for analysis. Selected achievement scales were administered in September of the following year to assess retention. The alpha reliabilities, test-retest reliabilities, and standard errors of the scales were reported by project staff (Fisher et al., 1978) and an independent investigator (Wright & Kim, 1977).

Student attitudes toward reading, mathematics, and school were measured in the second grade by 16 items, using a 3-point response scale. These attitudes were measured in the fifth grade by 24 items, using a 7-point response scale. Alpha reliabilities and standard error of measurement on all three test administrations were acceptable for research purposes (Fisher et al., 1978).

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[4]During the BTES, four separate samples of students and teachers were studies in four sequential years (Phase II, Phase III-1, Phase III-1 Continuation, and Phase III-B). The last of these field studies, conducted during the 1977-78 school year is summarized here. The comprehensive technical report of the study is entitled *Teaching Behaviors, Academic Learning Time and Student Achievement* by Fisher et al., 1978.

Time allocated to reading and mathematics curriculum content categories (e.g., decoding consonant blends, inferential comprehension, addition and subtraction with no regrouping, mathematics speed tests, etc.) was recorded by teachers in daily logs. After training on log keeping procedures, teachers recorded allocated student time per day, per content category, for all the school days between October and May (See Dishaw, 1977 a and b for a description of procedures and summary data on allocated time).

Allocated time, engagement rates, and success rates for the target students were measured by direct observation of the target students by field observers. The observers used a time-based rotating sample procedure, recording data on specially designed optically scorable coding sheets. [Instrument development is described in Marliave, Fisher, Filby, & Dishaw (1977). Data collection procedures and descriptive statistics are documented in Filby & Marliave (1977) and in Fisher, Filby, & Marliave (1977).] In this observation system the activity of each target student is sampled once approximately every 4 minutes. The reading or mathematics curriculum content area was recorded using categories that corresponded to those of the teacher logs described above. The student's engagement (involvement, on-task behavior, attending) or nonengagement with the instructional task was coded. The student's level of success was also categorized. Success was coded high, medium, or low as a function of the particular target student's response to the current task.

Interactive teaching behaviors were also measured as part of the direct observation system. A number of variables associated with the teacher's behavior were coded if, at the moment of observation, the student and teacher were involved in some interaction. Seven interactive teaching behaviors, comprising three general categories, were coded: presentation, including planned explanations, unplanned explanations, and providing structuring or directions; monitoring, including observing student activities and questioning students; and feedback, including feedback about student academic responses and feedback designed to control student attention to the task. These general categories of interactive teacher behavior are three of the five general teaching functions examined in this study and described above.

Observations in a classroom were conducted for a complete day, once each week, for over 20 weeks of the school year from October to May. All observers had prior teaching or research experience. The observers, who were trained intensively for 3 weeks, were responsible for visiting eight classes, once each, over a 2-week period. Thus, each classroom was alternately visited by two different observers, and each observer was responsible for being familiar with the classroom work and behavior of 48 target students. Paired observations were also carried out throughout the data collection period, to provide reliability estimates of the observations (Filby & Marliave, 1977; Fisher, Filby, & Marliave, 1977).

The teacher planning functions (diagnosis and prescription) were assessed from general interviews in the fall and the spring of the year, short weekly interviews, and teachers' predictions of item difficulty for target students. In addition, general characteristics of the class room and the instructional program were rated each week by the field observer. Fifteen scales were used to measure such variables as classroom cooperation, cognitive task orientation, the teacher's clarity of presentation and abruptness toward students, and the teacher's knowledge of subject matter. Extensive preliminary analysis was done to define and select variables for inclusion in relational analyses (Filby & Cahen, 1977, 1978).

The major analysis of these data assessed relationships between (1) facets of Academic Learning Time and student achievement and (2) teaching behaviors and student learning, as measured by ALT and student achievement. Relationships in the data were identified using a number of methodological strategies; however, most of the analyses were cast in the form of the multiple linear regression model (Marliave et al., 1977 a and b; Filby & Cahen, 1977, 1978; and Fisher et al., 1978).

FINDINGS

Fourteen major findings from this field study are organized in two groups. The first set of findings reports relationships between ALT and student achievement. The second set covers teaching processes and classroom environment in relationship to student learning.

ACADEMIC LEARNING TIME AND STUDENT ACHIEVEMENT

> *The amount of time that teachers allocate to instruction in a particular curriculum content area is positively associated with student learning in that content area.*

Teachers who allocate more time to a particular content area of the curriculum have students who achieve at higher levels than teachers who allocate less time to that content area. Very large differences in time allocation were observed between classes. For example, the average amount of time allocated to mathematics in second grade classes varied from 25 minutes per day in one class to 60 minutes per day in another class. In fifth grade reading and reading-related instruction, the average amount of allocated time was found to vary from about 60 minutes per day in some classes to about 140 minutes per day in other classes.

Within reading and mathematics, classes differed in the amount of time allocated to different skill areas. For example, in one second-grade class the average student received 9 minutes of instruction over the whole school year in the arithmetic associated with the use of money. This figure can be contrasted with classes where the average second grader was allocated 315 minutes per school year in the curriculum content area of money. As another example, in the fifth grade some classes received less than 1,000 minutes of instruction in reading comprehension for the school year (about 10 mintes per day). This figure can be contrasted with classes where the average student was allocated almost 5,000 minutes of instruction related to comprehension during the school year (about 50 minutes per day).

The differences in time allocations at the level of "reading" and "mathematics" and at the level of specific subcontent areas are substantial. These differences in how teachers allocate time are related to differences in student learning. Other things being equal, the more time allocated to a content area, the high the academic achievement.

> *The proportion of allocated time that students are engaged is positively associated with learning.*

Allocated time sets an upper bound on the amount of in school learning time a student has. Student nonengagement operates to reduce actual learning time below this upper bound. Within the reading period, for example, students pay attention to the task only part of the time. The percentage of the time that students are engaged is related to learning. Students who pay attention more learn more.

This basic fact is not very startling; without attention, little can be learned. However, the data reveal that the average rate of engagement varies widely across classes and among individual students. For example, during reading and mathematics instruction there were classes that had an average engagement rate of about 50 percent. This means that students were attending to their work only half of the time. In other classes, the average engagement rate approached 90 percent. In other words, two classes might allocate the same amount of time to reading instruction, but one class might have

almost twice as much real engaged learning time as the other. Since engagement rate has been shown to be highly variable across classes and since that variability has been empirically related to achievement, it is possible that increasing engagement rates will lead to increased achievement.

> *The proportion of time that reading or mathematics tasks are perfomed with high success is positively associated with student learning.*

Three rather broad categories, described above, were used in this study to define the difficulty level of the material or activities for individual students: high success, medium success, and low success. Our findings consistently point out the positive effects of school tasks that are performed with high success (i.e., correctly). Other research on instructional design has stressed the importance of high success rates. High success rate in scholastic activities has also been found to be one of the factors that contributes to high levels of student self-esteem.

The average student in the study spent about half the time working on tasks that provided high success. In grade five mathematics, the average was somewhat less - about one-third of instructional time was high success. Students who spent more time than the average in high success activities had higher achievement scores in the spring, better retention of learning over the summer, and more positive attitudes toward school. The idea of success rate is more understandable if one thinks about the cyclical nature of learning. Learning is a process of moving from not knowing to knowing. When new material is introduced the student most likely will not understand completely and will make some errors. Guided practice and/or explanation help the student understand, and s/he comes to make fewer errors. Eventually, the student will perform correctly, although probably with some effort. Learning will become well established and further work will be practice or review; this stage could be viewed as one of consolidation. At some later point, the student knows the material so well that further practice is of minimal value; it is time to move on to something new. Our results suggest that for learning of basic skills in the elementary grades, the stage of successful practice (consolidation) is particularly important to the thorough mastery of concepts and procedures.

Although we have emphasized the importance of giving students ample opportunity for successful practice, we must point out that it would not be desirable for students to spend all of their time on tasks they can perform completely correctly. Common sense suggests that too high a rate of high success work might be boring and repetitive and could inhibit the development of persistence. Probably, some balance between high success and more challenging work is appropriate. Also, we found that older students and/or students who were generally skilled at school learning did not require as high a percentage of time at the high success level. Apparently these students had learned problem solving - how to take a task they did not completely understand and work it out. Such students are able to under take the challenge of more difficult material, as Jong as they eventually experience success.

> *The proportion of time that reading or mathematics tasks are performed with low success is negatively associated with student learning.*

When students worked with materials or activities that yielded a low success rate, achievement was lower. In this study, no teacher assigned a high proportion of materials that were exceptionally hard for students. However some students worked on materials judged to be excessively difficult for them as much as 20 percent of the time. Other students never worked at a low success rate. Students who were observed to spend more

time on excessively difficult material generally learned less than other students. It is seldom, if ever, desirable for elementary level students to be given tasks in which they experience low success.

Increases in Academic Learning Time are not associated with more negative attitudes toward mathematics, reading, or school.

The data from this study revealed that students with high and low rates of allocated and engaged time were equally likely to have positive or negative attitudes toward the subject matter and the school. Educators are naturally concerned about whet her greater than average time in academic pursuits or greater than average rates of attention will result in negative attitudes. In the current study, that did not happen. In fact, there is one consistent, positive trend in the data. It appears that students experiencing high rates of success are somewhat more likely to have an increasingly positive attitude toward reading, mathematics, and school.

Summary. The first five findings are concerned with measures of ongoing student learning and their association with student achievement. Academic Learning Time is an important predictor of student achievement. Allocated time, engagement rate, and success rate on school activities are all associated with student achievement. Students who accumulate more Academic Learning Time generally have higher scores on achievement tests. This means that Academic Learning Time can be interpreted as an immediate, ongoing measure of student learning. Also, students do not generally develop negative attitudes when they have large amounts of Academic Learning Time, and high success may contribute to positive attitudes.

RELATIONSHIP OF INSTRUCTION PROCESSES AND CLASSROOM ENVIRONMENT TO STUDENT LEARNING

Both student achievement and Academic Learning Time are measures of student learning. The next question is: What impact do teaching behaviors and characteristics of the classroom environment have on student learning? Student achievement, engagement rate, and success rate were all used as measures of aspects of learning. Measure of the five teaching functions and of classroom environment were related to these outcome measures. This section reports major findings.

The teacher's accuracy in diagnosing student skill levels is related to student achievement and Academic Learning Time.

Teachers were asked to predict how their students would do on certain test items used in the achievement battery. This accuracy in predicting student performance was used as a measure of the teacher's diagnostic ability. A positive relationship was found between a teacher's diagnostic ability and the reading and mathematics achievement of students. Diagnostic ability probably relates to student achievement by working, in part, through student Academic Learning Time. The teacher's diagnostic ability was negatively related to low success rate (that is, the better the teacher was as a diagnostician, the less likely s/he was to prescribe materials that were extremely difficult). The diagnostic ability of the teacher was also positively related to student engagement. Among teachers in this sample, the better diagnosticians generally had students who showed higher rates of engagement. The evidence, although not always consistent, suggests that improving the teacher's ability to make an accurate assessment of student performance would have positive effects on student learning.

The teacher's prescription of appropriate tasks is related to student achievement and student success rate.

The classroom observers in this study rated the "appropriateness" of instruction in the classes they examined. In making these ratings, they were asked to think about how reasonable the instruction was for those particular students; that is, whether the instruction generally matched the needs and skill levels of individual children. This rating of appropriateness generally was positively related to achievement. Appropriateness in prescribing learning activities probably relates to student achievement partly because of the relationship between appropriateness and Academic Learning Time. Appropriateness of prescription was related to the proportion of time students had low success on their work: higher ratings of appropriateness were always associated with less frequent occurrences of very hard material.

More substantive interaction between the student and an instructor is associated with higher levels of student engagement.

Substantive interaction between teachers and students consisted of presentation of information on academic content, monitoring of work, and feedback about performances. Most student-teacher interaction took place in a group setting with only a small part of such interac tion occurring during seatwork as one-to-one "tutoring." Students who spent more time in a group setting had higher rates of engagement. When group time was characterized by high levels of substantive interaction (as opposed to organizational tasks or waiting for others), engagement rates were higher during groupwork and during seatwork. When students received more contact with an instructor during seatwork, engagement rates were higher in seatwork. Engagement rates were especially low when students spent two-thirds or more of their time in seatwork and had little interaction with an instructor. The use of aides, parent volunteers, cross-age tutors, and peer tutors increases the amount of interactive instruction and can be presumed, therefore, to keep engagement rates higher. Thus this finding has implications for class size, individualized instruction, use of aides, and grouping practices. Those allocations of resources and those organizational arrangements that allow for more substantive interaction between instructor and student will be preferred because of the positive association of substantive interaction with student engagement.

Academic feedback is positively associated with student learning.

Academic feedback was defined as information given to the student about whether his or her answers were right or wrong. Many different specific behaviors ful filled this function, including answering questions in class, checking papers, using programmed texts, and lis tening to oral reading. The percentage of instructional time during which the student received feedback was positively related to student engagement rate and to achievement. Hence more academic feedback may lead to higher engagement and achievement.

Structuring the lesson and giving directions on task procedures were positively associated with high student success.

Teachers who gave directions more often and spent time discussing the structure of the lesson had students who showed a greater rate of high success. Anecdotal reports suggest that students sometimes do not know what they are supposed to be doing or how

they are supposed to mark a particular worksheet. Clarifying activities by the teacher can help raise student achievement by affecting the high success rate component of ALT.

Explanation specifically in response to student need is negatively associated with high student success.

One teaching behavior provided explanation in response to student need. This occurred when a student did not understand something and the teacher explained it to him. Most explanation-need occurred during seatwork. Students who received more explanation in response to need tended to have fewer high success tasks and more low success tasks. From a slightly different perspective, a student who had more need received more explanation in response to need. Apparently, though, the explanation did not solve the problem since, in the long run, the student had little high success. Frequent need for explanation may be a signal that changes are needed in the student's instructional program, either in the difficulty of the assignments or in preparation for seatwork.

More frequent reprimands for inappropriate behavior are negatively associated with student learning.

The study examined the impact of task engagement feedback or "information given to the student about whether his behavior was acceptable or unacceptable." Usually task engagement feedback amounted to a reminder to the student to get back to work. Such reminders were given more often to students who were off-task more often. They were also given more often to students for whom some tasks were excessively hard. It may be that some students are sometimes unable to do tasks they have been assigned, so they do not work, and the teacher then reprimands them for not working. Students who received more frequent reprimands also tended to show less growth on achievement tests. It is hard to imagine teaching without reminding students of the rules for acceptable behavior. However, the need for frequent reminders may be a sign of trouble.

The teacher's value system is related to ALT and to student achievement. Teacher emphasis on academic goals is positively associated with student learning.

Classes judged to have high emphasis on academic performance typically showed high levels of achievement. More of the unusually high-achieving classes, as opposed to the unusually low-achieving classes, had teachers characterized by a strong academic orientation. These classes were not necessarily "cold" or unconcerned with student feelings. They did, however, emphasize the importance of school learning. In contrast, some classes were primarily oriented toward affective outcomes, such as student attitudes and feelings. In these classes, less time was allocated to academic instruction, student engagement rates were lower, students were more likely to be given low success tasks, and students achievement was therefore lower. Nothing in these data suggests that classes should be free of affect -quite the contrary. But the evidence is clear that when teacher attention to aca demic instruction is substantially reduced, students achieve less.

A learning environment characterized by student responsibility for academic work and by cooperation on academic tasks is associated with higher achievement.

In classes where students took responsibility for their classwork and belongings and where students helped each other, shared materials, and worked together, achievement was generally higher. Descriptions of specific classes indicated that this relationship

held most often when there was a high level of academic focus in the classroom. In other words, where students worked together to reach academic goals and where they took responsibility for achieving them, achievement was higher. Cooperation and student responsibility in non-academic pursuits did not have this effect.

SOME IMPLICATIONS

In this section we go beyond the major findings and discuss possible implications of the study. Our goal is to underline those issues we believe to be important for elementary education and to integrate the objective results with belief based on experience. The study used correlational methodology and, therefore, we have demonstrated no casual relationships. In this section, we make strong inferences in translating the findings into statements that can be applied to elementary school teachers and students in general.

ACADEMIC LEARNING TIME AND ACHIEVEMENT

A major finding of the study is that increases in Academic Learning Time are associated with increases in student achievement. The practical importance of Academic Learning Time in relationship to achievement is illustrated by an example from our analysis of grade two reading instruction. Consider a grade two student whose October reading score was average for the sample of students in the study (50th percentile). If this student experiences the average amount of Academic Learning Time (573 minutes total, or 23 minutes per day in reading), the student can be expected to show average reading achievement in December (50th percentile again). It is important to note that the "average" student with "average" Academic Learning Time does show considerable learning in terms of predicted raw scores. If this average student experiences only 4 minutes per day of Academic Learning Time (100 minutes total for the interest period), then s/he would be expected to show almost no change in raw score and would decline considerably in relative terms (50th percentile in October, 39th percentile in December). If the same student experiences very large amounts of Academic Learning Time, say 52 minutes per day, the s/he could be expected to show considerable improvement in reading achievement relative to the other students in the study (50th percentile in October, 66th percentile in December). Thus, the student with large amounts of Academic Learning Time benefits substantially. Note that the December score is an "expected" score. That is, the average December score will equal this expected score for a large group of students. However, for a specific student the actual score will vary considerably around the expected score.

It may appear that this range from 4 to 52 minutes per day is unrealistically large. However, these times actually occurred in the classes in the study. Furthermore, it is easy to imagine how either 4 or 52 minutes per day of Academic Learning Time might come about. If 50 minutes of reading instruction per day is allocated to a student who pays attention about a third of the time, and one-fourth of the student's reading time is at a high level of success, the student will experience only about 4 minutes of engaged reading at a high success level. Similarly, if 100 minutes per day is allocated to reading for a student who pays attention 85 percent of the time, at a high level of success for almost two-thirds of that time, then s/he will experience about 52 minutes of Academic Learning Time per day.

THE LEARNING STUDENT

A student who accumulates large amounts of Academic Learning Time may be characterized as follows. First, the learning student works on an academic task that is designed to result in increased knowledge or skills. The amount of time that the student spends in a given knowledge or skill area is directly and positively related to learning in that area. Furthermore, this appears to be as true for the more conceptual knowledge

areas (comprehension) as it is for the more basic skill areas (decoding). Therefore, the learning student spends relatively great amounts of time working on tasks that are directly related to the subject matter to be learned.

The learning student is also very attentive. S/he is actively involved in the task at hand, probably with some enthusiasm. The learning student is busy performing the academic part of the task, rather than sharpening pencils, looking for a book, or waiting in line to ask the teacher a question. S/he is not "socializing" or day dreaming. Nevertheless, the student is enjoying the activity and paying attention for relatively long periods of time does not upset the student.

The learning student spends a lot of time practicing and reviewing skills. S/he undertakes an activity related to a new skill only after thoroughly learning skills prerequisite to the new skill, so s/he virtually never encounters an activity that is really entirely "new." There is always some need for consolidation of acquired skills (practice) but as the student advances, s/he actually "learns how to learn": it becomes easier to acquire newer skills without so long a period for consolidation of prerequisite skills.

A major conclusion is that this "learning student" is not necessarily an unhappy student. The learning student does not learn to dislike learning. We do not find any evidence that students are less satisfied when the sheer quantity of work (allocated time) is relatively great. Furthermore, we do not find that students who pay more attention (work intensively) acquire a distaste for learning. In fact, there is some indication that high attention is usually the result of interest and enthusiasm, rather than coercion, so high rates of attention represent a more positive attitude toward learning.

It is interesting to note that the high success component of learning is associated with more positive student attitudes. Successful students probably enjoy learning more because of their success. Failure, even when it is only occasional, appears to result in a more negative attitude among elementary school students.

To some extent, the characteristics of the learning student are under the direct control of the teacher. Teachers make decisions about what to teach and how much time to spend on a particular goal. The ALT model implies that these decisions are very important. Teachers should be aware of how much time is really being spent on different skill areas. Classroom time is limited, so teachers should be careful to spend time on those activities that they consider the most important. If some skills are particularly important for students, it would be reasonable to spend large amounts of time on those skills.

The student's success rate is also largely under the direct control of the teacher. As teachers assign tasks to students, they should try to match the task to the student's skill level, thereby providing frequent high success. This strategy is particularly promising at earlier grades and for less advanced students. Note that there have been previous advocates of this approach (programmed learning and mastery learning). However, many teachers probably do not recognize the extent to which less advanced students need practice and review.

EFFECTIVE TEACHING

Diagnosis. The data support the conclusion that diagnosis is an important part of effective teaching. Students learn more when teachers know more about what their individual students can and cannot do.

In this studynwe were primarily interested in cognitive achievement. To foster cognitive achievement, it is important for the teacher to know the cognitive skills and level of performance of individual students. To measure teacher diagnostic skills, we asked teachers to predict how their students would do on representative items from the

BTES test battery. Students learned more when their teachers were more accurate in predicting performance.

Teachers were more accurate in predicting cognitive performance when they knew more about the subject matter and when they attended to differences between students. Teachers who can make accurate diagnoses have established a foundation for instructional planning.

Prescription. Prescription refers to the process of deciding what students may work on in the classroom. It is a complex area to describe and evaluate. The major positive factor in this area was the "appropriateness" of the instructional program for the needs of the students. This variable represents the integration of the two planning functions, diagnosis and prescription. It assesses the extent to which teachers use their knowledge of individual students to prescribe apparently reasonable instructional programs, matched to the needs of students. Appropriateness was related to success rate and to achievement.

Our measure of appropriateness was a rating made by trained field workers based on interviews and extensive observation. Field workers were asked to consider the pacing of instruction - whether faster students could move ahead while slower students received extra help. They were asked to consider student success rate. They were given a hypothetical example of appropriateness - that the teacher might notice a student's interest in mathematical puzzles and bring in some additional materials that the student might be interested in - and an example of inappropriate instruction - the teacher having all students in the same reading book regardless of clear differences in reading skill.

Field workers were also asked to give the reasons for some of their ratings. The most salient dimension in second-grade classes appeared to be flexibility of grouping. When noting instances of appropriateness, field workers often commented that the teacher would "regroup students according to needs" or that a student who was doing particularly well or particularly poorly was moved to another group. For grade five classes, this same dimension appeared, but fieldworkers also seemed to attend to the overall organizational structure of the class. Individualized programs in grade five tended to be rated relatively high on appropriateness.

The definition of "appropriate" used for the ratings was fairly broad and general. It assesses not whether each student was given the best instruction for his or her needs (something that would be impossible to determine), but instead whether the program appears to be reasonable for the different students in the class.

Presentation. Presentation skills appear to be useful for increasing student engagement in mathematics. Teachers tend to explain concepts more often in mathematics than in reading (the term "explain" is used broadly here; demonstrating the steps involved in an addition problem would be considered explanation). Students pay attention more in mathematics when they receive more frequent planned presentation of concepts in a group setting. They also pay attention more when the teacher spends time discussing the goals or structure of the lesson and/or giving directions about what the students are to do. Perhaps, because of the tendency to give relatively more seatwork in math than in reading and because of the variety of problems to work, it is important that students know both what the context of the lesson is and what they are to do. Then they become more involved in the task. In both reading and math, students tend to make fewer errors on daily tasks when teachers spend more time structuring the lesson and giving directions. It seems critical that students understand what they are supposed to do so that they can respond correctly. Descriptions of particularly successful classes often mentioned that the teacher had a regular routine of beginning each lesson with a

presentation in a group setting. The teacher would tell the students what they were going to work on, make sure all students understood the assignment, and go over examples where appropriate.

One kind of presentation was consistently associated with less high success and more low success: explanation of academic content specifically in response to student need. Students who made more errors and did not understand classroom assignments received more explanation specifically in response to need. In short, students who needed help, got help. Although this seems reasonable, teachers should be wary of over-reliance on this technique. Explanation should increase understanding and increase the overall frequency of high success. In our classes, this did not always happen. The danger is that explanation-need is too little, too late. Frequent use of explanation-need might best be interpreted as a symptom that the success level or pacing of instruction is inappropriate for the student. Major changes in the tasks might be in order.

Monitoring. Monitoring is keeping track of student progress on instructional tasks. The major form of monitoring that we observed was teacher questioning in a group setting. Teacher questions account for about one third of the interactive, substantive instruction that takes place. Students pay attention more when they are more often involved in substantive interaction, and teacher questions are an important part of that process. They involve the students in the interaction and give the teacher information about what the students understand.

The term monitoring can also be used to refer to the teacher behavior of circulating around the room during seatwork, checking on how students are doing. We found that a teacher rarely stops to observe a student's work without making some comment, providing feed back or explanation. When a student receives this kind of attention from an instructor during seatwork, s/he pays attention more. Thus, it is a good idea to monitor seatwork by going around the room giving help or feedback as frequently as possible. Descriptions of high achieving classes suggest that good teachers do this not only to keep students on task, but also to find out as much as they can about how students are doing so they can plan further instruction.

Feedback. One particularly important teaching activity is providing academic feedback to students (letting them know whether their answers are right or wrong, or giving them the right answer). Academic feedback should be provided as often as possible to students. When more frequent feedback is offered, students pay attention more and learn more. Academic feedback was more strongly and consistently related to achievement than any of the other teaching behaviors.

Academic feedback as defined in the observation system includes many different behaviors. We do not know at this point what types of feedback might be more valuable than others. We can at least suggest some of the possibilities.

As defined in this study, feedback is the major component in group interaction. Much classroom interaction follows a question-and-answer or recitation format: the teacher asks a question; a student answers the question. Presumably, when the teacher asks a question all students are supposed to think of an answer. When some student gives an answer orally, each student gets feed back on his or her internal answer. So, when one student gave an answer aloud, our observers considered it feed back to students listening to the answer. It can also be thought of as a form of "modeling." This kind of feedback within group interaction is an important way to encourage student attention as well as teach content.

Some classes that we observed had a regular routine of meeting as a group to check answers on group assignments. One fifth-grade math class had regular home work assignments and spent the first part of each day going over them. Presumably, students are more likely to complete tasks when they know they will be held accountable.

An oral reading circle was also a situation we defined as involving high levels of feedback. Much like the recitation sequence, oral reading was considered feedback to a student who was reading along silently. The teacher might also correct errors, thus providing feedback to all students. This important purpose for oral reading should be kept in mind.

Noncredentialed instructors such as aides, volunteers, and peers can provide feedback. To plan instruction, choose learning tasks, or explain concepts requires some skill as an instructor, and probably some training. But anyone who knows the answer to a problem can tell a student whether an answer is right or wrong, or give the answer to the student. Since an important part of learning is responding and receiving feedback, all classroom personnel should be used wherever possible to provide feedback.

Feedback can also come from the curriculum materials rather than a human instructor. Programmed texts are organized to provide immediate feedback. The curriculum also provides feedback when students check their answers in the back of the book or with an answer key. Feedback from the curriculum was not frequent in our classes, but it could be an important way to increase the amount of feedback students receive.

In addition to academic feedback, we also looked at task engagement feedback - feedback to the student about whether classroom behavior was acceptable or unacceptable. Most of the task engagement feedback we observed turned out to be negative, such as reminders to students to get back to work when they were off task. We found no evidence that frequent use of such reprimands had any positive effect. It may be that some well-timed and well-phrased reminders are useful, but when task engagement feedback becomes frequent it is a sign that some structural changes are needed. There is an important lesson here for teachers who use these findings to increase student engagement: Scolding students more often is not the answer. Instead, one might (l) check to see that tasks are not too hard for the student (task engagement feedback was positively correlated with low success rate), (2) increase the clarity and emphasis with which expectations are stated and the consistency with which students are held accountable, or (3) increase the amount of substantive interactive instruction.

A final comment comes from descriptions of high achieving classes. These classes tended to have some type of positive reward system. Good work was rewarded. Such rewards were not frequent, but students had some sense, formal or informal, of what they had to do to get them. There seems to be value in reward systems that acknowledge major learning events; they give the student recognition for working and for succeeding.

Context. Schooling has many different purposes. One purpose is cognitive learning. Others might be develop ing independent work habits, learning social interaction skills, feeling good about oneself, enjoying work, appreciating the fine arts, or keeping students off the street. Most teachers value and work toward a number of different outcomes. Because the study focused primarily on cognitive outcomes, we cannot fully evaluate classroom instruction. Our data do point out, though, that choices must be made and that teachers should be aware of the choices they can and do make.

Two of the general variables in the study described the focus or orientation of the teacher. One was academic orientation - the extent to which the teacher emphasized, valued, and worked toward cognitive achievement. The other was orientation toward affect - the extent to which the teacher was aware of, acknowledged, and valued student feelings.

Examining these variables in relationship to student engagement and student achievement reinforced the old maxim, “first things first.” If the teacher’s goal is to have every student show substantial growth on basic skills, then it is important that the teacher show his or her commitment to achieving that goal. The teacher must be willing to allocate classroom time to academic instruction and must communicate to the

students the belief that academic learning is important. The teacher must be willing to make a personal effort to reach that goal.

Some teachers in our study placed primary emphasis on affective outcomes - music, personal development, and good feeling. Under these conditions, both ALT and achievement were relatively low. Many teachers give first priority to academic instruction, but also consider student feelings and value human development. There were examples in both grades of teachers who made a sincere effort to provide competent academic instruction and also to take into account student interests and human feelings. Often these classes were in the middle range of ALT and of achievement.

Another context variable, "learning environment," needs to be considered. This variable was a composite of two ratings - one on "cooperation," the other on "student responsibility." Especially in grade two, classes higher on learning environment tended to have higher achievement. Both components, cooperation and student responsibility, contributed to this effect. When students worked together to reach academic goals and when they took responsibility for achieving them, achievement was higher. Cooperation and student responsibility in nonacademic pursuits did not have this effect.

An image of a model class could be constructed from these results: there is a clear focus on cognitive learning; the students expect to work and are held responsible for doing so; the teacher cares about the students and wants to help them learn; teacher and students interact comfortably and frequently on work activities. In other words, it is a class where the teacher emphasizes the belief that the purpose of school is learning and fosters an environment where everyone, teacher and students, works together to reach that goal.

USE OF THE ALT MODEL

Teaching is a complex process. The ALT model tries to deal with the reality of teaching. It is therefore a complex model. It is intended to provide a coherent, general framework for analyzing and describing the teaching learning process. We think this makes the model widely applicable to many approaches to elementary school teaching.

It would be appropriate to use the model as a basis for observing, analyzing, and discussing ways to teach. Teachers and prospective teachers might benefit from a chance to examine the concepts in the ALT model and to use them for systematic observation in a variety of classes. A chance to watch the learning student would be particularly valuable, since teachers lose sight of the individual student learning process when they must manage an entire class. If different instructional approaches were observed, teachers could analyze the different ways in which the five teaching functions of the model were (or were not) fulfilled.

Teachers studying the ALT model would have to understand it as a framework both for student and teacher behaviors. Academic Learning Time provides the student behavior framework. Since Academic Learning Time occurs simultaneously with instruction itself, it provides an individual student variable for assessing the impact of instruction. Therefore, Academic Learning Time is of potentially great value as an information tool to be used by teachers in the evaluation of their daily instruction. An awareness of the Academic Learning Time for an individual student, or the profile of Academic Learning Time across students in a class, may help a teacher decide when to intervene in an instructional sequence and what to change. This framework provides an observable in-class criterion that can even guide minute-to-minute instructional decisions.

The ALT framework for teacher behaviors categorizes these behaviors in terms of the general functions they serve in instruction. When specific teaching behaviors are analyzed at a molecular level, the impact of each behavior is unstable over even relatively small changes in context. The same behavior may serve different functions,

and different behaviors may serve the same function, depending on the context. This implies that there is no one specific behavior that will be essential to the performance of any given function.

This functional view of teaching behavior has considerable implication for the practice of teaching. Certainly teachers need a repertoire of specific teaching behaviors, but they must also have a good grasp of the functions that specific behaviors fulfill in a given context. Teachers who are aware of teaching functions will be able to conceptualize their classroom behavior in terms of this more general framework. They will be able to evaluate what they are doing in terms of instructional functions that should be served. Furthermore, they will be able to recognize what they are not doing, in terms of functions that are not served by any of their usual behaviors. Hence, where Academic Learning Time provides a basis for determining when students are or are not learning, the five teaching functions provide a basis for analyzing the strengths and weaknesses of the instructional process.

TEACHING AS MANAGEMENT: SEEKING A WORKABLE AND DYNAMIC BALANCE

To apply the BTES model to typical classroom in struction, a broad view of teaching is needed, one that emphasizes the teacher's role as a manager of instruction. Furthermore, it must be recognized that this management role varies enormously as a function of the instructional situation. That is, to teach one student something, a teacher can learn about that student in depth, work directly with the student on relevant tasks, model desired behavior, give constant feedback, and provide timely and appropriate explanation. With a class of 30 students, however, this kind of one-to-one teaching is an infrequent luxury. Instead, the teacher must try to plan generally reasonable activities for the different students in the class and keep everything moving along as well as possible. The teacher cannot consider each student in isolation, but must manage instruc tion for all students simultaneously. A dynamic balance between individual and group needs is required.

The ALT model can be thought of in terms of two competing goals: student engagement and student high success. The data show that student engagement rates are higher when students have more contact with an instructor. Increasing the number of teaching personnel (aides, volunteers, peer tutors, etc.) is a good way to increase the amount of interactive instruction a child receives. If the number of person nel (per pupil) is fixed, the amount of interaction can only be increased through increasing the amount of group instruction. At the extreme, this means whole class instruction, which has the advantage of efficiency and ease of classroom behavior management. The teacher can give directions to everyone at once, keep an eye on what students are doing, monitor academic performance more easily, and give group feedback. This usually results in increased student engagement.

The problem with large group instruction is that the same task is seldom appropriate for all students in the class, at least not for very long. The findings for student rate of high success, and related findings on diagnosis and prescription, show the importance of matching tasks to individual student needs. Especially when students are low in entering knowledge or school learning skills, it is important for them to have enough successful practice time to master the material. This means that the instructional program must, to some extent, provide different tasks for different students and allow different amounts of practice. "Individualized" programs emphasize the goal of appropriate instructional content and pacing for each individual. In the extreme, each student might be working on a different task at any point in time. Therefore, the teacher cannot give directions

or feedback efficiently in person; these functions are usually built into the curriculum system. Some students may react to these independent seatwork settings and the lack of interactive contact by being less attentive.

Probably, for most classes and most teachers in the elementary grades, it will not be suitable to use one organizational pattern for the entire day. That is, constant whole class instruction will probably not provide sufficiently appropriate content for all students. On the other hand, constant independent seatwork in individualized programs will probably be too difficult to manage efficiently while maintaining engagement. Small group work is a useful compromise for individualizing content in a reasonabe way, maintaining efficiency and engagement, and providing social experience. Even here, the same students will probably not fit in the same groups for all instructional content. Furthermore, it will not be possible for all students to spend all of their time working in groups. The teacher must devise some workable system using different settings (groupwork seatwork) for different students in different content areas at different times during the day, and keep the whole system adaptable to changes in student needs during the year.

In sum, the teacher must try to balance conflicting goals, taking into account the needs of the class as a whole, as well as the needs of individual students. There is not one "right" way to organize the instructional program. Different approaches have different assets and liabilities. By keeping in mind the joint goal of student attention and high student success, the teacher can evaluate the current organizational structure and adapt it over time. ■

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