Teaching Functions in Instructional Programs [1]

BARAK ROSENSHINE [2]
University of Illinois at Urbana-Champaign

In the past 5 years our knowledge of successful teaching has increased considerably. There have been numerous successful experimental studies in which teachers have been trained to increase the academic achievement of their students. In these studies, which have taken place in regular classrooms, one group of teachers received training in specific instructional procedures, and one group continued their regular teaching. In the successful studies the teachers implemented the training, and, as a result, their students had higher achievement and/or higher academic engaged time than did students in the classrooms of the untrained teachers. Particularly noteworthy studies include:

Texas First Grade Reading Group Study (Anderson, Evertson, & Brophy 1979, 1982),
Missouri Mathematics Effectiveness Study (Good & Grouws 1979) (for math in Grades 4-8),
The Texas Elementary School Study (Evertson, Emmer, Sanford, & Clements 1982),
The Texas Junior High School Study (Emmer, Evertson, Sanford, & Clements 1982),
Organizing and Instructing High School Classes (Fitzpatrick 1981, 1982),
Exemplary Centers for Reading Instruction (ECRI) (Reid 1978, 1979, 1980, 1981, 1982) (for reading in Grades 1-5),
Direct Instruction Follow Through Program (Distar) (Becker 1977).

For example, in the study by Good and Grouws (1979) 40 teachers (Grades 4-8) were divided into two groups. One group of 21 teachers received a 45-page manual which contained a system of sequential, instructional behaviors for teaching mathematics. The teachers read the manual, received two 90-minute training sessions, and proceeded to implement the key instructional behaviors in their teaching of mathematics. The control teachers did not receive the manual and were told to continue to instruct in their own styles. During the 4 months of the program all teachers were observed six times.

The results showed that the teachers in the treatment group implemented many of the key instructional behaviors and, in many areas, behaved significantly differently from the teachers in the control group. For example, the treatment teachers were much higher in conducting review, checking homework, actively engaging students in seatwork, and making homework assignments. The results also showed that the test scores in mathematics for students of the treatment teachers increased significantly more than did the scores for students of the control teachers.

Fitzpatrick (1982) conducted a similar study involving ninth-grade algebra and foreign language. Twenty teachers were divided into two groups, and the treatment group received a manual explaining and giving teaching suggestions on 13 instructional principles. The treatment group met twice to discuss the manual. All teachers were observed five times

---

[1] . *The Elementary School Journal,* Volume 83, Number 4, march 1983.
[2] . This paper was prepared initially for a conference entitled Research on Teaching: Implications for Practice, sponsored by the National Institute of Education, at Airlie House in Warrenton, Virginia, February 25-27, 1982.

in one of their classrooms.

The results showed that the treatment teachers implemented many of the principles more frequently than did the control teachers. For example, the treatment teachers were higher in attending to inappropriate student behavior, commanding attention of all students, providing immediate feedback and evaluation, having fewer interruptions, setting clear expectations, and having a warm and supportive environment. In addition, overall student engagement was higher in the classrooms of the treatment teachers.

The other programs cited above were similar to these two. I would urge educators to use the manuals and training materials from these programs in preservice and in-service training. Four of the manuals are useful for general instruction (Emmer et al. 1982; Evertson et al. 1982; Fitzpatrick 1982; Good & Grouws 1979). The manual by Anderson et al. (1982) is oriented primarily toward instruction in elementary reading groups, and the programs by Reid (1978-1981) and by Engelmann (Becker 1977) include both general instructional methods and highly specific procedures for teaching reading.

The purpose of this paper is to study these successful teacher training and student achievement programs and identify the common functions which appear across these programs. These teaching functions form a general model of effective instruction, which will be discussed below. The model is also useful as a heuristic; it aids in thinking about teaching and suggests areas for future research.

An overview of effective instruction

The studies cited above, as well as the correlational studies which preceded them, indicate that, in general, students taught with structured curricula do better than those taught with more individualized or discovery learning approaches. Furthermore, students who receive their instruction directly from the teacher achieve more than those expected to learn new material or skills on their own or from each other. In general, to the extent that students are younger, slower, and/or have little prior background, teachers are most effective when they:

- structure the learning;
- proceed in small steps but at a brisk pace;
- give detailed and redundant instructions and explanations; provide many examples;
- ask a large number of questions and provide oven, active practice;
- provide feedback and corrections, particularly in the initial stages of learning new material;
- have a student success rate of 80% or higher in initial learning;
- divide seatwork assignments into smaller assignments;
- provide for continued student practice so that students have a success rate of 90%-100% and become rapid, confident, and firm.

It is most important that younger students master content to the point of overlearning. Basic skills (arithmetic and decoding) are taught hierarchically so that success at any level requires application of knowledge and skills mastered earlier. Typically, students are not able to retain and apply knowledge and skills unless they have been mastered to the point of overlearning — to the point where they are automatic. The high student success rates seen in classrooms of effective teachers and programs are obtained because initial instruction proceeds in small steps that are not too difficult and also because teachers see that students practice new knowledge and skills until they are overlearned (Brophy 1982).

Overlearning basic skills is also necessary for higher cognitive processing. In a discussion of beginning reading, Beck (1978) noted that data support the position that the brain is a limited-capacity processor and that, if a reader has to spend energy decoding a word (whether through phonics or context), there is less energy available to comprehend the sentence in which the word appears. Similarly, Greeno (1978) noted that mathematical problem solving is enhanced when the basic skills are overlearned and become automatic. In simpler terms, successful learning requires a large amount of successful practice.

Surprisingly, these general procedures also work for older, skilled learners. As part of an introductory physics course at Berkeley for students with interests in biology and medicine, Larkin and Reif (1976) developed a program to teach the skills of studying scientific texts. The experimental students read the material, answered questions, and received ancillary instruction when they made errors so that ultimately all students mastered the material. Later in the course, all students read new material on marketing and new material on gravitational force and answered questions on each passage. Students who received direct instruction in studying scientific text performed better than the controls on each set of material. Larkin and Reif (1976, p. 439) concluded: "Providing direct instruction in a general learning skill is a reliable way to help students become more independent learners. The results described here indicate that students do *not* automatically acquire a learning skill merely through experience in a subject matter. To enhance independent learning, learning skills should be taught directly". The instructional procedures for teaching these physics students were quite similar to those described for young learners. The primary differences were that the size of steps was larger, and there were fewer questions.

Thus, across a number of studies we find *(a)* a general pattern of effective instruction; *(b)* an advantage to direct, explicit instruction — even explicit instruction in becoming independent learners; and *(c)* the importance of overlearning, particularly for hierarchically organized material.

Teaching functions

Putting together ideas from all the studies cited in the first paragraph of this article, I developed the list of six instructional "functions" which appear in table 1:

1. Review, checking previous day's work (and reteaching if necessary).
2. Presenting new content/skills.
3. Initial student practice (and checking for understanding).
4. Feedback and correctives (and re-teaching if necessary).
5. Student independent practice.
6. Weekly and monthly reviews.

These functions are presented in more detail in table 1 and will be discussed in the remainder of the paper. There is no hard, fast dogma here. It is quite possible to make a reasonable list of four or six or eight functions; however, these functions are meant to serve as a guide for discussing the general nature of effective instruction.

There is some difference in the time teachers spend on these functions in lower and upper grades. In the lower grades, particularly in reading and math, the amount of time spent presenting new material is relatively small, and much more time is spent in student practice (through teacher questions and student answers). In later grades, the time spent in presentation becomes longer, and the teacher-directed practice becomes shorter.

1. Daily review and checking previous work

The goal of the review at the start of the lesson is making sure that the students know the prerequisite skills for the day's lesson. Activities include: teacher reviewing the concepts and skills necessary to do the homework; having students correct each other's papers; giving the teacher feedback on homework items where the students had difficulty or made errors; and reteaching or providing additional practice where necessary.

There are many ways in which this function can be carried out: the teacher can ask questions, students can check each other's papers, and students can reteach each other. However, the important point is that the function is carried out — particularly if the instruction is hierarchical. In elementary grades, this function occurs when the teacher reviews word lists, word sounds, number facts, and mathematical procedures.

The idea of beginning a lesson by checking the previous day's assignment appears in the experimental study of Good and Grouws (1979) and is found again in the work of Emmer et al. (1982). Each of these programs was designed for Grades 4-8. In primary grades, such checking and reteaching are explicitly part of the Distar program (Becker 1977) and the ECRI program (Reid 1978).

One would think that daily review and checking of homework are common practices. Yet, in the Missouri Math program (Good & Grouws 1979), where daily review was included in the training manual given to the treatment teachers, the treatment teachers conducted review and checked homework 80% of the time, whereas the control teachers did this only 50% of the time.

TABLE 1.
Instructional Functions

1. Daily review, checking previous day's work, and reteaching (if necessary):
Checking homework
Reteaching areas where there were student errors

2. Presenting new content/skills:
Provide overview
Proceed in small steps (if necessary), but at a rapid pace
If necessary, give detailed or redundant instructions and explanations
New skills are phased in while old skills are being mastered

3. Initial student practice:
High frequency of questions and overt student practice (from teacher and materials)
Prompts are provided during initial learning (when appropriate)
All students have a chance to respond and receive feedback
Teacher *checks for understanding* by evaluating student responses
Continue practice until students are firm
Success rate of 80% or higher during initial learning

4. Feedback and correctives (and recycling of instruction, if necessary):
Feedback to students, particularly when they are correct but hesitant
Student errors provide feedback to the teacher that corrections and/or reteaching is necessary
Corrections by simplifying question, giving clues, explaining or reviewing steps, or reteaching last steps
When necessary, reteach using smaller steps

5. Independent practice so that students are firm and automatic
Seat work
Unitization and automaticity (practice to over-learning)
Need for procedure to ensure student engagement during seatwork (i.e. teacher or aide monitoring)
95% correct or higher

6. Weekly and monthly reviews:
reteaching, if necessary

Note
With older, more mature learners *(a)* the size of steps in the presentation is larger, *(b)* student practice is more covert, and *(c)* the practice involves covert rehearsal, restating, and reviewing (i e., deep processing or "whirling").

2. Presentation of material to be learned

All teachers, of course, do demonstration. But recent research in Grades 4-8 has shown that effective teachers of mathematics spend *more time* in demonstration than do less effective teachers (Evertson, Emmer, & Brophy 1980b; Good & Grouws 1979). For example, Evertson et al. (1980b) found that the most effective mathematics teachers spent about 23 minutes per day in lecture, demonstration, and discussion, compared with 11 minutes for the least effective teachers. The effective teachers are using this additional presentation time to provide redundant explanations, use many examples, provide sufficient instruction so that the students can do the seatwork with minimal difficulty, check for student understanding, and reteach when necessary.

What does one do in effective demonstration? Summarizing ideas from the research review of Brophy (1980), the experimental study by Emmer et al. (1982), and the study on teacher clarity by Kennedy, Bush, Cruickshank, and Haefele (1978), one can present the following suggestions for effective presentation:

Present material in small steps. Focus on one thought (point, direction) at a time.
Avoid digressions.
Organize and present material so that one point is mastered before the next point is given.
Model the skill (when appropriate).
Have many, varied, and specific examples.
Give detailed and redundant explanations for difficult points.
Check for student understanding on one point before proceeding to the next point.
Ask questions to monitor student progress.
Stay with the topic, repeating material until students understand.

When demonstrations are not clear, the main problems appear to be not giving sufficient directions and explanations, assuming everybody understands because there are no student questions, and introducing more complex material before students have mastered the early material.

Although demonstration is a major part of instruction in areas such as mathematics, English grammar, reading decoding, science, and foreign language, there are some areas where, unfortunately, demonstration is infrequently used. Demonstration is infrequent when teaching reading comprehension or higher-level cognitive thinking. Durkin (1978-1979, 1981) noted that there is seldom a demonstration phase in reading comprehension. She defined "comprehension instruction" as specific instruction by the teacher directed toward helping the student understand or work out the meaning of more than a single word. She distinguished comprehension instruction from comprehension assessment, in that comprehension assessment consisted of a teacher asking questions and telling students whether their answers were right or wrong. In her study, 24 fourth-grade teachers were observed during the reading period for a total of almost 5,000 minutes (or almost 200 minutes per teacher). She found that comprehension instruction occurred less than 1% of this time. Durkin (1981) also inspected elementary reading textbooks to see if these books provided explicit demonstration on how to answer to comprehension questions. Again, she found a lack of explicit instruction in this area.

Similarly, although teachers are exhorted to ask higher-level cognitive questions (i.e., questions that require application, analysis, and synthesis), teachers seldom demonstrate to their students how to answer such questions (nor are they taught how to provide this demonstration).

Instructional design. The field of instructional design involves research on how to design presentations so that students can achieve mastery in the fewest number of trials and the smallest amount of time. In the elementary grades, good instructional design means that student errors and confusion are minimized and students receive explicit instruction rather than having to guess.

In a study of instructional design, Beck and McCaslin (1978) analyzed eight beginning reading programs to answer three questions:

1. Were confusable letters, specifically *b* and *d,* taught at a wide temporal and sequential distance from each other (i.e., how many intervening graphemes were taught between these two letters, and how much time elapsed between teaching these letters)?
2. What was the potential effectiveness of each program for teaching either the short *i* or the short *e* sound?
3. What was the likely effectiveness of the programs for teaching students to blend sounds?

The authors report on how the eight reading programs sequenced confusable letters — in this case, *b* and *d.* Research (Gibson, Gibson, Pick, & Osser 1962) indicates that confusable items should be taught separately. Despite the "obviousness" of the fact that confusable letters should not be taught at the same time, Beck and McCaslin (1978) found that three programs still taught *b* and *d* within a week of each other and with few intervening graphemes.

3. Guided student practice

In the successful experimental studies, the demonstration is followed by guided practice (or teacher-led practice). That is, the teacher asks questions and is also standing by to supply assistance and help, if necessary. This guided practice continues until the students are confident and respond firmly.

This instructional function is usually performed by the teacher, who *(a)* asks a large number of questions, *(b)* guides students in practicing the new material — initially using prompts to lead students to the correct response and later fading prompts when students are responding correctly, *(c)* checks for student understanding, *(d)* provides feedback, *(e)* corrects errors, *(f)* reteaches when necessary, and *(g)* provides for a large number of successful repetitions.

Frequent questions. Both correlational and experimental studies have shown that a high *frequency* of teacher-directed questions is important for acquisition of basic arithmetic and reading skills in the primary grades. Stallings and Kaskowitz (1974) identified a pattern of factual question-student response-teacher feedback as most functional for student achievement. Similar results favoring guided practice through teacher questions were also obtained by Coker, Lorentz, and Coker (1980), Soar and Soar (1973), Stallings, Gory, Fairweather, and Needles (1977), and Stallings, Needles, and Stay-rook (1979).

During successful guided practice two types of questions were usually asked by the teacher: questions which called for specific answers, and those which asked for explanation of how an answer was found. Similar results indicating the importance of a high frequency of questions have been obtained in mathematics in Grades 6-8. In
a correlational study of junior high school mathematics instruction (Evertson, Anderson, Anderson, & Brophy 1980b), the most effective teachers asked an average of 24 questions during the 50-minute mathematics period, whereas the least effective teachers asked only 8.6 questions. (For each group the majority of the questions were factual; however, the most effective teachers asked 25% process questions-explaining how a result was obtained — whereas the least effective teachers only asked 16% process questions.)

Two experimental studies (Anderson et al. 1979; Good & Grouws 1979) used guided practice as part of the experimental treatment. In each study, the teachers who received the additional training were taught to follow the presentation of new material with guided practice. The practice consisted of students responding to teacher questions and doing exercises on their own. In each study, the teachers in the trained group asked more questions and had more guided practice than did the control teachers who continued their normal teaching. And, in each study, the students in the experimental groups had higher achievement than the students of teachers in the regular, control groups. Furthermore, the Anderson et al. (1979) study found strong positive correlations between student achievement and the amount of time spent in question-answer format and between student achievement and the number of academic interactions per minute. Thus, it is not only useful to spend considerable time in guided practice; it is also valuable to have a high frequency of questions and problems.

Of course, all teachers spend time in guided practice. However, the more effective teachers and their students spent more time in guided practice, more time asking questions, more time correcting errors, more time repeating the new material that was being taught, and more time working problems under teacher guidance and help.

The importance of frequent practice. Note that in all these studies the consistently positive results are not being obtained merely by the type of teacher question being asked but by the *frequency* of direct, convergent teacher questions and by the *frequency* of student responses. Elementary students need a great deal of practice, and factual, convergent questions provide a form of controlled practice whose frequency has consistently been correlated with student achievement.

Frequency is particularly important in the primary grades because no matter how quick a learner is, it takes a large number of repetitions before he or she can recognize words rapidly. For example, Beck (1978) showed that, among first-grade children, words that were recognized in less than 4 seconds appeared more than 25 times in the instructional materials, whereas words which were recognized in 5 seconds or longer appeared less than 10 times.

Frequency, in another form, is also important for adults. Kulik and Kulik (1979) found that in college classes that had weekly quizzes, scores on final examinations were almost invariably better than they were in classes that had only one or two quizzes during a term.

High percentage of correct answers. Not only is the frequency of teacher questions important, but the percentage of correct student responses is also important. One of the major findings of the BTES study (Fisher, Berliner, Filby, Marliave, Cahen, & Dishaw 1980) was that a high percentage of correct answers (both during guided practice and when working alone) was positively correlated with achievement gain. Similarly, Anderson et al. (1979) found that the percentage of academic interactions where the student gave the correct answer was positively related (r = .49) to achievement gain.

More specific information can be obtained from studies which compare the most effective and least effective classrooms. For example, in the study by Anderson et al. (1979), the mean percentage of correct answers during reading groups was 73% in the treatment teachers' classrooms but only 66% in the control classrooms. Gersten, Carnine, and Williams (1981) found that teachers using the Distar program who obtained high reading achievement from their students had student accuracy rates near 90%, whereas those with lower class achievement had accuracy rates of less than 75%. In a correlational study in fourth-grade mathematics classes, Good and Grouws (1975) found that the most successful math teachers had a success rate of 82%, whereas the least successful had a success rate of 76%. However, this result was not replicated in a study of junior high school math (Evertson et al. 1980a).

Overall, a high frequency of correct responses from *all* students is particularly important in the elementary grades. The one exception to this statement occurred in seventh- and eighth-grade mathematics.

This principle, a high percentage of correct responses given rapidly and automatically, is a relatively new finding in research on classroom instruction. We can probably never give specific answers on how high this percentage should be. As a reasonable benchmark for now, one could recommend that the success rate be about 80% when students are working on new material; during reviews, students' responses should be rapid, smooth, and almost completely correct (perhaps 95% correct).

How do some teachers obtain high success rates? The answers are suggested from the previous discussion, namely: presenting materials in small steps, directing initial student practice through questions, continuing practice until students are firm, overlearning, and frequent review. Of all these variables, two seem most important. The effective programs and the effective teachers teach new material in small steps so that the possibility for errors is lessened, and they practice to overlearning — that is, they continue practice beyond the point where the children are accurate. For example, in the ECRI programs (Reid 1980) there is daily review of the new words in the stories that have been read and will be read. Students repeat these words until they can say them at the rate of one per second. In the Distar program (Becker 1977) the new words in any story are repeated by the reading group until *all* students are accurate and quick. In the instructions to teachers in their experimental study on primary reading groups, Anderson et al. (1979) stressed the importance of overlearning and making sure that each student "is checked, receives feedback, and achieves mastery". All of the above procedures, which facilitate a high success rate, can be used with any reading series.

Checking for understanding. Guided student practice also includes teacher "checking for understanding". This refers to frequent assessments of whether *all* the students understand the content or skill being taught or the steps in a process (such as two-digit multiplication).

Checking for understanding appears in the teacher training materials developed by Madeline Hunter (Hunter & Russell 1981), has a prominent place in the teachers' manual developed for the Missouri Mathematics Effectiveness Project (Goods & Grouws 1979), and appears in the manual "Organizing and Managing the Junior High Classroom" (Emmer & Evertson 1981).

It is best that checking for understanding take place frequently so that the teacher can provide corrections and do reteaching when necessary. Some suggestions for conducting checking for understanding include:

Prepare a large number of oral questions beforehand.

Ask many brief questions on main points, on supplementary points, and on the process being taught.

Call on students whose hands are not raised.

Have all students write answers (on paper or a chalkboard) while the teacher circulates.

Have all students write the answer and check their answers with a neighbor (usually with older students).

At the end of a lecture/discussion (usually with older students) write the main points on the board and have the class meet in groups and summarize the main points to each other.

The *wrong* way to do checking for understanding is to ask a few questions, call on volunteers to hear their (usually correct) answers, and then assume that all the class either understands or has now learned from hearing the volunteers. Another error is to ask "Are there any questions?" and, not hearing any, to assume that everybody understands. The teacher's error, in the above cases, was not having prepared enough questions (or problems) to use in checking for understanding. It is recommended that these questions be prepared beforehand, when the lesson is being planned. A third error (particularly with older children) is assuming that one does not need to check for understanding, that simply repeating the points will be sufficient.

Calling on individual students. First in a correlational study (Brophy & Evertson 1974, 1976), and then in an experimental study (Anderson et al. 1979), it was found that in primary-grade reading groups student achievement was better if the teacher called on students in *ordered turns.* Such ordered turns were for reading new words and reading a story out loud. In explaining the results, the authors say that ordered turns ensure that *all* students have opportunities to practice and participate, and ordered turns simplify group management by eliminating hand waving and other student attempts to be called on by the teacher.

In each study, student call-outs were usually negatively related to achievement gain. However, in these studies, the frequency of call-outs for lower-achieving students was positively related to achievement. This finding supports Brophy and Evertson's (1976) conclusion that *it is best to get Low-achieving students to respond in any fashion.* However, due to the lack of other studies in this area, these results are tentative.

Anderson et al. (1982) note that, although the principle of ordered turns works well in small groups, it would be inappropriate to use this procedure with whole-class instruction in most situations. They suggest that when a teacher is working with a whole class it is usually more efficient to select certain students to respond to questions or to call on volunteers than to attempt systematic turns.

Group responding. One technique for obtaining a high frequency of responses in a minimum amount of time is through group responding (see Becker 1977). This technique is particularly useful when students are learning material that needs to be overlearned, such as decoding, word lists, and number facts.

Two successful programs, Distar (Becker 1977) and ECRI (Reid 1978-1982), make extensive use of choral responding in primary-grade reading groups. In these programs, choral responses are initiated by a specific signal from the teacher so that the entire group will respond at the same time (much like a conductor and an orchestra). When the teacher does not provide training and does not insist that students respond in unison, there is the danger that the slower students may delay their responses a fraction of a second and echo the faster students, or they may not respond at all.

Becker (1977) argued that choral responding (to a signal) *(a)* allows a teacher to monitor the learning of all students effectively and quickly; *(b)* allows the teacher to correct the *entire group* when an error is made, thereby diminishing the potential embarrassment of individual students who make errors; and *(c)* makes the drill more like a game because of the whole-group participation. The Oregon Direct Instruction Model suggests that teachers use a mixture of both choral responses and individual turns during the controlled practice phase, with choral responding occurring about 70% of the time. The individual turns allow for testing of specific children. If the slower children in the group are "firm" (i.e., respond quickly and confidently) when questioned individually, the teacher moves the lesson forward; however, if they remain slow and hesitant on the individual turns, then this is a signal that the children need more practice. In this case, it would also be argued that, because the hesitant children from the individual turns were in a homogeneous group, it is likely that the other children could also benefit from the additional practice.

Group responding, in unison and to a signal, is also used successfully in the ECRI program for learning new words and for reviewing lists of up to 100 old words. With this training students learn to read the list of new words at a speed of one word per second.

Choral responding works best in small groups such as reading groups, where the teacher can monitor the responses of individual students. Group responding is also used with the whole class in primary-grade mathematics when students are reviewing number facts such as multiplication tables.

4. Feedback and correctives

A major teaching function is responding to student answers and correcting student errors. During guided practice, during checking for understanding, and during review, how should a teacher respond to a student's answer?

Simplifying a bit, there are four types of student responses: correct — and quick and firm; correct — but hesitant; incorrect — but a "careless" error; and incorrect — suggesting lack of knowledge of facts or a process.

Correct, quick, and firm. When a student response is correct, quick, and firm (usually occurring in the later stages of initial learning or in a review), then research suggests that the teacher simply ask a new question, thereby maintaining the momentum of the practice. The idea here is to keep the lesson moving at a brisk pace and also to keep the students' attention focused on the academic content, not on their successes or failures or on how the teacher feels about them (Anderson et al. 1979).

Correct but hesitant. This response would probably occur during the initial stages of learning (e.g., guided practice and checking for understanding) or during a review of relatively new material. In this case, it is suggested that teachers provide short statements of feedback (e.g., "correct", "very good"). It is also suggested that the teacher provide moderate amounts of process feedback — that is, re-explain the steps used to arrive at the correct answer (Anderson et al. 1979; Good & Grouws 1979). Such feedback may not only help the student who is still learning the steps in a solution, but it may also aid other students who need this information to understand why the answer is correct.

Incorrect but careless. When a student makes a *careless* error during review, drill, or reading, then the teacher should simply correct the student and move on.

Incorrect but lacking knowledge of facts or a process. Errors during the early stages of learning new material indicate that a student does not thoroughly understand the facts or process being taught. One approach to these errors is to help the student by providing hints and/or asking simpler questions (Anderson et al. 1979; Stallings & Kaskowitz 1974). This approach seems useful when the student can correct the error rather quickly (e.g., 30 seconds or less).

Another approach to student errors is to reteach the material, reexplaining the steps used to reach the correct answer. Good and Grouws (1979) instruct teachers to reteach when the error rate is high during a lesson. Reteaching, particularly during the initial stages of learning new material, is recommended by Becker (1977) and by Reid (1980), and each of these programs provides specific correction procedures for teachers to use. The Distar program not only specifies correction procedures but also specifies additional teaching to "firm up" the student in any area of weakness.

Whether one uses hints or reteaches the material, the important point is that *errors should not go uncorrected.* When a student makes an error, it is inappropriate to simply give the student the answer and then move on. It is also important that errors be detected and corrected early in a teaching sequence. If early errors are uncorrected they become extremely difficult to correct later, and systematic errors (or misrules) can interfere with subsequent learning.

In their review on effective college teaching, Kulik and Kulik (1979) found that instruction was more effective when *(a)* students received immediate feedback on their examinations, and *(b)* students had to do further study and take another test when their quiz scores did not reach a criterion. Both points seem relevant to this discussion: students learn better with feedback — as immediate as possible; and errors should be corrected before they become habitual.

5. Independent practice

During guided practice, students *(a)* begin to work new problems or apply new skills; *(b)* receive additional process explanations, if necessary; and (c) receive corrections and reteaching when necessary. When the guided practice is successful, the students can move into independent practice.

During independent practice the students usually go through two stages: unitization and automaticity (Samuels 1981). During unitization the students are putting the skills together. The students make few errors, but they are also slow and expend a good deal of energy toward accomplishing the task. After much practice the students achieve the “automatic” stage where they respond successfully and rapidly, and no longer have to “think through” each step. When students are learning two-digit multiplication and are hesitantly working the first few problems, they are in the unitization phase. When they have worked sufficient problems correctly, so that they are confident, firm, and automatic in the skill, then the students are in the automaticity phase.

The advantage of automaticity is that students who reach it can give their full attention to reading comprehension or math problem solving. Thus, when learning new material, it is important that students continue their practice to the point of overlearning, to the point where they are rapid, quick, and firm in their responses. This overlearning is particularly important in hierarchical material such as mathematics and elementary reading.

Managing students during seatwork. The most common context in which independent practice takes place is individual seatwork. Students in Grades 1-7 spend more time working alone at seat-work than any other activity (approximately 50%-75% of their time) (Evertson et al. 1980a, 1980b; Fisher et al. 1980; Stallings & Kaskowitz 1974; Stallings et al. 1977). However, they are less engaged during seatwork than when they are in groups receiving instruction from the teacher. Therefore, it is important to learn how to maintain student engagement during seatwork.

Student engagement during seatwork is usually increased by the following instructional procedures:

More time is spent in lecture, discussion, and guided practice — that is, more lime is spent preparing students for seatwork.

The teacher structures the seatwork and directs the class through the first seat-work problems.

Seatwork follows directly after guided practice.

Seatwork is directly relevant to the demonstration and guided practice.

The teacher actively circulates during seatwork, providing feedback, asking questions, and giving short explanations.

One finding is that teachers whose classes are more engaged during seatwork prepared these classes for the seatwork during the demonstration and guided practice. Evertson et al. (1980b) found that the most effective teachers in junior high mathematics spent 24 minutes (in a 50-minute period) in demonstration and guided practice, whereas the least effective teachers spent only 10 minutes on these same activities.

A major finding of Fisher et al. (1980) was that teachers who had more questions and answers during group work had more engagement during seatwork. That is, another way to increase engagement during seatwork was to have more teacher-led practice during group work so that the students could be more successful during the seatwork. Successful teachers also had the students work, as a group, on the first few seatwork problems before releasing them for seatwork (Anderson et al. 1979). The guided practice of Hunter and Russell

(1981) and of Good and Grouws (1979) are additional examples of the importance of teacher-led guided practice before seatwork.

In summary, seatwork activities take place in all classrooms. But the successful teachers spent a good deal more time than
did average teachers in demonstrating what is being taught and in leading the students in guided practice. Students who are adequately prepared during the teacher-led activity are then more able to succeed during the seatwork. In contrast, the less successful teachers spent less time in demonstration and guided practice and relied more on self-paced, “individualized” materials.

A second finding is that teachers who are successful managers of seatwork are actively circulating, asking questions, and giving explanations during seatwork. Fisher et al. (1980) found that when students have contacts with the teacher (or another adult) during seatwork their engagement rate increases by about 10%. Teachers moving around and interacting with students during seatwork is also an illustration of the “active teaching” which was successful in the experimental study of Good and Grouws (1979). The advantage of a teacher circulating and monitoring during seatwork led Good and Grouws to argue that leaching the class as a whole can be an effective strategy for fourth- to eighth-grade mathematics. Such whole-class teaching permits the teacher to actively circulate and interact during seat-work.

When teachers are monitoring students during seatwork, how long should the contacts be? The research suggests that these contacts should be relatively short, averaging 30 seconds or less (Evertson et al. 1980a, 1980b). Longer contacts appear to pose two difficulties: the need for a long contact suggests that the initial explanation was not complete; and the more time a teacher spends with one student, the less time there is to monitor and help other students.

A third finding (Fisher et al. 1980) was that, when teachers had to give a good deal of explanation during seatwork, student error rates were higher. Having to give a good deal of explanation during seatwork suggests that the initial explanation was not sufficient or that there were not sufficient practice and corrections *before* seatwork. The finding by Evertson et al. (1980a, 1980b) that long contacts during seatwork were negatively related to achievement suggests a replication of this negative correlation.

Another effective procedure for increasing engagement during seatwork is to break the instruction into smaller segments and have two or three segments of instruction and seatwork during a single period. In this way, the teacher provides an explanation (as in two-digit multiplication), supervises and helps the students as they work a problem, provides an explanation of the next step, and then supervises the students as they work the next problem. This procedure seems particularly effective for difficult material and/or slower students. This practice was advocated in the manual for teachers in the successful Junior High School Management Study (Emmer et al. 1982) and characterized successful teachers of lower-achieving students in junior high math classes (Evertson 1982).

Other ways of accomplishing the independent practice function. The goal of independent practice is to provide over-learning and to provide sufficient practice so that students are quick, confident, and firm. As noted above, a major setting in which this function takes place is individual seatwork. Three other ways in which independent practice can take place are discussed below: teacher-led practice, independent practice with a routine of specific procedures, and student cooperative practice in groups.

In the elementary grades, independent practice is often teacher-led. For example, if a teacher is leading a review of word lists, letter sounds, or number facts, this activity can be called independent practice if the children are at a high success level and do not require prompts from the teacher.

In her study of successful teachers of lower-achieving junior high English classes, Evertson (1982) found that the teacher who had the highest engagement rate had very brief seatwork activities. Instead, the material was presented through short presentations, and these were followed by long periods of repeated questions where the participation of all students was expected, the questions were narrow and direct, and there was a high degree of student success.

The ECRI program (Reid 1978-1982) obtains high engagement by organizing routines to be followed when practicing *each* story. During independent practice each student works independently on a story for which he is trying to achieve "mastery". To achieve mastery a student has to: *(a)* read all new words in the story at a rate of one per second or faster, *(b)* spell all new words without error, (c) read any selection in the story at a predetermined rate, and *(d)* answer comprehension questions on the story.

During independent study students proceed through a checklist of tasks relevant to these skills. They use a stopwatch or the clock to time themselves. When they are ready, one student gives a spelling test to another, checks another student for accuracy and speed on the word list, and/or checks another student for accuracy and speed on the reading selection.

There are noteworthy advantages to these ECRI procedures. First, this series of tasks can be readily followed because they are repeated for each story. Therefore, the teacher is *not* faced with the typical problem of having to prepare students for a different worksheet each day. Second, the tasks are designed to ensure that all students receive sufficient practice and obtain a high level of automaticity. Third, the student interaction provides a social dimension to this task, allows a student to get help from another student, and yet keeps the students focused on the academic task. I believe that many of these ECRI procedures could be incorporated into existing programs. In particular, teachers might consider the repeated reading until the students are reading rapidly and the student cooperative work.

Students helping students. Researchers have also developed procedures for students to help each other during seatwork (Johnson & Johnson 1975; Sharan 1980; Slavin 1980a, 1981). In some cases the students in the groups prepare a common product, such as the results of a drill sheet (Johnson & Johnson 1975), and in other situations the students study cooperatively in order to prepare for competition that will take place (Slavin 1980a). Research using these procedures usually shows that students who do seatwork under these conditions achieve more than students who are in regular settings. Observational data indicate that students are also more engaged in these settings than are similar students in conventional settings (Johnson & Johnson, in press; Slavin 1978, 1980b; Ziegler 1981). Presumably, the advantages of these cooperative settings come from the social value of working in groups and the cognitive value gained from explaining the material to someone and/or having the material explained. Another advantage of the common worksheet and the competition is that it keeps the group focused on the academic task and diminishes the possibility that there will be social conversation.

In summary, the purpose of independent practice is to provide the students with sufficient practice so that they can do the work automatically. This is usually done by having students work alone at seatwork. Four research suggestions for improving student engagement during seatwork are:

1. The need for clear instruction-explanations, questions, and feedback — and sufficient practice before the students begin their seatwork. Having to provide lengthy explanations during seatwork is troublesome for the teacher and for the students.
2. Circulate during seatwork, actively explaining, observing, asking questions, and giving feedback.
3. Have short contacts with individual students (i.e., 20 seconds or less).
4. For difficult material, have a number of segments of instruction and seatwork during a single period.

Although the most common organization of independent practice is seatwork with each child working alone, three other forms of organization have been successful:

1. teacher-led student practice, as in drill;
2. a routine of student activities to be followed during seatwork where the student works both alone and with another student;
3. procedures for cooperation within groups and competition among groups during seatwork.

6. Weekly and monthly reviews

The learning of new material is enhanced by weekly and monthly reviews. Many of the most recent instructional programs include periodic reviews and also provide for reteaching in areas in which the students are weak. In the Missouri Mathematics Effectiveness Study (Good & Grouws 1979), teachers are asked to review the previous week's work every Monday and to conduct a monthly review every fourth Monday. The review provides additional teacher checking for student understanding, ensures that necessary prior skills are adequately learned, and is also a check on the teacher's pace. Good and Grouws recommend that the teacher proceed at a fairly rapid pace (to increase student interest) and suggest that, if a teacher is going too fast, the weekly review will reveal it.

Periodic reviews and recycling of instruction when there are student errors have been part of the Distar program since 1968. Extensive review is also built into the ECRI program in that slower students are reviewing new words for 3 weeks before they encounter the words in a story in a reader. The need for massed learning followed by spaced reviews is also part of Hunter's (1981) program of increasing teacher effectiveness.

Management functions. Many of the programs cited in the first paragraph of this article also contain suggestions for managing transitions between activities, setting rules and consequences, alerting students during independent work and holding them accountable, giving students routines to follow when they need help but the teacher is busy, and other management functions.

The developers of these programs understand that instruction cannot be effective if the students are not managed. However, these functions are discussed in the article by Brophy in this issue.

Discussion

This paper has covered a number of teaching functions: review of previous learning, demonstration of new material, guided practice and checking for understanding, feedback and corrections, independent practice, and periodic review. As I wrote this paper I became impressed with the fact that different people, working alone, came up with fairly similar solutions to the problem of how to instruct effectively in classrooms. The major authors cited in the first paragraph of the article are more similar than they are different. The fact that these people, working alone, have reached similar conclusions and have student achievement data to support their positions helps validate each research study.

One advantage of this paper is that it provides a general view, an overview of the major functions in systematic teaching. What is missing, however, is the specific detail that is contained in the training manuals and materials developed by each of the investigators. I would hope that all teachers and trainers of teachers have a chance to study and discuss the individual training manuals.

These components are quite similar to those used by the most effective teachers. All teachers already perform some or all of the functions discussed above. However, the specific programs elaborate on how to perform these functions and provide more routines, procedures, and modifications than an individual teacher, working alone, could have thought of. These programs make teachers aware of the six instructional functions, bring this set of skills to a conscious level, and enable teachers to develop strategies for consistent, systematic implementation (Bennett 1982).

Now that we can describe the major teaching functions, we can ask whether there are a variety of ways in which individual functions can be fulfilled. We have already seen that the independent practice function can be met in three ways: students working alone, teacher leading practice, and students helping each other. (There are even a variety of ways for students to help each other.)

We have just begun to explore this issue of the variety of ways of meeting each function, and at present no conclusions can be drawn on this issue. It may be that each function can be met three ways: by the teacher, by a student working with other students, and by a student working alone — using written materials or a computer. Right now, however, not all functions can be met in all three ways — and we are limited in our choices by the constraints of working with 25 students in a classroom, the age and maturity of the students, the lack of efficient “courseware” for the student to use when working alone, and the lack of well-designed routines that will keep students on task and diminish the lost time when they move from activity to activity. For example, although the idea of students working together during independent practice always existed “in theory”, such working together was also associated with students being off-task and socializing. We needed the routines such as those developed by Johnson and Johnson (1975), Reid (1981), and Slavin (1981) before we could be confident that students would work together during independent practice *and be* on task. Similarly, although "checking for understanding" could "theoretically" be accomplished by students working with materials or by students working with other students, we do not have effective routines for enabling this to happen — at present — in the elementary grades.

In sum, now that we can list the major functions or components which are necessary for systematic instruction, we can turn to exploring different ways in which these functions can be effectively fulfilled.

References

Anderson, L. M.; Evertson, C. M.; & Brophy, J. E. An experimental study of effective teaching in first-grade reading groups. *Elementary School Journal,* 1979,79, 193-222.

Anderson, L. M.; Evertson, C. M,; & Brophy, J. E. Principles of small-group instruction in elementary reading. East Lansing; Institute for Research on Teaching, Michigan State University, 1982.

Beck, I. L. *Instructional ingredients for the development of beginning reading competence.* Pittsburgh; Learning Research and Development Center, University of Pittsburgh, 1978.

Beck, I. L., & McCaslin, E. S. *An analysis of dimensions that affect the development of code-breaking ability in eight beginning reading programs.* Pittsburgh: Learning Research and Development Center, University of Pittsburgh, 1978.

Becker, W. C. Teaching reading and language to the disadvantaged — what we have learned from field research. *Harvard Educational Review,* 1977,47,518-543.

Bennett, D. Should teachers be expected to learn and use direct Instruction? *Association for Supervision and Curriculum Development Update,* 4 June 1982,24,5.

Brophy, J. Recent research on teaching. East Lansing: Institute for Research on Teaching, Michigan State University, 1980.

Brophy, J. Successful teaching strategies for the inner-city child. *Phi Delia Kappan,* 1982, 63, 527-530.

Brophy, J. Classroom organization and management. *Elementary School Journal,* in this issue.

Brophy, J. E., & Evertson, C. M. Process-product correlations in the Texas teacher effectiveness study: final report. Austin: R&D Center for Teacher Education, University of Texas, 1974.

Brophy, J. E., & Evertson, C. M. *Learning from teaching: a developmental perspective.* Boston: Allyn & Bacon, 1976.

Coker, H.; Lorentz, C. W.; & Coker, J. Teacher behavior and student outcomes in the Georgia study. Paper presented at the annual meeting of the American Educational Research Association, Boston, 1980.

Durkin, D. What classroom observation reveals about reading comprehension instruction. *Reading Research Quarterly,* 1978-1979, 14, 481-533.

Durkin, D. Reading comprehension instruction in five basal reading series. *Reading Research Quarterly,* 1981,4,515-544.

Emmer, E. T., & Evertson, C. M. *Teacher's manual Jar the junior high classroom management improvement study.* Austin: R&D Center for Teacher Education, University of Texas, 1981.

Emmer, E. T.; Evertson, C. M.; & Anderson, L. M. Effective classroom management. *Elementary School Journal,* 1980, 80, 219-231.

Emmer, E, T.; Evertson, C. M.; Sanford, J.; & Clements, B. S. Improving classroom management: an experimental study in junior high classrooms. Austin: R&D Center for Teacher Education, University of Texas, 1982.

Evertson, C. M. Differences in instructional activities in higher- and lower- achievingjunior high English and mathematics classrooms. *Elementary School Journal,* 1982, 82, 329-351.

Evertson, C.; Anderson, C.; Anderson, L.; & Brophy, J. E. Relationship between classroom behaviors and student outcomes in junior high mathematics and English classes. *American Educational Research Journal,* 1980, 17, 43-60. (a)

Evertson, C. M.; Emmer, E. T.; & Brophy, J. E. Predictors of effective teaching in junior high mathematics classrooms. *Journal of Research in Mathematics Education,* 1980, 11, 167-178. (b)

Evertson, C; Emmer, E. T.; Sanford, J.; & Clements, B. S. Improving classroom management: an experimental study in elementary classrooms. Austin: R&D Center for Teacher Education, University of Texas, 1982.

Fisher, C. W.; Berliner, D. C; Filby, N. N.; Marliave, R.; Cahen, L. S.; & Dishaw, M. M. Teaching behaviors, academic learning time, and student achievement: an overview. In C. Denham & A. Lieberman (Eds.), *Time to Learn.* Washington, D.C.: Department of Education, 1980.

Fitzpatrick, K. A. An investigation of secondary classroom material strategies for increasing student academic engaged time. Unpublished doctoral dissertation. University of Illinois at Urbana-Champaign, 1981.

Fitzpatrick, K. A. The effect of a secondary classroom management training program on teacher and student behavior. Paper presented at the annual meeting of the American Educational Research Association, New York, 1982.

Gersten, R. M.; Carnine, D. W.; & Williams, P. B. Measuring implementation of a structured educational model in an urban school district. *Educational Evaluation and Policy Analysis,* 1981, 4, 56-63.

Gibson, E.J.; Gibson,J.J.; Pick, A. D.; & Osser, H. A developmental study of the discrimination of letter-like forms. *Journal of Comparative and Physiological Psychology,* 1962, 55, 897-906.

Good, T. L., & Grouws, D. A. *Process-product relationships in fourth grade mathematics classrooms.* Columbia:

University of Missouri — Columbia, 1975.
Good, T. L., & Grouws, D. A. The Missouri mathematics effectiveness project. *Journal of Educational Psychology,* 1979, 71, 355-362.
Greeno, J. Understanding and procedural knowledge in mathematics instruction. *Educational Psychologist,* 1978, 12, 262-283.
Hunter, M. Effective practice. In *Increasing your teaching effectiveness.* Palo Alto, Calif: Learning Institute, 1981.
Hunter, M., & Russell, D. Planning for effective instruction: lesson design. In *Increasing your teaching effectiveness.* Palo Alto, Calif.: Learning Institute, 1981.
Johnson, D., & Johnson, R. *Learning together and alone.* Englewood Cliffs, N.J.: Prentice-Hall, 1975.
Johnson, D., & Johnson, R. The integration of handicapped students into regular classrooms: effects on cooperation and instruction. *Contemporary Educational Psychology,* in press.
Kennedy, J. J.; Bush, A. J.; Cruickshank, D. R.; & Haefele, D. Additional investigations into the nature of teacher clarity. Paper presented at the annual meeting of the American Educational Research Association, Toronto, March 1978.
Kulik, J. A., & Kulik, C. C. College teaching. In P. L. Peterson & H. J. Walberg (Eds.), *Research on teaching: concepts, findings, and implications.* Berkeley, Calif.: McCutchan, 1979.
Larkin, J. H., & Reif, F. Analysis and teaching of a general skill for studying scientific text. *Journal of Educational Psychology,* 1976, 68, 431-440
Reid, E. R. *The Reader Newsletter.* Salt Lake City: Exemplary Center for Reading Instruction, 1978, 1979, 1980, 1981, 1982.
Samuels, S. J. Some essentials of decoding. *Exceptional Education Quarterly,* 1981, 2, 11-25.
Sharan, S. Cooperative learning in small groups. *Review of Educational Research,* 1980, 50, 241-271.
Slavin, R. E. Student teams and comparisons among equals: effects on academic performance. *Journal of Educational Psychology,* 1978, 70,532-538.
Slavin, R. E. Cooperative learning. *Review of Educational Research,* 1980, 50, 317-343. (a)
Slavin, R. E. Effects of student teams and peer tutoring on academic achievement and time on task. *Journal of Experimental Education,* 1980, 48, 252-257. (b)
Slavin, R. E. Student team learning. *Elementary School Journal,* 1981,82,5-17.
Soar, R. S., & Soar, R. M. Classroom behavior, pupil characteristics, and pupil growth for the school year and the summer. Gainesville: Institute for Development of Human Resources, University of Florida, 1973.
Stallings, J.; Gory, R.; Fairweather, J.; & Needles, M. *Early childhood education classroom evaluation.* Menlo Park, Calif.: SRI International, 1977.
Stallings, J. A., & Kaskowitz, D. *Follow through classroom observation evaluation, 1972-73.* Menlo Park, Calif.: Stanford Research Institute, 1974.
Stallings, J.; Needles, M.; & Stayrook, N. *How to change the process of teaching basic reading skills in secondary schools.* Menlo Park, Calif.: SRI International, 1979.
Zeigler, S. The effectiveness of classroom learning teams for increasing cross ethnic friendship: additional evidence. *Human Organization,* 1981,40, 264-268.