Synthesis of Research on Explicit Teaching [1]

BARAK V. ROSENSHINE [2]

A decade of research on teaching has firmly established the effectiveness of systematic, step-by-step instruction.

The research on effective teaching conducted since 1974 has yielded a pattern of instruction that is particularly useful for teaching a body of content or well-defined skills. This pattern is a systematic method for presenting material in small steps, pausing to check for student understanding, and eliciting active and successful participation from all students.

Although this method was derived primarily from reading and mathematics research conducted in elementary and junior high schools, the results are applicable to any "well-structured" (Simon 1973) discipline where the objective is to teach performance skills or mastery of a body of knowledge. Specifically, these results are most applicable to the teaching of mathematical procedures and computations, reading decoding, explicit reading procedures such as distinguishing fact from opinion, science facts and concepts, social studies facts and concepts, map skills, grammatical concepts and rules, and foreign language vocabulary and grammar.

These findings are less relevant for teaching in areas that are less well-structured, that is, where the skills do not follow explicit steps or the concepts are fuzzier and entangled. Thus, the results of this research are less relevant for teaching composition, writing of term papers, reading comprehension, analyzing literature or historical trends, for the discussion of social issues, or for teaching entangled concepts such as "liberal" or "modernism" (Spiro and Meyers 1984).

In general, researchers have found that when effective teachers teach concepts and skills explicitly, they:

- begin a lesson with a short statement of goals;
- begin a lesson with a short review of previous, prerequisite learning;
- present new material in small steps, with student practice after each step;
- give clear and detailed instructions and explanations;
- provide active practice for all students;

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[1] . *Educational Leadership*, April 1986, p. 60-69.

[2] . **Barak V. Rosenshine** is professor of educational psychology, Department of Educational Psychology, College of Education, University of Illinois at Urbana-Champaign, 210 Education Building, 1310 S Sixth St, Champaign, IL 61820- 6990

The writing of this article was supported in part by the College of Education, University of Illinois at Urbana-Champaign, as part of its contribution to the North Central Regional Educational Laboratory *Author's note* My thanks to John Edmunds, Sheila Valencia, and Marsha Weil for help in revising this article

- ask many questions, check for student understanding, and obtain responses from all students;
- guide students during initial practice;
- provide systematic feedback and corrections;
- provide explicit instruction and practice for seatwork exercises and, where necessary, monitor students during seatwork; and
- continue practice until students are independent and confident.

The major components include teaching in small steps with student practice after each step, guiding students during initial practice, and providing all students with a high level of successful practice.

Use and limits

It would be a mistake to say that this small-step approach applies to all students or all situations. It is most important for young learners, slow learners, and for all learners when the material is new, difficult, or hierarchical. In these situations, relatively short presentations are followed by student practice. However, when teaching older, brighter students, or when teaching in the middle of a unit, the steps are larger; that is, the presentations are longer, less time is spent in checking for understanding or in guided practice, and more independent practice can be done as homework because the students do not need as much help and supervision. But even for these situations, it is more efficient to return to small-step instruction when the material becomes difficult.

Information-processing research

A way to understand the need for explicit teaching is to look at recent research on human information processing. The information-processing results apply in three areas; the limits of our working memory, the importance of practice, and the importance of continuing until students are fluent.

First, current information-processing theories suggest that there are *limits* to the amount of information learners can attend to and process effectively. We can only process about seven points at a time in our working memory. When too much information is presented at once, or when the processing demands are too great, our working memory becomes swamped. We become confused, omit or skim material, and do not process it (Tobias 1982).

This is why, when teaching new or difficult material, teachers should teach only a small amount and arrange for student practice after each part so that what is taught at any time is manageable for working memory. In addition, by reviewing relevant learning and by providing an outline, a teacher can help students focus more readily on major points.

A second finding is that **we have to *process* new material in order to transfer it from our working memory to our long-term memory**. That is, **we have to elaborate, review, rehearse, summarize, or enhance the material**. Students can do this through active practice, which is facilitated if the teacher asks questions, requires students to summarize main points, has students tutor each other, and supervises students as they practice new steps in a skill.

Finally, extensive practice and frequent review are needed after the material is first learned so that it can be *recalled* effortlessly and automatically in future work. When prior learning is automatic, this frees space in our working memory, which can be used for application and higher-level thinking.

We might summarize these three points by saying it is important for the teacher to provide "instructional support" for students when teaching new material. Such support occurs when the teacher (1) breaks material into small steps in order to reduce possible confusion, (2) gives the student active practice in each step in order to move the new learning into long-term memory, and (3) provides for additional practice and overlearning so that the learners are using the new material or skills effortlessly.

Six Teaching Functions

In summarizing the studies on effective teaching, I have divided the results into six teaching functions: review, presentation of new material, guided practice, feedback and corrections, independent practice, and weekly and monthly reviews. Similar functions have also

been developed by Good and Grouws (1979) and Russell and Hunter (1981). From students of effective teachers and from research on information processing and human learning, we have learned a good deal about how to use these components successfully. These results are summarized in Table 1.

Table 1.
Teaching Functions

1. Review
Review homework Review relevant previous learning Review prerequisite skills and knowledge for this lesson

2. Presentation
State lesson goal and/or provide outline Teach in small steps Model procedures Provide concrete positive examples and negative examples Use clear language Check for student understanding Avoid digressions

3. Guided practice
High frequency of questions or guided practice Ail students respond and receive feedback High success rate Continue practice until students are fluid

4. Corrections and Feedback
Give process feedback when answers are correct but hesitant
Give sustaining feedback, clues, or reteaching for incorrect answers
Provide reteaching when necessary

5. Independent practice
Students receive help during initial steps, or overview Practice continues until students are automatic (where relevant) Teacher provides active supervision (where possible) Routines are used to give help to slower students

6. Weekly and monthly reviews

These six functions are not new. While all teachers use some of them some of the time, effective teachers use all them most of the time and implement them consistenly and systematically. With less effective teaching, review may be infrequent or unsystematic demonstration may be too short or unclear, students may receive insufficient guided practice, the teacher may correct too few errors, and too much time may be allocated to independent practice and not enough time to demonstration and guided practice.

These teaching functions represent some of what Gage (1978) calls “the scientific basis for the art of teaching”. In practice, these ideas require a good deal of art, creativity and thoughtfulness to apply and modify these ideas for different students and different subject matter.

1. *Daily review*. Effective teachers begin a lesson with a five- to eight-minute review of previous material, correction of homework, and review of relevant prior knowledge. To make sure that the students possess the prerequisite skills for the day's lesson, the teacher can review the concepts and skills necessary to do the next day's homework; have students correct each other's papers; ask about items where the students had difficulty or made errors; and review or provide additional practice on facts and skills that need reteaching.
Daily review is particularly important for teaching material that will be used in subsequent learning, for example, math facts, reading sight words, and grammar, and skills such as math computation, math factoring, or solving chemical equations.
One example of effective daily review is in the successful ECRI (Exemplary Center for Reading Instruction) Reading Program (Reid 1978). In this program, five minutes a day are spent reviewing and introducing new words from stories in the reader. The students go over the word lists in unison until they are fluent. When students are reading fluently and easily at the rate of about one word a second, it is possible to review 150 words in less than four minutes. Similar review procedures could be used in a variety of areas.
Daily review was also part of the successful experimental study in elementary mathematics (Good and Grouws 1979). In this study, the teachers who had been trained conducted re-

view and checked homework 80 percent of the days they were observed, whereas teachers in the control group did so on only 50 percent of the days. This suggests that, **although daily review is generally recognized as important, it is not as common a practice as we had thought**.

2. *Presenting new material.* Research has shown that effective teachers of mathematics spend more time on presenting new material and guided practice than do less effective teachers (Evertson et al. 1980, Good and Grouws 1979). For example, in the Evertson study the most effective mathematics teachers spent about 23 minutes per day in lecture, demonstration, and discussion in contrast to 11 minutes for the least effective teachers. The effective teachers used this additional presentation time to give additional explanations and many examples, check for student understanding, and provide sufficient instruction so that the students could practice independently with minimal difficulty, in contrast, the less effective teachers gave much shorter presentations and explanations and then sent the students to independent practice, Under those conditions students were less successful because they were not yet ready for independent practice. Hence, they made too many errors and had to be retaught.

The first step in effective presentation of new material is to focus learners' attention. This is done by providing students with a short: behavioral objective, such as “At the end of this lesson you will be able to distinguish between metaphor, simile, and personification”, or “Today you will be able to do problems using two-digit multiplication”. These objectives reduce the complexity of the presentation and help teachers to focus and avoid confusing digressions.

Effective teachers then proceed by presenting one point at a time using many examples. The examples provide the concrete learning and elaboration. that is useful for processing a manageable amount of new material.

Explicit instruction from the teacher not only helps the learner focus, it also reduces ambiguous processing. It is important for the teacher to avoid ambiguous phrases such as “sort of”, “as you see”, and “a few”. These phrases lack clarify and may confuse learners (Smith and Land 1981).

Effective teachers also stop to check for understanding by posing questions, asking students to summarize the presentation to that point or to repeat directions or procedures, or asking students whether they agree or disagree with other students’ answers. This checking tells teachers whether they need to reteach the material.

The wrong way to check for understanding is to ask, “Are there any questions?” and, hearing none, assume that the students have learned the material. Another error is to ask a few questions, call on volunteers to hear their (usually correct) answers, and then assume from hearing the volunteers that the class understands and has learned.

The following suggestions for effective presentation have emerged from the experimental and correlational classroom literature.

- State lesson goals.
- Focus on one thought (point, direction) at a time, i.e., complete one point before beginning another.
- Teach in small steps, checking for understanding on one point before proceeding to the next.
- Give step-by-step directions.
- Model the behaviors by going through the directions.
- Organize material so that one point is mastered before the next point is given.
- Avoid digressions.

3. *Conducting guided practice.* Alter the presentation, or after short segments of the presentation, the teacher conducts guided practice. A major purpose of this activity is to supervise students' initial practice on a skill and provide the active practice, enhancement, and elaboration necessary to move new learning from working memory into long-term memory.

The length of the presentation segment prior to guided practice is open to debate. Some people advocate that when teaching explicit concepts such as metaphor or simile, or explicit skills such as two-digit multiplication or determining common multiples and least common multiples, the guided practice should begin after a short presentation, and this pattern of

short presentation and guided practice should continue throughout the lesson. Others advocate presentations of 8-10 minutes before beginning guided practice. As little research directly informs this issue, a teacher might experiment with different lengths and team which is more effective for different students and different skills.

During guided practice, students actively participate by working problems or answering teacher questions. A number of correlational studies have shown that the teachers who effectively obtained larger gains in student achievement asked many questions (Stallings and Kaskowitz 1974; Stallings et al. 1977, 1979; Soar 1973; Coker et al. 1980). During successful guided practice, two types of questions are usually asked: those calling for specific answers, and process questions, which call for an explanation of how an answer was found. In a correlational study of junior high school mathematics instruction (Evertson, Anderson, and Anderson 1980), the most effective teachers asked an average of 24 questions during the 50-minute period, whereas the least effective teachers asked only 8.6 questions, The most effective teachers asked six *process* questions per period, whereas the least effective teachers asked only 1.3. In two experimental studies (Anderson et al. 1979, Good and Grouws 1979), teachers were taught to follow the presentation of new materials with guided practice, using a high frequency of questions; in each study, students in the experimental groups had higher achievement than did students in the control groups.

In all these studies, it is the frequency of practice that is most important. **Students need a good deal of practice when learning new material, and effective teachers find ways to provide it**. For example, when teaching concepts such as phrase and clause or past, present, and future participle, the guided practice could consist of the teacher giving examples and having the students identify them and explain their answers, and later, having the students create their own examples. At each step, the guided practice continues until the students are fluent. (The amount of practice can be increased if the teacher also asks the class to signal whether they agree or disagree with an answer by raising their thumbs up or down.)

When teaching procedures such as two-digit multiplication, the guided practice consists of practicing the skills in small steps with teacher supervision. Some students practice at the board while others work at their seats. When the teacher feels they are ready, the students proceed to the next step. If they are not ready, the teacher gives additional practice.

When teaching a more elaborate skill, such as the steps in dissecting, a lesson in computer software, or solving a geometry problem, students might first restate the steps that were taught. If the material is difficult, it might be best for the teacher to ask students to state the steps one at a time so they can correct any confusion. Stating the steps might be repeated until all students are fluent. Then the teacher would supervise as the students begin the actual practice, guiding them through each procedure until they can do the steps without errors.

There are, additionally, two related factors teachers need to consider when providing guided practice: the percentage of answers students give correctly and students' active participation.

- Effective teachers try to ensure a high success rate of student responses to their frequent questions (Fisher et al. 1980, Anderson et al. 1979,Gerstein et al. 1981). For example, in a study of 4th grade mathematics, Good and Grouws (1979) found that 82 percent of the answers were correct in the classrooms of the most successful teachers, whereas the least successful teachers had a success rate of 73 percent. The optimal success rate appears to be around 75-80 percent during guided practice, suggesting that the effective teachers combine success with sufficient challenge. The teachers obtained this success level by combining short presentations with supervised student practice and by giving sufficient practice on each part before proceeding.
- Students need to *actively* practice and process new learning. Teachers often lead this process, during presentation and guided practice, by asking questions of individual students. Students can repeat directions, procedures, or main points, or answer questions on facts and procedures. Instead of calling on one student at a time, imaginative teachers increase the amount of active participation by asking *all* students to:

1/ tell their answer to a neighbor;

2/ summarize the main idea in one or two sentences, writing the summary on a piece of paper, and sharing this or repeating the procedures to a neighbor.

3/ write the answer on a chalkboard, which is then held up;

4/ raise their thumb if they know the answer (thereby allowing the teacher to cheek the entire class);

5/ raise a finger if they agree with an answer someone else gave; and

6/ raise different colored cards when the answer is a, b, or c.

Group active participation is particularly useful when teaching students to identify parts of things or to discriminate among similar concepts. Examples of identification include teaching sight words, new words, parts of a plant, parts of a book, or parts of a dictionary. Discrimination includes learning to differentiate between similar concepts such as the Senate and the House of Representatives, or between adverbs and adjectives.

The purpose of all these procedures (cards, fingers, writing answers on a sheet of paper) is to provide active participation for the students and to allow the teacher to see how many students are correct and confident. If these overt procedures seem too childish, an alternative would be to have students write their answers and immediately grade each others' papers. (Some teachers have told students that they need feedback on how well the class is doing, and if the students won't participate overtly, then they can take an exam...)

4. *Provide feedback and corrective.* During guided practice, checking for understanding, or any recitation or demonstration, how should a teacher respond to a student's answer? If a student is correct and confident, the teacher can simply ask another question or give a short statement of praise (e.g., "very good") while maintaining the momentum of the practice. However, if the student is correct but hesitant, it is important to tell the student that the answer is correct. In such cases, it is also useful to give "process feedback". Process feedback, a term developed by Good and Grouws (1979), refers to the teacher saying, "Yes, that's right, because..." and then proceeding to re-explain the process one goes through to get the correct answer. Such reteaching or process feedback gives learners the additional explanation that is sometimes needed when they are still unsure.

When a student has made an error, it is appropriate for the teacher to simplify the question, provide hints, or reteach the material. The important point is that errors should not go uncorrected; it is inappropriate simply to give the correct answer and move on.

In their review of effective college teaching, Kulik and Kulik (1979) found that instruction was more effective when students (a) received immediate feedback on their examination and (b) had to do further study and take another test when their quiz scores did not reach the 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. *Conduct independent practice.* By the end of guided practice, students are expected to do the steps correctly, but hesitantly. Independent practice provides the additional practice that students need to become fluent in a skill, and to enable them to work without the cues given during guided practice. This need for fluency and independence applies to many of the procedures that are taught in school: use a rule to measure widths, add decimals, read a map, conjugate a regular verb in a foreign language, proof-read copy for errors, write major chords, complete and balance a chemical equation, operate equipment, and apply safety procedures. This need for fluency also applies to facts, concepts, and discriminations that are to be used in subsequent learning. After substantial practice, students achieve an automatic stage where they are successful and rapid and no longer have to think through each step. Students who have reached this automatic stage can give their fall attention to comprehension and application.

The independent practice should be on the same material as the guided practice. For instance, if the guided practice was on identifying types of sentences, then the independent practice should be on identifying types of sentences or, perhaps, creating individual compound and complex sentences. It would be inappropriate in this case to assign independent practice that asked students to "write a paragraph using two compound and two complex sentences" because the students have not been sufficiently prepared to do this.

Independent practice is really a continuum in which the students begin their work under teacher supervision and conclude with homework without supervision. When the material is difficult, more time is spent in supervised independent practice; when the material is easier, more of the independent practice can be done as homework.

Teachers also need to consider both their own role when students are practicing independently and how students can help each other.

Highlights of Research on Explicit Teaching of Well-Defined Knowledge and Skills

Six teaching functions aid student learning of explicit, well-structured information and skills such as mathematical procedures, science facts and concepts, grammatical rules, and vocabulary.

1. Each day, start the lesson by correcting the previous night's homework and reviewing what students have recently been taught.
2. Tell students the goals of today's lesson. Then present new information a little at a time, modeling procedures, giving clear examples, and checking often to make sure students understand.
3. Allow students to practice using the new information under the teacher's direction; ask many questions that give students abundant opportunities in correctly repeat or explain the procedure or concept that has just been taught. Student participation should be active until all students are able to respond correctly.
4. During guided practice, give students a great deal of feedback. When students answer incorrectly, reteach the lesson if necessary. When students answer correctly, explain why the answer was right. It is important that feedback be immediate and thorough.
5. Next, allow students to practice using the new information on their own. The teacher should be available to give short answers to students' questions, and students should be permitted to help each other.
6. At the beginning of each week, the teacher should review the previous week's lesson and at the end of the month review what students have learned during the last four weeks. It is important that students not be allowed to forget past lessons once they have moved on to new material.

These steps may be less important and are not sufficient for less well-defined topics, such as writing a term paper, a research report, or analyzing literature.

• Investigators have found that students are more engaged during seatwork when the teacher circulates around the room and monitors and supervises their work (Fisher et al. 1978). However, these contacts should be relatively short, averaging 30 seconds or less.

The same researchers found that students of teachers who spend more time in guided practice are more engaged during seatwork; in contrast, when teachers give a great deal of explanation *during* seatwork, students make more errors (Fisher et al. 1978). Lengthy explanation during seatwork indicates that the initial teaching and guided practice were not sufficient.

• Some investigators have developed procedures by which students help each other during seatwork (see Johnson and Johnson 1984, Sharon 1980, Slavin 1980b). Research shows that all students usually achieve more in these cooperative settings than do students in regular settings (Slavin 1980b). Slavin's manual (1980a) explains how these procedures can he used in classrooms. Presumably, some of the advantage conies from students having to explain the material to someone else or listening to someone other than the teacher explain the material (Webb 1982). Cooperative/ competitive settings also help slower students by providing extra instruction for them during seatwork.

6. *Weekly and monthly review.* Some of the successful programs in elementary schools provide for frequent review. For example, Good and Grouws (1979) recommend that teachers review the previous week's work every Monday and the previous month's work every fourth Monday. These reviews and tests provide additional successful practice for students. Kulik and Kulik (1979) found that even college students who were given weekly quizzes scored better on final exams than did students who had only one or two quizzes during a term.

In sum, explicit instruction in well-structured areas is a process in which the teacher initially takes full responsibility for performing a task but gradually relinquishes responsibility to

the student (Lohman 1985, Pearson and Gallagher 1983) This progression can be seen as a continuum that moves from teacher modeling, through guided practice using prompts and cues, to independent and fluent performance by the learner

Gains in Achievement – and in Attitude

The six functions I have described can be modified to suit different learners (see Table 2) When students are faster or older, or when the material is less difficult, less review is necessary and more time can be spent on presenting new material There is also less need for guided practice and independent practice in class, and more of the independent practice can be done as homework because the students do not need as much help and supervision

What is novel about current studies of effective teaching is that they have provided a research base that comes from experiments conducted in classrooms with regular teachers teaching regular subject matter. The results have consistently shown that when teachers teach more systematically, student achievement improves — frequently with gains in students' attitudes toward themselves and school.

Table 2.
Modifications to Suit Different Students

Slower Students
More review
Less presentation
More guided practice
More independent practice

Faster Students
Less review
More presentation
Less guided practice
Less independent practice

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