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ABSTRACT

This report describes the results of an experiment on teacher structuring, soliciting, and reacting behavior. Four teachers each taught eight groups of sixth-grade students using eight different variations of the classroom recitation strategy. The eight variations differed in the amount and kind of structuring, soliciting, and reacting behavior used by the teachers. Classes that were asked more recall questions during the lesson (low soliciting) performed better on the achievement posttest than did classes that were asked more thought questions (high soliciting). Classes taught with a high level of structuring did slightly better than classes given little structuring. Classes that received praise for correct answers and reasons for the wrongness of an answer (high reacting) did slightly better than those classes given neutral feedback and no reason for an answer's being considered wrong (low teaching). Although the results of the study showed variations in the recitation strategy did not make a dramatic difference, they also did not show that the recitation strategy itself was a weak teaching approach. The results for student achievement and attitude showed that the effects of the teacher were sometimes greater than the effects attributable to the teaching variations. (Author/RC)

STANFORD CENTER
FOR RESEARCH AND DEVELOPMENT
IN TEACHING

Occasional Paper No. 7

PRELIMINARY REPORT OF A FACTORIALLY DESIGNED EXPERIMENT ON TEACHER STRUCTURING, SOLICITING, AND REACTING

Prepared by the
Program on Teaching Effectiveness, SCRDT

School of Education
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Stanford, California

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Introductory Statement

The Center's mission is to improve teaching in American schools. Its work is carried out through three research and development programs--Teaching Effectiveness, The Environment for Teaching, and Teaching and Linguistic Pluralism--and a technical assistance program, the Stanford Urban/Rural Leadership Training Institute. A program of Exploratory and Related Studies includes smaller studies not included in the major programs. The ERIC Clearinghouse on Information Resources is also a part of the Center.

The experiment reported here, conducted by the Program on Teaching Effectiveness, represents an attempt to explore the causal nature of the links between teacher behavior and student learning. The experimental design is a departure from the frequently used correlational approach to research on teaching.

Abstract

This report describes the results of an experiment on teacher structuring, soliciting, and reacting behavior. Four teachers each taught eight groups of sixth-grade students using eight different variations of the classroom recitation strategy. The eight variations differed in the amount and kind of structuring, soliciting, and reacting behavior used by the teachers. Classes that were asked more recall questions during the lesson (low soliciting) performed better on the achievement posttest than did classes that were asked more thought questions (high soliciting). Classes taught with a high level of structuring did slightly better than classes given little structuring. Classes that received praise for correct answers and reasons for the wrongness of an answer (high reacting) did slightly better than classes given neutral feedback and no reason for an answer's being considered wrong (low reacting).

PRELIMINARY REPORT OF A FACTORIALLY DESIGNED EXPERIMENT ON TEACHER STRUCTURING, SOLICITING, AND REACTING[1]

Program on Teaching Effectiveness[2]

This report begins with a summary of the results and then goes on to the method, rationale, discussion, and conclusions of the experiment.

Results of the Experiment

The results demonstrated that the teachers who participated were able to control the way in which they performed the recitation strategy. Figure 1 summarizes the observers' records of what the four teachers did in each treatment variation. The bars indicate the average number of times the teachers used high and low levels of three clusters of teaching behaviors in each variation. As can be seen, the eight profiles of the treatment variations clearly differ in the ways intended. Thus, the teachers were able to control their teaching to create eight distinct variations of the recitation strategy.

The next question is, Did the variations have measurably different effects on student achievement? Table 1 shows the average class achievement on a 36-item multiple-choice test given immediately after instruction and again three weeks later. The effects of the treatment variations can be seen by comparing the average achievement of the classes in the high group with the average achievement of the classes in the low group for structuring, soliciting, and reacting. The academic achievement of the classes has been adjusted for the initial differences between the classes in academic aptitude. Thus, the effects of variations in aptitude have been removed from these scores.

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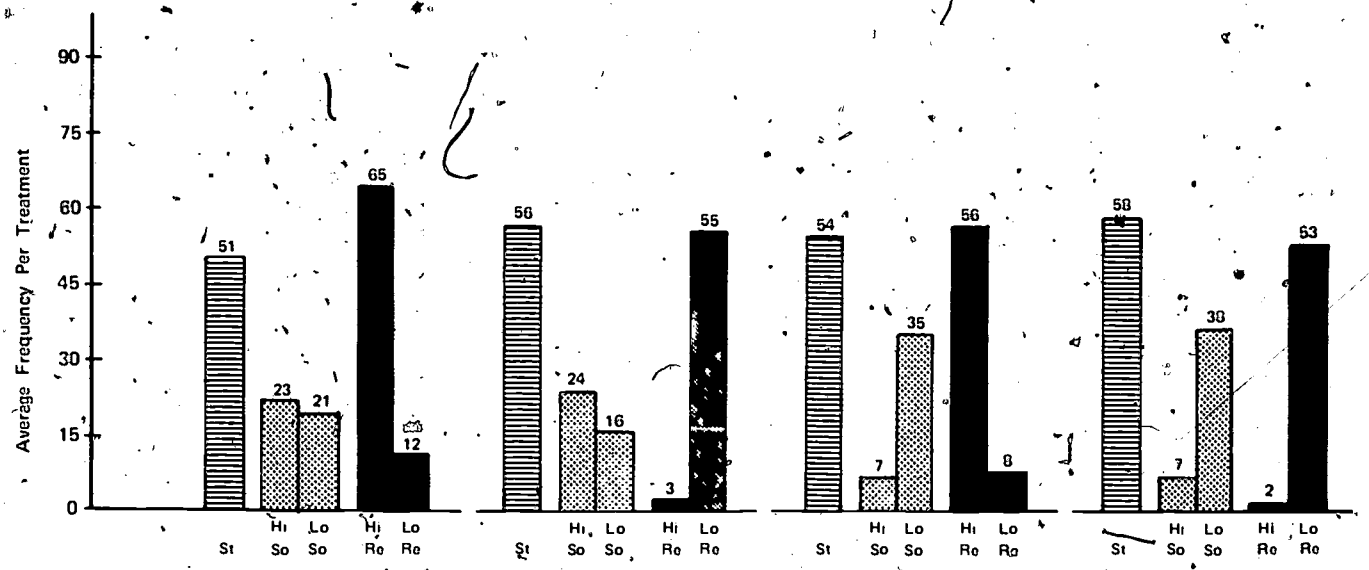
[1] A full report of the results of this study will be available as a technical report from the Stanford Center for Research and Development in Teaching at a future date.

[2] SCRDT's Program on Teaching Effectiveness is a program of research and development on teaching funded by the National Institute of Education. The major mission of the Program on Teaching Effectiveness is to develop and test improved ways of teaching for both novices and experienced teachers. The Program is particularly interested in testing new ways of helping experienced teachers improve their work. The staff members responsible for the experiment reported here were, in alphabetical order, Christopher M. Clark, N. L. Gage, Ronald W. Marx, Penelope L. Peterson, Nicholas G. Stayrook, and Philip H. Winne.

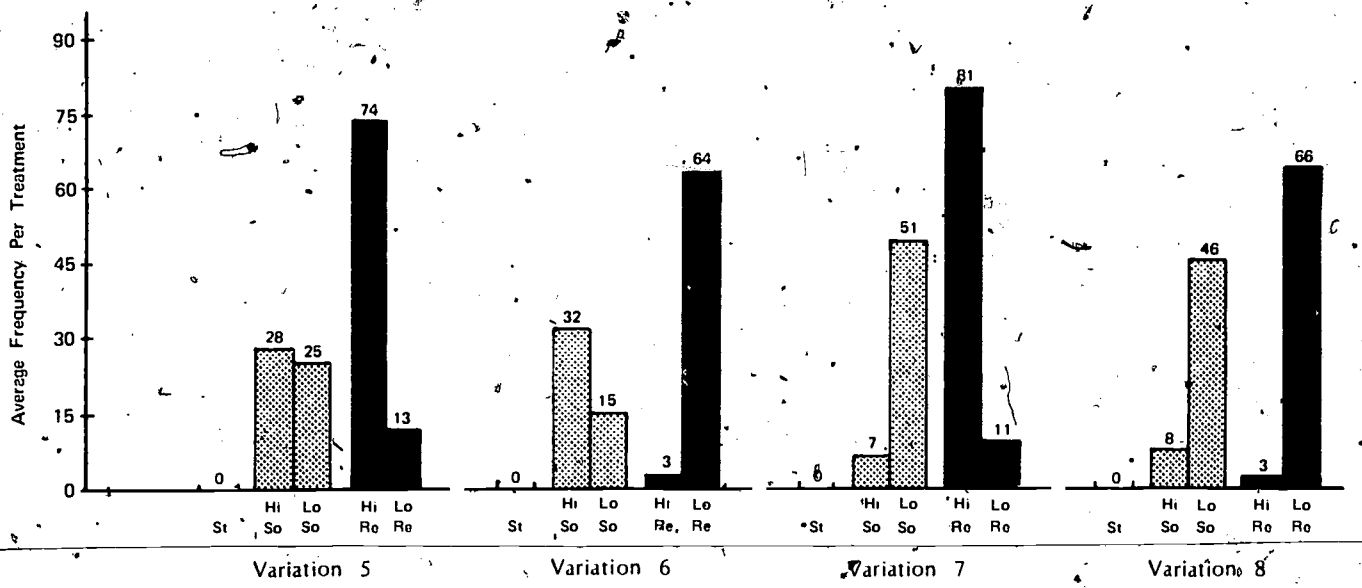


Variation 1
High Structuring
High Soliciting
High Reacting

Variation 2
High Structuring
High Soliciting
Low Reacting

Variation 3
High Structuring
Low Soliciting
High Reacting

Variation 4
High Structuring
Low Soliciting
Low Reacting



Variation 5
Low Structuring
High Soliciting
High Reacting

Variation 6
Low Structuring
High Soliciting
Low Reacting

Variation 7
Low Structuring
Low Soliciting
High Reacting

Variation 8
Low Structuring
Low Soliciting
Low Reacting

Figure 1. Treatment Variations: (Profiles showing the average number of structuring, soliciting, and reacting behaviors per treatment.)

TABLE 1

Average Achievement of Classes (Adjusted for Aptitude) for High and Low Levels of Structuring, Soliciting, and Reacting

Variation	Number of Students	Average Achievement on Immediate Test	Average Achievement on Retention Test
High Structuring	209	20.48	19.17
Low Structuring	199	20.06	18.51
High Soliciting	214	19.65	18.35
Low Soliciting	194	20.89	19.33
High Reacting	206	20.49	19.29
Low Reacting	202	20.05	18.39

The classes taught with a high level of structuring did slightly better on both the immediate and the retention multiple-choice tests than classes given little structuring. But this result was perhaps due to chance.

Classes that were asked more recall questions during the lesson (low soliciting) did better on the multiple-choice test than classes that were asked more thought questions--questions that required integrating and applying information (high soliciting). This result was probably not due to chance. The multiple-choice test was composed of two types of items--items that required recall of information and items that required integrating and applying information. Groups that were asked more thought questions during class (high soliciting) did worse on the recall test items than groups that were asked more recall questions (low soliciting). Classes in the high soliciting group and classes in the low soliciting group did equally well on the thought questions. These results indicate that students recall more information if the teacher asks mostly recall questions during class. On the other hand, the students' ability to apply and integrate their information seems not to be affected by the type of question the teacher asks during class.

Finally, the students who received praise for correct answers and reasons for the wrongness of an answer (high reacting) did slightly better than students given neutral feedback and no reason for an answer's being considered wrong (low reacting).

Students' attitudes toward ecology, the subject matter dealt with in all teaching sessions, were generally unaffected by the variations in structuring, soliciting, or reacting. Students expressed a positive attitude toward what they were studying in all the teaching variations.

Purpose and Method

By training teachers to vary systematically the way in which they performed the recitation strategy, we hoped to determine whether (a) teachers can be trained to control precisely the way they teach when using that strategy and (b) different versions of the same basic teaching strategy have measurably different effects on the amount and kinds of student learning.

The recitation strategy consists of repeated episodes of structuring, soliciting, responding, and reacting. Structuring consists of telling the students what is going to happen next--what they are going to be dealing with, talking about, and handling, and how the teacher intends to deal with the material. Soliciting is about the same as question-asking, except that the question need not always be a complete sentence or stated in words. Responding refers to student answering. Reacting is what the teacher does after the student has given an answer.

Four experienced teachers were trained to teach eight variations of the recitation strategy. These eight variations differed in the amount and kind of structuring, soliciting, and reacting used by the teacher. The high and low levels of structuring, soliciting, and reacting were defined by combining teaching behaviors which, earlier survey research had suggested, were related to student achievement.

HIGH STRUCTURING consisted of

- reviewing the main ideas and facts covered in a lesson;
- stating objectives at the beginning of a lesson;
- outlining the lesson content;
- signaling transitions between parts of a lesson;
- indicating important points in a lesson;
- summarizing the parts of the lesson as the lesson proceeded.

LOW STRUCTURING consisted of

- the absence of the teaching behaviors associated with high structuring.

HIGH SOLICITING consisted of

asking a relatively large proportion of questions which required the students to do more than simply recall information. Asking the students to combine facts to form principles, compare or contrast, interpret, or evaluate are typical examples of high soliciting.

LOW SOLICITING consisted of

asking a relatively large proportion of questions requiring students simply to recall information.

HIGH REACTING consisted of

praising correct responses;

providing reasons when a student response was judged to be incorrect;

prompting by providing a hint when a student response was incorrect or incomplete;

writing correct student responses on the chalkboard;

waiting in silence a relatively long time (3 seconds or more) a) after a student response, to encourage elaboration, and b) before calling on a second student when the first student called on failed to respond correctly or completely.

LOW REACTING consisted of

using neutral feedback (e.g., "OK," "Uh huh") after correct student responses;

not providing reasons when a student response was judged to be incorrect;

probing by asking a student to continue or elaborate a response;

waiting in silence a relatively short time (less than 3 seconds) a) after a student response and b) before calling on a second student after the first student called on failed to respond correctly or completely.

Table 2 shows the level of structuring, soliciting, and reacting used in each variation.

TABLE 2

Levels of Structuring, Soliciting, and Reacting in Eight Variations of the Recitation Strategy

Variation	Structuring	Soliciting	Reacting
1	HIGH	HIGH	HIGH
2	HIGH	HIGH	low
3	HIGH	low	HIGH
4	HIGH	low	low
5	low	HIGH	HIGH
6	low	HIGH	low
7	low	low	HIGH
8	low	low	low

The Context: Students, Curriculum, and Procedure

The study was conducted in sixth-grade public school classrooms. The students in each classroom were randomly divided into two classroom groups. Each group was taught by one of the trained teachers using one of the eight strategy variations. An attractive and scientifically accurate two-week curriculum on ecology was created for the experiment.

Before the teaching began, the students were given several pretests: a vocabulary test, memory tests, a true-false test of their knowledge of ecology, and a measure of their attitude toward ecology. The ecology lessons were taught for about forty minutes per day for nine days. During the first five minutes of each lesson, the students read a short unit on ecology. The remainder of the lesson was devoted to classroom recitation with the teacher structuring and soliciting, the students responding, and the teacher reacting. The teacher taught from a detailed lesson plan which served as a script for teaching each of the variations. Each lesson plan specified the subject matter to be covered, the questions to be asked, and the teaching behaviors to be used in the teaching approach. The four teachers--trained over a period of two weeks in the content of the curriculum and in the eight specific variations of the recitation strategy--were observed and recorded on audiotape as they taught. As Figure 1 shows, they conformed closely to the details of each of the variations.

Posttests

At the end of nine days of instruction the students took multiple-choice and essay tests of their knowledge and understanding of ecology and filled out a questionnaire about their attitude toward ecology. Three weeks later the students were given the same multiple-choice and essay tests in order to measure their retention of the ecology material. Also at this time the students again took the true-false test of their knowledge of ecology and filled out the attitude questionnaire.

Rationale for Studying the Recitation Strategy

The classroom recitation has been the subject of more research than any other kind of teaching. Although many other forms of teaching occur with some frequency, classroom recitation is still extremely widespread not only in the United States but throughout the world.

The recitation strategy is likely to continue to be used. Its flexibility makes it appropriate for many educational objectives. It is also adaptable to students of many different kinds. As against programmed instruction or computer-assisted instruction, it emphasizes things that only human teachers can do well, such as engage in a dialogue with students. Beyond what is possible with tutoring, independent study, or self-guided study, it allows teachers to arrange for students to interact with one another in ways that help them learn the skills of working with others in democratic and productive ways. More than the lecture method, the recitation strategy allows teachers to find out readily what the students are thinking and feeling and to modify their activity responsively.

The recitation strategy has been much studied, but usually by means of survey research. In such research, teachers behave as they are accustomed to behaving, and relationships between measures of teacher behavior and student achievement and attitude are determined. The main weakness of survey research is that it is difficult to infer that a certain teaching act causes students to learn better. On the other hand, experimental research does permit such inferences.

Discussion

All in all, the effects of variations within the recitation strategy on student achievement and attitude were small. Most of the variations in class

achievement were attributable to the differences in average academic ability of the classes. For example, because of the student assignment policies of the schools that were used, some of the experimental classrooms contained mostly students of high ability, while other classes contained mostly students of low ability. After the influence of these class differences was statistically removed, the differences between classes in student achievement and attitude were quite small across the variations.

One explanation for the small differences obtained is that the variations in the recitation strategy were not powerful enough to overcome the major role played by students' initial ability in determining their achievement. Since twelve years of growth and development had gone into producing differences in ability between students, it is not surprising that our short teaching sessions did not eliminate these differences.

Another explanation for the lack of significant effects is that the students were not exposed to the teaching variations long enough for the variations to show their effects. The students were exposed to the curriculum and teaching method for only six hours, or a total of about one school day. Although the teaching time in this study was short, it was long enough to produce a difference of 1.2 points in student achievement (after adjustment for aptitude) between the high- and low-soliciting variations.

Although the results of our study show that variations in the recitation strategy do not make a dramatic difference, they do not show that the recitation strategy itself is a weak teaching approach. In fact, our results suggest quite the opposite conclusion. The students in this study learned a great deal about ecology under all variations of the recitation strategy. Table 3 presents the students' average score on the 20-item true-false test of knowledge about ecology before the ecology unit and the average score three

TABLE 3

Average Student Scores on Knowledge about Ecology before Teaching and Three Weeks after Teaching

Number of Students	Average Pretest Score	Average Retention Score
408	7.52	11.78

weeks after completion of the unit. The results show that the students achieved a 4-item improvement on a test in which 95% of the students fell within a spread of 11 points. This gain reflects the amount of knowledge that students acquired as a result of teaching and remembered three weeks after they had been taught. (Because of time constraints, the students were not given the true-false test immediately after teaching.)

Finally, the results for student achievement and attitude showed that the effects of the teacher were sometimes greater than the effects attributable to the teaching variations. In view of the well-controlled nature of the classroom interaction, this result reflects the occurrence of teacher effects due to personal variations unique to each teacher and unrelated to the teaching variations manipulated in this study. Since the four teachers' personalities were not studied systematically, the nature of the personal differences between them cannot be determined.

Conclusions

At this preliminary stage, several conclusions can be drawn from this study:

1. The students learned a substantial amount about ecology. That is, the curriculum material and the recitation strategy in combination were apparently effective in helping students know and apply ecological facts, concepts, and principles.

2. The four teachers were able to vary their instructional performance with high precision. The teachers taught up to four different variations of the same lesson in a single day, making transitions between substantially different variations with no apparent difficulty. This finding indicates that experienced teachers can be trained to behave both flexibly and precisely in implementing a complex teaching strategy. Observers' impressions indicated that none of the eight variations seemed bizarre or unlike what might go on in any classroom. It seems plausible that all eight variations do occur in American classrooms.

3. Teaching behavior variables of the recitation strategy like those manipulated in this study do not seem to have large and powerful effects on student achievement over nine 40-minute teaching sessions. What the effects

might be over longer periods of teaching is conjectural. Also, better methods of estimating the importance of effects are needed.

4. Despite the rigorous control of content and teaching methods which made the performances of the teachers highly similar in these respects, there were still noticeable differences in the effectiveness of individual teachers. These differences indicate that personal factors unique to each teacher might be at least as important as teaching techniques in influencing student achievement and attitudes.

5. It is possible to do scientifically well-controlled yet realistic experiments on teaching in regular schools. This demonstration makes it more likely that future research findings can be translated into forms that will be more immediately useful to classroom teachers in the real world of the schools.