ALTERING STUDENT RESPONSES THROUGH CHANGES IN TEACHER VERBAL BEHAVIOR

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JUNIPER GARDENS CHILDREN'S PROJECT

Two experiments were conducted in a junior-high special-education class of eight pupils in an inner-city school. In the first experiment, the teacher doubled the number of words used by the pupils in answering questions by altering the type of questions asked. In the second experiment, the number of words used by students and the percentage of answers given in complete sentences, increased from less than 5% to approximately 90% when the teacher instructed the pupils to answer in complete sentences and asked another pupil to answer using a sentence if the first one did not do so. In both experiments, a brief return to baseline conditions brought a return to low levels of verbal responding. An analysis of which pupils were called on by the teacher, teacher praise, and in the second experiment the types of questions asked, indicated that these variables were not responsible for the increases in verbal responding.

DESCRIPTORS: language, verbal behavior, questions, sentences, instruction, special-education classes, junior high school students

Verbal output has been the subject of several applied behavior analysis experiments in school settings. Hart and Risley (1968) increased the use of adjectives by disadvantaged preschool children by making praise and access to materials contingent on color naming. Reynolds and Risley (1968) increased the verbal rate of a disadvantaged preschool child by first prompting an imitative response and then issuing materials and adult social attention contingent on the child's verbalization.

Other school studies have shown that the verbal behaviors of pupils can be altered (*e.g.*,

Broden, Hall, and Mitts, 1971; Hall, Fox, Willard, Goldsmith, Emerson, Owen, Davis, and Porcia, 1971). These school studies, however, were concerned with decreasing inappropriate verbalizations. The present study attempted to analyze the effects of systematically altering teacher questions, instructions, and consequences, in an effort to increase the amount and complexity of student verbal responding.

Subjects and Setting

Seven boys in a special-education class served as subjects. The class met each school morning from 8:00 to 10:00 in a public junior high in an all-black economically deprived area in Kansas City, Kansas. Class began each day with a 25-min discussion of the day's assignments of math, reading, and social science. To be counted as a session, at least three of the seven students had to be present. The teacher was in her second year of teaching and had no prior experience with behavior-modification principles. During preliminary observations it was evident that no significant disruptive problems existed in the class. However, these same observations indicated that during discussions few, if any, stu-

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dents responded to questions with more than one or two words. The purpose of the present study was to investigate procedures to increase participation in discussion, as measured by the number of words and the number of complete sentences used when students responded.

PROCEDURES

Observation

Daily observations were made by an observer who entered the room before class began and sat at the back of the room. The observer recorded data on a three-column form (See Figure 1). In the first column, the teacher's questions were recorded word for word. In the second column, the students' answers were noted. The third column was used to record which student answered the question and which students raised their

hands following each teacher question. All sessions were tape recorded.

Teacher Questions

If the teacher began a sentence with an implied or stated interrogative word (who, what, when, where, why, how, did, or does) it was recorded as a question. In order to be tallied, the question also had to be followed by a pause and/or by the teacher calling on someone to answer. At least once during each condition, another observer made an independent but simultaneous record of teacher questions. Reliability scores were obtained by comparing the two records question by question. Agreement was scored if the observers agreed (1) that the question had been asked, and (2) that the question dealt with the same subject-noun. The number of agreements in their records was divided by total num-

Number Present 7 Date April 12, 1972
Class NE-7 Observer Beasley

Teacher Question	Student Response	Student	Question-Type-Classification
1. What is a check?	a piece of paper	J	<u>Review</u> (discussed previous day) <u>Multiple Word Answer</u> (cannot be answered with one word.)
2. Why do we write checks?	to get money	E	<u>New</u> (not previously discussed) <u>Multiple Word Answer</u> (cannot be answered with one word.)
3. Do any of you have a checking account?	yes	G	<u>New</u> (not previously discussed) <u>Single Word Answer</u> (can be answered in one word.)
4. What is the first line on the check for?	the date	M	<u>Review</u> (before them in text) <u>Single Word Answer</u> (can be answered in one word.)
5. Where do we sign our name?	at the bottom	O	<u>Review</u> (reviewed before in class) <u>Single Word Answer</u> (can be answered in one word.)

Number Present 7 Date May 2, 1971
Class NE-7 Observer Beasley

Teacher Question	Student Response	Student	Question-Type-Classification
1. What color is a stop-light?	A stoplight is red.	E	<u>Review</u> (discussed previously in class) <u>Single Word Answer Required</u> (can be answered with one word.)
2. Why must we stop?	We should stop because other cars might hit us.	J	<u>Review</u> (discussed previously in class) <u>Multiple Word Answer Required</u> (needs more than one word to answer.)
3. Who can tell us about an accident they saw?	I saw one on Minnesota last summer.	M	<u>New</u> (not previously discussed) <u>Multiple Word Answer Required</u> (needs more than one word to answer.)
4. Why do you think it happened?	This guy was speeding.	M	<u>New</u> (not previously discussed) <u>Multiple Word Answer Required</u> (needs more than one word to answer.)
5. What page are we ready to read on?	We're on page 5.	G	<u>Review</u> (before them in text) <u>Single Word Answer Required</u> (can be answered in one word.)

Fig. 1. An example of a data sheet used to record the class discussion sessions: Column I was used to record the teacher's question, Column II was used to enter the students' responses, Column III indicated which student responded, and Column IV indicated whether the question was new, review, or required a single- or multiple-word answer.

ber of agreements plus disagreements. Agreement ranged from 97 to 100%.

The questions were categorized in order to make certain that changes in student responses had not occurred as a result of a change in the type of question asked. One category included New Questions, which dealt with material not covered in the textbook or during previous in-class discussions or lectures. A second category included Review Questions, which asked for information that had been discussed previously in class or was contained in the textbook.

Each of the first two categories was divided into two additional categories, which specified whether the student would be required to respond with a long or short answer. Questions in the "One-Word Answer" category could be answered in one word (articles such as "a" or "the" were not counted in determining whether the response was One Word). Typical one-word type questions were true-false, fill-in, and those asking for which one, how many, or one thing. "Multiple-Word Answer" questions frequently asked for definitions, explanations, multiple-step answers, or student views. The number of words a student used in responding was irrelevant in categorizing the questions. The questions in Figure 1 are classified according to these categories.

Reliability scores on the four question categories were obtained by having two observers independently score the same questions. The two records were then compared question by question. The number of categories the observers agreed on were divided by the total number of observer agreements plus disagreements and was multiplied by 100 to obtain a percentage figure. Each condition was checked at least three times. The mean reliability scores for each condition ranged from 82 to 100%.

Student Answers

Student answers were recorded only when a pupil raised his hand and was called on by the teacher. Each answer was classified according to the number of words used to answer the question and according to whether or not the re-

sponse was in the form of a sentence. The answer was counted as a sentence if it had a subject and a verb. At least three reliability checks were conducted by the two observers during each condition. Agreements were tallied by comparing the two observers' records and scoring an agreement if the observers both said it was or was not a sentence. Number of agreements was divided by number of agreements plus disagreements and multiplied by 100 to obtain a percentage. Agreement ranged from 92 to 100%.

EXPERIMENT I

Baseline₁

Baseline₁ rates were obtained on the four types of teacher questions asked during eight class discussions. The length of student answers, measured in number of words, was also recorded. No attempt was made to alter teacher presentation or question types.

New and Multiple-Word Questions₁

Following Baseline₁, the teacher was asked to increase the number of New Questions and questions requiring multiple-word answers during each class session. For example, she was asked to increase the number of questions beginning with "why", since single-word answers could not appropriately follow that question type. No instructions were issued to the students.

Baseline₂

During Baseline₂, the teacher was asked to reduce the number of New and Multiple-Word questions to approximately Baseline₁ levels.

New and Multiple-Word Questions₂

The teacher again increased the number of New and Multiple-Word questions.

RESULTS

Baseline₁

Figure 2 presents a record of the number of words used by students in answering teacher

Fig. 2. A record of the number of words used to respond to the teacher's questions. Baseline₁—before experimental procedures, New and Multiple-Word Questions₁—the teacher increased the number of New and Multiple-Word Answer questions, Baseline₂—the number of New questions was reduced, New and Multiple-Word Questions₂—the number of New and Multiple-Word Questions were increased.

questions. During Baseline₁, students answered using an average of 2.0 words.

New and Multiple-Word Questions₁

When the teacher was asked to increase the number of New and Multiple-Word questions, the mean length of student answers doubled to four words.

Baseline₂

When the teacher discontinued asking New and Multiple-Word Questions, the length of student answers again decreased to approximately two words.

New and Multiple-Word Questions₂

When the teacher once again increased the number of New and Multiple-Word Questions a corresponding increase in the length of student

answers to almost four words per answer was observed.

Table 1 gives the per cent of times New and Multiple-Word Questions were asked during each condition. Since questions were either New or Review, an increase in New Questions indicated a proportionate decrease in Review-type questions. Since each question was also either a Multiple-Word or One-Word Answer Question, an increase in Multiple-Word Questions also resulted in a proportionate decrease in One-Word Answer Questions. As can be seen from Table 1, the teacher increased her use of New and Multiple-Word Answer Questions during the experimental phases.

To make certain that other factors were not responsible for the observed changes in length of student answers, teacher attention to students was also assessed, but was found to vary unsys-

Table 1

A table presenting the per cent of new questions (as opposed to review questions) requiring multiple-word responses (as opposed to questions that could be answered by one word) during baseline and experimental conditions.

	<i>Baseline₁</i>	<i>New and Multiple-Word₁</i>	<i>Baseline₂</i>	<i>New and Multiple-Word₂</i>
New Questions Asked by Teacher	16%	33%	23%	30%
Questions Requiring Multiple-Word Responses Asked by Teacher	12%	50%	23%	45%

tematically across experimental conditions. During Baseline₁, 3% of the New Questions were reinforced; during New and Multi-Word conditions, 6% of the New Questions were reinforced. During Baseline₂, 0% and in New and Multi-Word₂ 3% of the New Questions were reinforced. Some correlation was noted in responses to Review Questions. Teacher praise was higher during Baseline₁ (16% of the responses were praised) and Baseline₂ (15%) than during New and Multi-Word₁ and New and Multi-Word₂, where 8% and 9% of the responses were praised respectively.

Praise to Multiple-Word Questions varied unsystematically from 0% in Baseline₁ to 5% in New and Multiple Word₁, to 5% praised during Baseline₂ and 12% during New and Multiple Word₂.

An analysis of the length of student answers to the various question types indicated that length of student answers to all types of questions increased when the teacher increased the

number of New and Multiple-Word Questions. The number of words per answer to each question category are presented in Table 2. As can be seen, the greatest increases were in the answers to New and Multiple-Word Answer Questions. Responses following Review and One-Word Answer Questions also increased during experimental conditions, however. Increasing New and Multiple-Word Answer Questions, therefore, appeared to increase the length of all responses.

An analysis of the data presented in Table 3 for the seven individual students indicated that each of them increased the length of his answers to questions during experimental conditions. Table 3 shows the largest increase to be 4.8 words per answer by Subject "R". The smallest increase was 0.3 words per answer by subject "G". The "Xs" indicate that Subjects "J" and "D" were not present during a given condition. Since J's absences occurred during only one condition and D's during Baseline₁ and one experimental condition, and since their other responses

Table 2

A table of the mean number of words per answer to new, review, one-word answer, and multiple-word answer questions during each phase of the experiment.

	<i>Baseline₁</i>	<i>New and Multiple-Word Questions₁</i>	<i>Baseline₂</i>	<i>New and Multiple-Word Questions₂</i>
New Questions	2.1	5.1	2.7	5.8
Review Questions	2.1	2.5	2.1	2.7
One-Word Questions	1.95	2.3	2.0	2.5
Multiple-Word Questions	2.4	4.8	3.2	5.3

Table 3

A table of the mean number of words per answer by each pupil during the various baseline and experimental phases.

Pupil	Baseline ₁	New and Multiple- Word	Baseline ₂	New and Multiple- Word
		Questions ₁		Questions ₂
J	X	5.0	1.6	3.4
E	1.4	3.0	2.8	6.7
O	2.2	3.1	1.4	2.6
G	1.7	2.0	1.6	2.2
R	0	4.8	1.9	5.6
D	X	3.3	2.8	X
M	2.4	4.4	1.8	3.2
Mean	1.1	3.7	2.0	3.4

follow the general pattern of students present during all conditions, it is assumed their absences were not significant factors.

Table 4 lists the per cent of times each student was called on to answer questions. Except for Subjects "O" and "R", there appears to be no correlation between length of responses and number of times they were called on. Neither "O" nor "R" were the best nor worst responders, thereby tending to negate the possibility that the teacher called on or ignored them to increase the general length of responses in the class.

EXPERIMENT II

A second experiment was conducted, using the same subjects, to determine the effect of instruc-

Table 4

A table of the per cent of occasions each pupil was asked to answer the teacher during the various baseline and experimental phases.

Pupil	Baseline ₁	New and Multiple- Word	Baseline ₂	New and Multiple- Word
		Questions ₁		Questions ₂
J	X	10%	10%	7%
E	19%	2%	3%	7%
O	14%	4%	14%	6%
G	33%	18%	15%	33%
R	0%	25%	16%	25%
D	X	16%	28%	X
M	34%	25%	14%	22%

tions and consequences on answering in complete sentences. The second experiment followed the first by a two-week break, during which no experimental conditions were in effect. Baseline₁ was begun following the two-week break. All previous instructions to the teacher to ask particular kinds of questions were discontinued.

An observer sat at the back of the room and recorded whether or not each student responded to a teacher question by using a complete sentence containing a noun and a verb. Tape recordings were made of each observation session. Periodically during each experimental phase, a second observer listened to the recordings and recorded student responses. Agreement between the two observers was computed by dividing the number of disagreements by the number of agreements plus disagreements and multiplying by 100. The per cent of agreement ranged from 85 to 100%.

Baseline₁

A baseline was recorded of the number of times a sentence was used by a student in response to a teacher question during class discussion. No attempt was made to alter conditions in effect before the baseline condition.

Instructions and Consequences₁

Following Baseline₁, the teacher instructed the students to respond to questions using sentences. This instruction was issued before each class discussion. If, at any time during the discussion, the instruction was not followed, the teacher paused approximately 5 sec, during which time the student could change his answer to one given in sentence form. If the student still did not answer in a sentence, the teacher asked, "Can anyone answer in a sentence?", and called on someone else to answer. No alteration was made in the types of teacher questions asked.

Baseline₂

Baseline₂ was begun on the tenth day of the experiment. During this condition the teacher refrained from issuing instructions to answer in

sentences and accepted any length of answer, whether or not it was a complete sentence.

Instructions and Consequences₂

The Instructions and Consequences₂ condition was essentially the same as Instructions and Consequences₁.

RESULTS

Figure 3 presents a record of the per cent of answers given in sentence form. During Baseline₁, students averaged 2.9 words per response, and only 4% of the student responses were in sentence form.

When the Instructions and Consequences₁ condition was instituted, the mean number of words per response increased to 5.3 and the per cent of responses in sentence form increased to

approximately 90%. In a return to baseline conditions (Baseline₂), both the number of sentences used by the pupils and the number of words per answer decreased to Baseline₁ levels.

Following a five-day reversal, the teacher once again issued the instruction to answer using sentences. Under these conditions, words and sentences used in responding increased once again.

An analysis of the types of teacher questions used in each condition revealed that in this experiment, the question types varied only slightly and unsystematically across conditions. Therefore, this was probably not a significant factor in the changes in pupil responding.

An analysis similar to that made in Experiment I of the per cent of times the teacher called on each student revealed that the teacher did

(AB)

Fig. 3. A record of the per cent of responses given in sentence form. Baseline₁—before experimental procedures. Instruction₁—instruction given to answer in sentences and noncomplying behavior ignored. Baseline₂—withdrawal of teacher instructions and attention given to all responses. Instruction₂—instructions given to answer in sentences and noncompliance ignored.

not systematically favor calling on one student over another during baseline or experimental conditions. It was also found that teacher praise varied unsystematically across experimental conditions.

DISCUSSION

The results of these experiments indicate that the teacher can modify the way in which students respond verbally by altering the types of questions asked and also by issuing instructions to the students and by ignoring noncompliance with those instructions. The fact that these simple procedures were effective in modifying verbal behavior may signify that complex and time-consuming procedures are not necessary to produce increased speech in inner-city pupils who are largely nonverbal.

It may be that complex speech patterns can be developed more easily than has been assumed previously. Research by Hart and Risley (1968) has indicated that preschool pupils from all-black inner-city environments have all component parts of middle-class language in their repertoires, but that they use some components at lower rates than their middle-class counterparts. This research would tend to corroborate those findings, as well as their demonstrations that increases in the use of appropriate language by these children could be increased through systematic manipulation of environmental factors (Hart and Risley, 1968; Reynolds and Risley, 1968). Heretofore little information has been available to parents, teachers, and other workers with these populations as to specific procedures that will result in increases in use of verbal language in applied settings; most of those suggested have required high response costs on the part of the teacher.

The significance of these findings would seem to be enhanced because the pupils in the study were from an all-black low socio-economic area inner-city school in which the general level of academic and verbal skills, as measured by middle-class standards, was low. In addition, they

had been labelled retarded and selected for placement in a special-education class because they were performing at a level significantly below the already depressed norms for their school. One of the major considerations for labelling them retarded and for placing them in a special class was a lack of language skills, including verbal responding. Thus, the development of procedures to increase use of appropriate verbal language was an important goal for this class. As the data show, until the experimental procedures were implemented, the teacher had been largely unsuccessful in increasing verbal responding during class discussion.

Madsen, Becker, and Thomas (1968) and Packard (1970) both found that instructions, even when paired with ignoring noncomplying behaviors, were relatively ineffective in modifying disruptive and attending behaviors. Several explanations, all speculative, might account for why instructions were effective in changing behavior in this study and not in the Madsen *et al.* and Packard studies. The students in the present study were older and possibly were more receptive to instruction, even though one reason they were in a special class was because of their histories of unresponsiveness. Fewer students were in this class than in the Madsen *et al.* and Packard studies, and therefore the teacher was able to respond to each one more often. It is also possible that the present verbal behaviors were more sensitive to instructional control than were the disruptive behaviors of the Madsen *et al.* study. Or, perhaps using one instruction to govern one behavior is more effective than employing numerous rules to govern multiple behaviors. Finally, the fact that here instructions were followed by systematic consequences that reinforced appropriate responding but ignored and provided a model for inappropriate responding may have been a factor. Further research would be necessary to determine which if any of these differences were causal factors.

One reason that applied behavior analysis researchers have shunned complex academic studies is due to the problems of defining be-

haviors and variables. Classifying teacher question types in this study was an attempt to help define a complex behavior, so that an analysis could be made of which aspects of this important teacher behavior affected pupil verbal responses. Recording and analyzing student answers in reaction to teacher questions was also necessary. Unless the significant components of a complex behavior can be identified, we cannot be certain whether or not the observed changes were due to experimentally manipulated conditions or to uncontrolled and unaccounted for factors. Thus, it was important to analyze the number and types of questions asked by the teacher and to identify whom she called on and how they responded, in order to determine the roles of these factors in changing student responses.

As noted, most experiments involving verbal behavior in public-school classrooms have been aimed at decreasing and controlling inappropriate speech. This study, in contrast, provides information on what teachers can do when classroom control is not a problem or what to do once control has been established. Since one of our primary aims in education is not to silence pupils but to encourage them to use speech ap-

propriately and effectively, it marks a needed step in a new direction for applied behavior analysis research.

REFERENCES

- Broden, M., Hall, R. V., and Mitts, B. The effect of self-recording on the classroom behavior of two eighth-grade students. *Journal of Applied Behavior Analysis*, 1971, 4, 191-199.
- Hall, R. V., Fox, R., Willard, D., Goldsmith, L., Emerson, M., Owen, M., Davis, F., and Porcia, E. The teacher as observer and experimenter in the modification of disputing and talking-out behaviors. *Journal of Applied Behavior Analysis*, 1971, 4, 141-149.
- Hart, B. and Risley, T. R. Establishing use of descriptive adjectives in the spontaneous speech of disadvantaged preschool children. *Journal of Applied Behavior Analysis*, 1968, 1, 109-120.
- Madsen, C. H., Becker, W. C., and Thomas, D. R. Rules, praise, and ignoring: elements of elementary classroom control. *Journal of Applied Behavior Analysis*, 1968, 1, 139-150.
- Packard, R. G. The control of classroom attention: a group contingency for complex behavior. *Journal of Applied Behavior Analysis*, 1970, 3, 13-28.
- Reynolds, N. J. and Risley, T. R. The role of social and material reinforcers in increasing talking of a disadvantaged preschool child. *Journal of Applied Behavior Analysis*, 1968, 1, 253-262.

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