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ABSTRACT

The two main purposes of this study were: (1) to determine the effectiveness of a teacher training program "Minicourse 9: Higher Cognitive Questioning"; and (2) to compare the relative effectiveness of two instructional techniques in changing teacher behavior-observation of videotaped model teachers displaying classroom skills, and reading of transcripts derived directly from the videotapes. A group of 54 teachers took Minicourse 9. A separate group of 24 teachers served as controls. A pre- and post-measure of each teacher's discussion behavior were collected. The two student response measures--frequency and length of higher cognitive responses--both increased favorably as a consequence of the Minicourse. The study indicates that the course was ineffective in changing teachers' use of refocusing. It also indicates that the written version of Minicourse 9 is at least equally as effective as the video version. On some course indices, such as probing questions, the written version is clearly superior. However, the written materials used in this study were developed directly from videotapes, and as a result, probably had greater realism and interest than if composed by a writer who created the classroom dialogue. (DB)

COMPARISON OF INSTRUCTIONAL MEDIA IN A MINICOURSE ON HIGHER COGNITIVE QUESTIONING

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Purpose of Study

This study was conducted for two main purposes. First, the authors wished to determine the effectiveness of a teacher training program, Minicourse 9: Higher Cognitive Questioning, in changing teacher and student behavior. The study was carried out as part of the research and development cycle used at the Far West Laboratory to produce training materials (Borg et al, 1970). A given set of materials such as Minicourse 9 is not released for general use until there is evidence indicating that it brings about significant behavioral changes in the target audience.

The second purpose of the study was to compare the relative effectiveness of two instructional techniques in changing teacher behavior. It is a well-established finding that a person can acquire new behavior patterns by observing these patterns displayed by another person (Bandura, 1965). This

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learning process has been labeled "vicarious learning" or "modeling". In the present study, we were concerned with the question, "What is the relative effectiveness, as measured by changes in teachers' question-asking behavior, of two forms of modeling: (a) observation of videotaped model teachers displaying classroom skills; or (b) reading of transcripts derived directly from the videotapes (written modeling)?" Two previous studies have compared similar modeling treatments. Allen et al (1967) found no difference between video and symbolic modeling in training pre-service teachers to use higher cognitive questions. Koran (1969) found a significant, though small difference favoring video modeling for a similar skill and teacher population.

Method

Treatments

Minicourses. The Teacher Education Program of the Far West Laboratory is developing a coordinated series of Minicourses, each covering a different set of basic teaching skills. Minicourses are designed primarily for inservice teachers, although there have been some adaptations to preservice settings. Each Minicourse is field tested at least three times before final release. The version tested here in two forms was developed for the second field test - the main one in the R & D cycle.[1]

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[1] Since this study, Minicourse 9 has completed the R & D cycle and is available in commercial form (Gall, Weathersby, and Dunning, 1971).

Minicourse 9 provides about 15 hours of training in four lessons. Each lesson follows the same sequence of: instruction in several teaching skills; a microteach session in which the teacher practices these skills with a small group of his students and videotapes it for later replay and self-analysis; and a reteach session, which is essentially another microteach session for further practice.

Video Treatment. The instructional phase of this treatment consisted of a teacher handbook which explained the course skills and provided practice in discriminating and writing various types of higher cognitive questions. It also contained four instructional and four model videotapes which showed teachers using the skills in various classroom situations.

Written Treatment. This treatment was the same as the video treatment except that trainees did not view any of the instructional or model videotapes. Instead they read transcripts of these videotapes. The transcripts were derived from the shooting scripts of the videotapes. The narration was put in paragraph form, and the discussion clips were transcribed in the form of teacher-student interactions.

Control Treatment. Trainees in this treatment received no instruction or visitation by Laboratory staff during the time that the video and written groups were taking Minicourse 9. The purpose of the control group was to determine the extent to which changes from pretesting to posttesting could be attributed to factors other than the experimental treatments.

Sample

A total of 80 teachers in two California school districts were recruited on a voluntary basis to participate in the study. One group of 56 teachers was recruited to take Minicourse 9. These teachers were randomly assigned to the video and written versions of the course. Descriptive statistics on teachers' age, teaching experience, and grade level are given in Table 1. Eventually, two teachers dropped from the course, resulting in a final sample size of 54.

A separate group of 24 teachers from the same school districts was recruited to serve as controls. These teachers were paid a stipend of $ 15.00 to conduct a pretape and posttape discussion lesson. As Table 1 shows, the control teachers differed from the treatment groups in generally being older and more experienced.

Data Collection Instruments

To determine the relative effectiveness of the two treatment and one control conditions, a pre-measure and a post-measure of each teacher's discussion behavior were collected.

One week prior to the start of the course, teachers in all three groups were assigned a one-page standard stimulus article on which they were to conduct a twenty-minute discussion with their classes. The articles were chosen so as to have the following characteristics: brevity; of interest to students; at the students' reading level; and containing a mixture of fact

and thought-provoking material. All 4-6th grade teachers received one article; the junior high school teachers received another.

The teachers were asked to have their students read the article a day prior to the audiotaped discussion, with no intervening discussion. One week after the course had concluded, teachers were given another standard stimulus article on which to base a discussion. Again the 4-6th grade teachers received one article; the junior high school teachers received another. An attempt was made to make the pre-post pairs of articles as equivalent as possible on the dimensions described above (brevity, interest, etc.).

Because it is is difficult to obtain a good audiotape recording in a regular classroom setting, teachers were requested to use only one-half of their students for pre- and post-course taping. To select a random sample of students, teachers referred to their class roster and selected the first, third, fifth student, etc. for inclusion in the sample. The same students were used for pre- and post-course taping.

To facilitate later scoring of discussion behaviors, typed transcripts were made of all audiotapes.

Scoring of Audiotapes. After the audiotapes had been transcribed, raters were trained to classify each question asked by a teacher into one of Bloom's six categories: Knowledge, Comprehension, Application, Analysis, Synthesis, and Evaluation. Two raters scored each transcript. Reliability coefficients ranged from .54 to .96; the median coefficient was .86. In the data analyses that follow, the question types except Knowledge were considered higher cognitive.

Following classification by type, raters judged whether each question "refocused" from the lesson topic to another lesson topic or to personal experience. The average interrater reliability coefficient was .71.

As part of the data analysis, it was planned to compute the mean length and number of student responses to each type of higher cognitive question. Before this analysis could be undertaken, however, it was necessary to resolve all disagreements by raters in classification of each question. A third rater who had not been one of the two raters assigned to score a particular transcript was used to resolve the disagreements. In all instances in which one of the original raters had classified a teacher utterance as a question of some type, whereas the other original rater had not considered it to be a question, the third rater was instructed to accept the scoring of the first-mentioned rater.

A research clerk counted the length of each student response to a question. However, if a student response was partially or entirely inaudible (as indicated by series of dots in the transcript), the response was not counted at all. Otherwise, the length of inaudible student responses would be unjustifiably shortened. However, inaudibility is not a biasing factor in computing the number of student responses to each type of question. Therefore, all student responses, irrespective of audibility, were entered into the computation of this variable.

Results

Percentage of Higher Cognitive Questions

Table 2 presents the mean percentage of higher cognitive questions asked before and after Minicourse 9 by teachers in the video, written, and control groups. Analysis of covariance and follow-up comparison between adjusted means reveals that, at each grade level, the video and written groups significantly outperformed the control group; but the video and written groups did not differ significantly from each other.

Frequency of use of each question type was also analysed, as a matter of interest. Results of these analyses indicated that percentage of higher cognitive questions increased for the video and written groups, primarily because of a sizable reduction in use of knowledge questions, with an accompanying small increase in use of higher cognitive questions.

Number of Student Responses

Table 3 presents the number of student answers given in response to teachers' higher cognitive questions. For a given teacher, the frequency of student higher cognitive answers is not necessarily equal to the frequency of teacher higher cognitive questions, since a given question might elicit more than a single response. This situation would occur if the teacher "redirected" the same question to several students, or if several students responded in turn to the same question.

Analyses of covariance, and subsequent comparison of adjusted means, indicated that the written group outperformed the controls at both grade levels. The video group outperformed the controls only at the 4-6th grade levels. Also, the written group significantly outperformed the video group at the junior high school level; the same comparison at the 4-6th grade level approached significance at the .05 level.

Length of Student Response

One of the assumptions underlying Minicourse 9 is that if teachers increase their use of higher cognitive questions, more thoughtful student responses should occur. Furthermore, it is assumed that there is a positive relationship between thoughtfulness of a response and its length.

The mean number of words in student responses to higher cognitive questions is shown in Table 4. Only slight changes occurred in the treatment groups. Even these increases can be attributed to factors other than the Minicourse, since the controls made comparable gains.

The possibility occurred to the authors that only slight increases were observed because teachers in the treatment groups elicited more student responses on the posttape (see Table 3). Teachers might be eliciting more long responses, but if they were also eliciting more short responses, the mean response length would not increase appreciably. Thus, the decision was made to determine whether there was an absolute increase in frequency of long responses after training. A long response was operationally defined as a response 15 words or longer in length. Table 5 presents the results

of this analysis. For the elementary school sample, the number of long responses decreased slightly for the control group, whereas they increased by 27 percent in the video group, and by 86 percent in the written group.

Less difference between the video and written groups was obtained in the junior high school sample. The increase for the video group was 38 percent, and for the written group it was 29 percent. The control group made only a slight percentage gain of 9 percent.

The results of this analysis indicate that the video and written treatments did, in fact, lead teachers to elicit longer student responses in terms of absolute frequency of occurrence. The fact that the overall mean response length did not increase indicates that the treatments led teachers to elicit more short responses as well.

Probing Questions

Table 6 presents the mean number of probing questions asked by each group of teachers before and after Minicourse 9. Probing questions were narrowly defined as questions requiring the student to defend or justify his original response to a higher cognitive question; most probing questions were identified by the use of the question stem "Why?" Analyses of covariance, and subsequent comparison of adjusted means, revealed that only the written group in the 4-6th grade sample made significant gains in use of this technique.

Refocusing Technique

Table 7 presents the mean frequency with which each treatment group used refocusing before and after Minicourse 9. It is evident that only the video and written groups in the junior high school sample made gains, but even these did not exceed the gain made by the controls. Analyses of covariance supported this impression: there were no significant differences between the three groups in either sample.

Post-Course Questionnaire Data

After posttaping was completed, each teacher in the video and written groups was administered a questionnaire to elicit his reactions to the course. Several of the items were designed to elicit teachers' perceptions of the Minicourse's effectiveness. Distribution of responses to these items for each treatment group is shown in Table 8. It appears that teachers perceived Minicourse 9 favorably, and that there were no substantial differences between treatment groups in this respect.

Conclusions

The main objective of Minicourse 9 is to increase teachers' use of higher cognitive questions in discussions. The data of the main field test indicate that the course does indeed accomplish this objective. However, we may speculate whether the obtained increases are of practical significance. For example, the junior high school written group gained only

5.6 percentage points, from 67.2 to 72.8 percent. However, it should be noted that the baseline percentages were unusually high compared to those obtained in other studies (see Gall, 1970 for a review of these studies). Two explanations can be offered for this phenomenon: the teachers in the sample were unusually well trained prior to Minicourse 9; or the assigned topic caused teachers to conduct a much better discussion than if they were asked to select their own discussion topic. We have no reason to believe that the teachers were unusual. The second explanation seems much more plausible, especially since in all the studies reporting low baseline data, teachers were free to select their own discussion topics.

Pursuing this line of reasoning, we may speculate that if Minicourse 9 were evaluated with unassigned pretape and posttape topics, different percentage gains would be obtained. Furthermore, since high baseline percentages are obtained using assigned topics, we may hypothesize that one of the things teachers learn in a training program on higher cognitive questioning is to select lesson material that is conducive to a thoughtful discussion.

The data on frequency of each question type indicate that teachers already have higher cognitive questioning skills prior to inservice training. The main change effected by the Minicourse is to decrease teachers' use of Knowledge questions, thereby increasing the percentage of higher cognitive questions.

The two student response measures - frequency and length of higher cognitive responses - both increased favorably as a consequence of the Minicourse.

Although length of response is probably related to its quality, the authors realize that much better measures of this variable need to be developed.[1]

The study indicates that Minicourse 9 was ineffective in changing teachers' use of refocusing. Therefore, this technique was omitted from the next developmental version of the course.

The study also indicates quite clearly that the written version of Minicourse 9 is at least equally as effective as the video version. On some course indices, such as probing questions, the written version is clearly superior. The reader should not construe this finding to mean that <u>any</u> written materials are as effective as instructional videotapes. The written materials used in this study were developed directly from videotapes; as a result, they probably had greater realism and interest than if they were composed by a writer relying only on imagination to create classroom dialogue. This finding influenced the design of the final, commercial version of the course: four of the instructional videotapes were made into films, in part because of their motivational appeal; the other four videotapes were converted to handbook form to lower cost of the product to the user.

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[1] The final version of Minicourse 9 moves in this direction by presenting various criteria (e.g. clarity, complexity, defensibility) which the teacher can use in evaluating his students' answers.

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Table 1

Descriptive Information about Participating Teachers

Group	Sample Size	Age		Years of Teaching Experience	
		$\bar{X}$	S.D.	$\bar{X}$	S.D.
I. Grades 4-6					
Video	16	30.9	8.7	6.9	8.1
Written	16	36.5	7.6	9.4	4.0
Control	13	40.6	10.6	11.5	10.9
II. Junior High School					
Video	10	34.3	7.6	6.3	3.6
Written	12	34.5	7.5	9.1	6.5
Control	11	42.5	11.6	14.7	9.0

Table 2

Percentage of Higher Cognitive Questions

Group	Precourse			Postcourse		
	$\bar{X}$	S.D.	N	$\bar{X}$	S.D.	N
I. 4-6th Grade Teachers						
Video	49.9	13.2	16	67.0	15.9	16
Written	40.4	15.9	16	63.8	15.4	16
Control	52.2	18.1	13	45.3	14.4	13
II. Junior High School Teachers						
Video	61.1	14.5	10	72.9	18.7	10
Written	67.2	15.7	12	72.8	13.3	12
Control	58.8	19.4	11	55.5	13.8	11

Table 3

Mean Number of Student Responses to Higher Cognitive Questions

Group	Precourse		Postcourse	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.
I. Grades 4-6				
Video	32.3	11.5	38.9	15.9
Written	31.1	12.1	47.1	12.9
Control	38.2	15.7	31.4	12.0
II. Junior High School				
Video	30.4	6.8	36.0	16.3
Written	39.0	16.1	55.3	20.3
Control	29.6	16.0	34.0	16.9

Table 4

Mean Number of Words per Student Response to Higher Cognitive Questions

Group	Pretape	Posttape
I. Grades 4-6		
Video	15.0	15.6
Written	11.3	13.2
Control	11.5	13.2
II. Junior High School		
Video	16.0	18.9
Written	19.4	17.8
Control	11.9	13.2

Table 5

Number of Students Giving Long Responses (15 words or more)

Group	Number of Classes	Pretape	Posttape
I. Grades 4-6			
Video	16	164	208
Written	16	133	247
Control	13	135	121
II. Junior High School			
Video	10	127	175
Written	12	194	250
Control	11	97	106

Table 6

Number of Probing Questions
Precourse and Postcourse

Group	Precourse		Postcourse	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.
I. 4-6th Grade Teachers				
Video	2.62	2.24	2.75	1.83
Written	1.93	1.73	4.81	2.92
Control	2.38	2.22	2.46	2.14
II. Junior High School Teachers				
Video	2.10	1.36	2.20	1.31
Written	1.58	1.78	2.83	3.38
Control	2.90	2.26	1.63	1.69

Table 7

Frequency of Use of Refocusing Technique
Precourse and Postcourse

	Precourse		Postcourse	
	$\bar{X}$	S.D.	$\bar{X}$	S.D.
I. 4-6th Grade Teachers				
Video	3.84	2.10	3.62	1.76
Written	3.56	1.84	3.59	1.40
Control	4.19	2.43	3.69	1.84
II. Junior High School Teachers				
Video	3.00	1.83	4.55	2.63
Written	2.58	1.79	3.87	3.05
Control	3.63	1.22	4.59	2.26

TABLE 8

General Evaluation of Minicourse 9

	VIDEO (N=21) %	WRITTEN (N=25) %
1. As compared to other inservice education experiences, how would you rate Minicourse 9?		
Much better than	52	48
Better than	33	44
On a par with	15	8
Worse than	0	0
Much worse than	0	0
2. As compared to your college (preservice) education courses, how would you rate Minicourse 9?		
Much better than	35	61
Better than	48	20
On a par with	17	11
Worse than	0	8
Much worse than	0	0
3. To what extent has Minicourse 9 helped you improve your overall teaching?		
Considerable Improvement	8	23
Some Improvement	75	58
Slight Improvement	13	16
No Improvement	4	3