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ABSTRACT

An experiment was performed to compare the relative effectiveness of two microteaching procedures. In the low-cost treatment, student teachers received training in higher cognitive questioning skills by means of written modeling procedures (Subjects read transcripts of videotape model lessons) and audiotape feedback after each microteaching session. The comparison group viewed videotape models and received videotape feedback. Comparisons of pre- and post-training tapes of teaching performance indicate that the variations are of equal effectiveness in increasing teachers' use of higher cognitive questions (average increase, from 35 percent to 57 percent) and length of student responses elicited by their questions. The document is divided into four sections: summary; general descriptions; literature reviews; and specific description of the videotape minicourse versus questioning strategies course using reading and discussion. (Author/JA)

THE EFFECTS OF TWO MICROTEACHING VARIATIONS: WRITTEN VERSUS VIDEOTAPE MODELING AND AUDIOTAPE VERSUS VIDEOTAPE FEEDBACK

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The studies reported in this paper were conducted as part of a contract with the Far West Laboratory for Educational Research and Development, a public non-profit agency supported in part by the Department of Health, Education and Welfare.

OBJECTIVES

The main objective of this study is to compare the effects of two versions of a Minicourse entitled Higher Cognitive Questioning. Minicourses are a series of self-instructional microteaching packages developed by the Far West Laboratory for Educational Research and Development for the purpose of in-service teacher education. One version of the Minicourse involved use of videotape modeling procedures and videotape feedback after each microteaching session. The contrasting version involved use of written modeling procedures and audiotape feedback after each microteach session.

A second objective is to compare the Minicourse which used videotape modeling and videotape feedback with an entirely different course. The other course used a handbook with written materials based on Gallagher rather than Bloom and employed small group discussions among interns rather than microteaching.

BACKGROUND

A previous research study conducted at the Far West Laboratory indicated that videotranscript (written) modeling of questioning skills, a relatively low-cost item, was as effective as videotape modeling in changing the teaching performance of intermediate-grade inservice teachers. Videotranscripts consisted of typed versions of the videotapes used in the comparison treatment. Both treatments were similar in that they used videotape feedback during the microteaching phase of the Minicourse. In the present study, the investigators were interested in the effectiveness of an even less expensive, simpler treatment: videotranscript modeling and audiotape feedback. There is reason to believe that this treatment might be effective since an earlier study had demonstrated the effectiveness of audiotape feedback when used with another Minicourse (Individualizing Instruction in Mathematics). However, the Far West Laboratory studies were conducted with inservice teachers. The present study involved a group of preservice teacher interns. It did not include a control group which did not receive the Minicourse in any form. However, it has generally been found in similar studies that control groups do not make "spontaneous" gains over the one-month period of the usual Minicourse. Thus, a control group would have been helpful, but not essential, for interpreting the results of the experiment.

The handbook/discussions group may be regarded as a control group in one sense. They did not take the Minicourse nor did they employ microteaching. However, they did receive an experimental treatment rather than a "no treatment" condition.

METHOD

The subjects were University of Oregon interns who were assigned to teach in grades 3-6 in five Oregon communities. Forty-eight subjects were randomly assigned to three groups. Group A (N=16) took the Minicourse version which included videotape modeling and videotape feedback. Group B (N=16) took the Minicourse version which included videotranscript modeling and audiotape feedback. Group C (N=16) took the course which used Gallagher's question categories and small group discussions among interns. The Minicourse involved

about fifteen hours of instruction, including eight microteach sessions, over a period of about seven weeks. The handbook/discussion course involved an equivalent amount of time.

DATA COLLECTION

Immediate pre- and post-training audiotapes were made of twenty-minute class discussions conducted by each teacher. The tapes were scored by trained raters for incidence of questioning skills taught in the Minicourse. Raters were trained to at least .80 interrater reliability before they began actual coding of the tapes. Raters also computed length and frequency of responses to teacher questions. Groups A and C were given an additional pre- and post-training test which consisted of writing ten questions based on pictures.

RESULTS

Previous research indicates that the average percentage of higher cognitive questions asked by teachers without specific training in this classroom skill is about 33 percent. This finding was also borne out in the present study. The average pre-test percentage of higher cognitive questions was 37 percent for Group A and 34 percent for Group B. Approximately nine weeks later, in the post-test, Group A asked an average of 60 percent higher cognitive questions, and Group B asked an average of 55 percent. Group C moved from an average of 35 percent in the pre-test to an average of 44 percent in the post-test.

In the pre-test the mean length of answers for students taught by Group A teachers was 10 words. The average length increased to 13 words on the post-test. A comparable gain was recorded for Group B. The average length of their responses increased from an average of 12 words to an average of 16 words. Group C decreased from an average of 11 words to an average of 10 words.

The paper consists of three parts:

A. Videotape Versus Written Instruction and Videotape Versus Audiotape Feedback: A Report to the Far West Laboratory by Keith A. Acheson and Paul E. Tucker.

B. Audiotape and Videotape Feedback: Review of Related Literature, by Paul E. Tucker.

C. Videotape Minicourse Versus Questioning Strategies Course Using Reading and Discussion: A Report to the Far West Laboratory by Keith A Acheson and Calvin J. Zigler.

PART A

VIDEOTAPE VERSUS WRITTEN INSTRUCTION
and
VIDEOTAPE VERSUS AUDIOTAPE FEEDBACK
IN A MINICOURSE ON HIGHER COGNITIVE QUESTIONING

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MINICOURSE REPORT

This paper reports the results of studies conducted at the University of Oregon during Winter Quarter of 1971, using Minicourse Nine, Thought Questions in the Intermediate Grades, developed by the Far West Educational Laboratory for Research and Development. Subjects in the study were interns from the University of Oregon who were teaching in Grades 3-6 in five Oregon communities. Thirty-two subjects were randomly assigned to one of two groups. Group A, n=16, took Minicourse Nine using videotape demonstration and instruction with videotaped microteaching practice. Group B, n=16, took Minicourse Nine using videoscript (written) demonstration and instruction with microteaching using audiotape recordings rather than videotape for feedback purposes during the practice phase of the course activities. Previous research conducted by the Far West Laboratory had indicated that the video-script instruction and demonstration had been as effective as videotape viewing in learning to ask higher cognitive questions in the intermediate grades. However, the experiments had used videotape feedback during the microteaching practice portions of the program. Hence, the major variable that was being manipulated in the present study was the substitution of audiotape microteaching feedback in place of videotape microteaching feedback.

A survey of the literature on audiotape and videotape feedback indicated that audiotape feedback could well be used as effectively as videotape in developing a skill (such as asking higher cognitive questions) which focuses

primarily on verbal behavior as opposed to nonverbal behaviors which would be evident only in videotape records. In the case of Minicourse Nine, the verbal behaviors under consideration are those derived from Bloom's Taxonomy, the Cognitive Domain, namely teachers' questions which call for Knowledge, Comprehension, Analysis, Synthesis, and Evaluation. These questions can be divided into two major categories - with Knowledge being thought of as "lower cognitive," and all the others put together labeled as "higher cognitive" questions. One of the stated performance objectives of Minicourse Nine is that at least two-thirds of the participants taking the course should increase by at least sixty percent their use of higher cognitive questions in a post-test as compared with the baseline determined in a pre-test. Twelve previous studies had shown that the average percentage of higher cognitive questions asked by teachers without specific training in this classroom skill is about thirty-three percent. In the present study, these findings were borne out. The average percentages for higher cognitive questions in the pre-test for groups A and B were thirty-seven percent and thirty-four percent respectively. Furthermore, an analysis of variance showed that there was no significant difference between the two groups on their use of higher cognitive questions in the pre-test. Group A (videotape instruction and feedback) and Group B (written instruction and audiotape feedback) for all practical purposes were equivalent in their use of higher cognitive questions at the beginning of the experiment.

At the time of the post-test, approximately nine weeks later, Group A had an average percentage of 60 percent higher cognitive questions and Group B had an average percentage of 55 percent higher cognitive questions, or a mean gain of 62 percent in both groups. Nine out of sixteen interns in Group A, or 56 percent, had a gain of at least 60 percent. Nine out of sixteen interns in Group B, or 56 percent, had a gain of at least 60 percent

in their use of higher cognitive questions from pre- to post-test. It would appear that the criterion stated above had not quite been reached, i.e. at least two-thirds of the participants gaining 60 percent. However, two people in Group A had initial percentages of 67 and 86, thus it would have been impossible for them to gain 60 percent since that would have resulted in asking more than 100 percent higher cognitive questions. Likewise, in Group B two people had initial percentages of 75 and 87 percent respectively. Hence, if we eliminate those two members of each group for whom the criterion was impossible, we may say that both groups approximated the performance objective of the course in terms of percentage of higher cognitive questions asked. (Table 1)

The other performance objective of the course is phrased in terms of student responses to teachers' higher cognitive questions - specifically the objective is that in post-test recordings two-thirds or more of the discussions have an average student response length of 12 words or more to higher cognitive questions asked by the teacher. Groups A and B in the present study began with average student response lengths in the pre-test of 10 and 12 words respectively. In the post-test the average student response length to higher cognitive questions for Group A was 13 words and for Group B it was 16 words. Thus on the second performance objective both groups achieved the criterion of 12 words on the average. In terms of classrooms, seven of the classes in Group A reached 12 words or more for student responses to teacher higher cognitive questions and 12 of the classes in Group B recorded an average of 12 words or more. On this basis the video group does not reach criterion but the audio group exceeds criterion with 75 percent of the classrooms. Again looking at averages for both groups, the mean length of student response increased by 30 and 33 percent respectively. Table 2 in the Appendix presents this complete information.

The present study was also concerned with whether there were any significant differences between the two groups on the post-test in respect to total percentages of higher cognitive questions and also in respect to the five individual categories of questions (Knowledge, Comprehension, Analysis, Synthesis, and Evaluation) used in the study. Analysis of covariance indicated that there were not significant differences between the two groups in any of the above comparisons. Tables 3 through 9 in the Appendix display the data and results of calculation for the above statement. Therefore, in summary we may say that on both performance objectives and on all criteria and tests made in the study, Group B, or the audio microteaching group, was as successful or more successful than Group A, the videotape group.

Statistical analyses were made of additional information collected during the study. Analysis of covariance was applied to the data on length of student responses discussed above. There were no significant differences between the two groups in their post-tests despite the apparent advantage of the audio group obtained by counting the number of classes which achieved the criterion. Table 10 presents the data and the calculation for this result.

The number of student responses to teacher higher cognitive questions is also a statistic of interest. To get a comparison between the two groups, the following procedure was followed. First, the number of student responses to teacher questions was calculated for each discussion. Then the number of responses to higher order questions was calculated. From this information, the percent of higher order question responses for each discussion was calculated. The resulting percentages were then compared between the two groups using analysis of covariance and the difference was found to be significant at the .05 level, favoring Group A, the video group. Thus the percent of responses to higher cognitive questions was significantly greater in the video group than it was in the audio group using adjusted post-test means. Another way of

looking at this data is to take the total number of responses in the pre-test and post-test for both groups. Such comparisons contain an element of risk since the length of discussions was not held exactly constant. Group A had 2715 total responses in the pre-test of which 890 were to higher cognitive questions, or 33 percent. On the post-test they had 1736 total responses of which 985 were to higher cognitive questions, or 57 percent. Group B on the pre-test had 1615 total responses, 313 to higher cognitive questions, or 19 percent. On the post-test, Group B had 1877 total responses, 667 to higher cognitive questions, or 36 percent. While Group A had fewer total responses in the post-test than in the pre-test, it increased the number of responses to higher order cognitive questions. Group B increased both the total number of responses and the number of responses which were higher cognitive questions.

Any conclusions in regard to these data are speculative but it appears possible that the teachers in Group A somehow had their students more involved in the higher cognitive questions than did those in Group B when we recall that there was no significant difference in the mean length of student responses to teachers' higher cognitive questions. The raw data are not such that these differences can be investigated. However, further research should be able to parcel out the unique effects of videotape feedback as opposed to audiotape feedback as it applies to a teacher's ability to elicit student responses to higher cognitive questions. One hypothesis might be that teachers exposed to videotape feedback will be more sensitive to the need to call on several students when a higher cognitive question has been asked since they have watched students who did not respond to questions; whereas, the audiotape group will have heard only students who did respond.

One difference between the present study and the previous main field test of Minicourse Nine conducted by the Far West Laboratory was that teachers in the present study were free to choose their own topics for discussion in both the pre- and post-tests. One of the possibilities concluded by the main field test was that the selection of discussion topics which are conducive to a thoughtful discussion may be one of the things teachers learn in a training program on higher cognitive questioning. When discussion material was assigned to teachers, they had unusually high baseline data for percent of higher cognitive questions. For example, the 7th Grade group began with an average of 67 percent higher cognitive questions and were able to increase to only about 73 percent on the post-test after having taken Minicourse Nine. Knowing what material the class is discussing is helpful to coders in making decisions about categories of questions. We would conclude that allowing teachers to choose their own discussion topics permits the important variables to operate in studies of this kind and that the disadvantages of assigning topics outweigh the advantages. The occurance of higher cognitive questions may be more a function of the topic for discussion which was chosen than it is of the teacher's skill in using higher cognitive questions. Further studies comparing groups who use assigned topics as opposed to those who don't should answer this question.

In the conduct of the present study, there were available four copies of the videotape version of Minicourse Nine and seven one-inch tape recorders for videotape demonstration, instruction and microteaching feedback. Sixteen cassette audiotape recorders were supplied by the Northwest Regional Educational Laboratory for pre-testing, post-testing and audiotape microteaching

feedback for Group B. The immediate supervisors for the interns in the study were familiarized with Minicourse Nine during a pre-study orientation meeting extending over a two-day period. They viewed portions of the four tapes used with Group A and looked at the videoscripts used with Group B and the teacher's manual used in both groups. Careful training in the use of both video recorders and audiotape recorders by interns and supervisors resulted in no equipment failure during the conduct of the study. One videotape recorder was replaced before the study was started so no participant was bothered by any equipment malfunction. The pre-test was conducted during one week prior to the beginning of the course. The interns were brought together in several groups and shown how to organize the classroom using a discussion group of about 12 students and the placement of the cassette audiotape recorder to get a good sound pickup. Those who were going to be using videotape likewise were instructed in the operation of the equipment, the use of the counter to gauge time, etc. This was done in groups of two to four interns. The course itself was conducted as a regular part of the interns' training during Winter Quarter of 1971. The course carried college credit. The acceptance of the course by teachers was favorable as has been demonstrated many times in previous tests by the Far West Laboratory of this and other minicourses.

The cassette audiotape recordings of pre- and post-test discussions were transcribed as typescripts and then coded into the categories K, C, A, S, E (Knowledge, Comprehension, Analysis, Synthesis, Evaluation). The three coders were not aware of whether typescripts were pre- or post-tests. Coders were periodically checked against standardized typescripts to ascertain and maintain reliability which ranged from .81 to .89.

Frequency and length of student responses were also counted from the typescripts. Conventions developed by the Far West Laboratory were used in dealing with unintelligible or inaudible remarks. In general tape recordings were of good quality and no equipment failures were experienced.

Coders were trained using typescripts supplied by the Far West Laboratory which had coded them in the main field test of Minicourse Nine. Rules for making coding decisions were also supplied by the Laboratory. Several training and practice sessions were required before coders achieved acceptable reliability (.80).

In summary, it is our conclusion that: (1) Minicourse Nine can be used effectively with ongoing programs such as the University of Oregon intern program which has participants in situations remote from the campus; (2) audiotape can be used for microteaching with effectiveness where verbal behaviors are the prime focus; (3) our results substantiate conclusions from other studies that suggest the audiotape recorder should be more widely used in supervision and teacher education; (4) further studies need to investigate which applications are uniquely suited to the videotape recorder and which are just as well handled by the audiotape recorder; and (5) further investigations should be made into the relationship between teacher questions and student responses as a function of discussion topic, categories of teacher questions, and categories of student responses.

PRE-TEST

VIDEOTAPE RECORDING

Intern Teacher Number	K	C	A	S	E	%K	%C	%A	%S	%E	C-E	K-E	%C-E
1	3	1	7	3	8	14	5	3?	14	36	19	22	86
2	34	4	3	3	3	72	9	6	6	6	13	47	28
3	19	3	1	1	4	68	11	4	4	14	9	28	32
4	36	4	1	--	2	84	9	2	--	5	7	43	16
5	25	--	--	1	3	74	--	--	3	24	9	34	26
6	23	6	2	1	1	70	18	6	3	3	10	33	30
7	9	3	4	1	1	50	17	22	6	6	9	18	50
8	17	7	13	1	--	61	25	11	4	--	11	28	39
9	15	--	--	6	--	71	--	--	29	--	6	21	29
10	7	1	3	1	1	54	8	23	8	8	6	13	46
11	25	7	1	--	2	71	20	4	--	8	10	35	29
12	41	11	4	--	3	69	19	7	--	5	18	59	31
13	32	2	10	1	8	60	4	19	2	15	21	53	40
14	30	3	3	2	4	71	7	7	5	10	12	42	29
15	11	--	11	4	7	33	--	33	12	21	22	33	67
16	23	--	2	--	1	88	--	8	--	4	3	26	12
Total of percents						1010	152	184	96	165			590
Mean						63	10	12	6	10			37

AUDIOTAPE RECORDING

17	1	--	2	1	--	25	--	50	25	--	3	4	75
18	46	2	7	--	2	81	4	12	--	4	11	57	19
19	37	--	--	--	2	95	--	--	--	5	2	39	5
20	48	5	2	8	1	75	8	3	13	2	16	64	25
21	41	4	2	--	--	87	9	4	--	--	6	47	13
22	15	3	3	--	11	47	9	9	--	34	17	32	53
23	14	--	--	4	4	64	--	--	18	18	8	22	36
24	33	5	1	--	--	85	13	3	--	--	6	39	15
25	4	8	13	2	4	13	26	42	6	26	27	31	87
26	9	2	3	--	1	60	13	20	--	7	6	15	40
27	17	1	2	1	3	71	4	8	4	13	7	24	29
28	23	--	3	--	3	79	--	10	--	10	6	29	21
29	39	9	--	--	1	79	18	--	--	2	10	49	20
30	14	1	--	--	7	64	5	--	--	32	8	22	36
31	20	2	17	--	5	45	5	39	--	11	24	44	55
32	27	--	2	--	5	79	--	6	--	15	7	34	21
Total of percents						1049	114	206	66	179			550
Mean						66	7	13	4	11			34

POST-TEST

Intern Teacher Number	K	C	A	S	E	%K	%C	%A	%S	%E	C-E	K-E	%C-E	Percent Increase in Higher Cognitive
1	10	2	4	5	3	42	8	17	21	13	14	24	58	-67
2	32	5	13	3	5	55	9	22	5	9	26	58	45	61
3	14	2	6	1	1	41	6	18	3	3	20	34	59	84
4	23	2	8	1	5	59	5	21	3	13	16	39	41	156
5	8	1	12	--	15	22	3	33	--	42	28	36	78	200
6	10	2	7	4	2	40	8	28	16	8	15	25	60	100
7	9	2	5	1	2	47	11	26	5	11	10	19	53	6
8	7	1	3	3	1	47	7	20	20	7	8	15	53	36
9	10	1	3	2	--	63	6	19	13	--	6	16	38	31
10	6	--	2	4	--	50	--	17	33	--	6	12	50	9
11	9	1	4	3	1	50	6	22	17	6	9	18	50	12
12	1	1	17	4	8	3	3	55	13	26	30	31	97	213
13	31	4	9	5	5	57	7	17	9	9	23	54	43	8
14	12	1	8	2	6	41	3	28	7	21	17	29	59	103
15	4	2	17	2	10	11	6	49	6	29	31	35	89	33
16	8	2	6	6	8	27	7	20	20	27	22	30	73	508
Total of percents						655	95	412	191	244			963	(56%) 60%
Mean						40	6	26	12	14			60	
Percent gain						-37	-40	116	100	40			62	
17	4	3	8	13	12	10	8	20	33	30	36	40	90	20
18	22	2	10	5	6	49	4	22	11	13	23	45	51	168
19	4	2	8	5	5	16	8	33	21	25	20	24	83	1560
20	12	--	2	--	7	57	--	10	--	33	9	21	43	72
21	15	5	9	2	13	34	11	20	5	30	29	44	66	407
22	16	3	10	2	4	46	9	29	6	11	19	25	54	102
23	9	1	3	--	2	60	7	20	--	13	6	15	40	11
24	28	3	5	--	4	70	8	13	--	10	12	40	30	100
25	16	--	12	3	5	62	--	46	12	19	10	26	38	-44
26	11	5	4	2	6	39	18	14	7	21	17	28	61	53
27	4	--	5	3	3	26	--	33	20	20	11	15	73	152
28	5	4	7	1	2	26	21	37	5	11	14	19	74	252
29	20	--	15	6	3	45	--	11	14	7	24	44	55	175
30	11	--	7	11	8	30	--	19	30	22	26	37	70	94
31	16	--	6	1	1	67	--	25	4	4	8	24	33	-60
32	42	8	5	--	--	76	15	9	--	--	13	55	24	14
Total of percents						713	109	361	168	269			885	(56%) 60%
Mean						45	7	23	11	17			55	
Percent of gain						-32	--	76	175	54			62	

VIDEOTAPE RECORDING

AUDIOTAPE RECORDING

Table 3

Analysis of Covariance for Knowledge Question Data

		Total	Within	Between
1.	Sum of products	726.75	656.063	70.688
2.	Sum of squares: X	12995.2	12947.7	49.531
3.	Sum of squares: Y	10414	10308.9	105.125
4.	Degrees of Freedom	31	30	1
8.	Adjusted y^2	10373.4	10275.6	97.725
9.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = .276$ $F_{.05} = 4.18$

10. Homogeneity of regression

$F = .348$ $F_{.05} = 4.20$

Table 4

Analysis of Variance by Covariance Adjustments for Comprehension Question Data

	Total	Within	Between
1. Sum of products	-197.75	-181.125	-16.625
2. Sum of squares: X	1870.88	1825.75	45.125
3. Sum of squares: Y	821.5	815.375	6.125
4. df	31	30	1
8. Adjusted y^2	800.598	797.406	3.192
9. df	30	29	1

$F = 0.116$ $F_{.05} = 4.18$

10. Homogeneity of regression

$F = 2.133$ $F_{.05} = 4.20$

Table 5

Analysis of Variance by Covariance Adjustments for Analysis Question Data

	Total	Within	Between
1. Sum of products	1038.06	1073.13	-35.063
2. Sum of squares: X	5768.88	5753.75	15.125
3. Sum of squares: Y	3688.22	3606.94	81.281
4. df	31	30	1
8. Adjusted y^2	3501.43	3406.79	94.638
9. df	30	29	1

$F = 0.806$ $F_{.05} = 4.18$

10. Homogeneity of regression

$F = 0.166$ $F_{.05} = 4.20$

Table 6

Analysis of Variance by Covariance Adjustments for Synthesis Question Data

	Total	Within	Between
1. Sum of products	419.563	398.	21.563
2. Sum of squares: X	1745.88	1717.75	28.125
3. Sum of squares: Y	2861.47	2844.94	16.531
4. df	31	30	1
8. Adjusted y^2	2760.64	2752.72	7.919
9. df	30	29	1

$F = 0.008$ $F_{.05} = 4.18$

10. Homogeneity of regression

$F = 0.138$ $F_{.05} = 4.20$

Table 7

Analysis of Variance by Covariance Adjustments for Evaluation Question Data

	Total	Within	Between
1. Sum of products	291.25	271.563	19.688
2. Sum of squares: X	3304	3297.88	6.125
3. Sum of squares: Y	3579.72	3516.44	63.281
4. df	31	30	1
8. Adjusted y^2	3554.04	3494.08	59.969
9. df	30	29	1

$F = 0.498$ $F_{.05} = 4.18$

10. Homogeneity of regression

$F = 3.245$ $F_{.05} = 4.20$

Table 8

Analysis of Variance by Covariance Adjustments for Higher-Cognitive Question Data

		Total	Within	Between
1.	Sum of products	10	-87.5	97.5
2.	Sum of squares: X	13025.5	12975.5	50.
3.	Sum of squares: Y	11106	10915.9	190.125
4.	df	31	30	1
8.	Adjusted y^2	11106.	10915.3	190.707
9.	df	30	29	1

$F = 0.507$ $F_{.05} = 4.18$

10. Homogeneity of regression

$F = 0.031$ $F_{.05} = 4.20$

Table 9

Analysis of Variance by Covariance Adjustments for Higher-Cognitive Response Data

	Total	Within	Between
1. Sum of products	4218.5	2074.81	2143.69
2. Sum of squares: X	8050	6723.88	1326.13
3. Sum of squares: Y	13873.2	10407.8	3465.28
4. df	31	30	1
8. Adjusted y^2	11662.6	9767.7	1894.86
9. df	30	29	1

$F = 5.626$ $F_{.05} = 4.18$

10. Homogeneity of regression

$F = .72$ $F_{.05} = 4.20$

Table 10

Analysis of Variance by Covariance Adjustments for Mean Length of Higher-Cognitive Student Response Data

		Total	Within	Between
1.	Sum of products	690	634.313	55.688
2.	Sum of squares: X	1671.72	1637.69	34.031
3.	Sum of squares: Y	2364	2272.88	91.125
4.	df	31	30	1
8.	Adjusted y^2	2079.2	2027.19	52.01
9.	df	30	29	1

$F = .744$ $F_{.05} = 4.18$

10. Homogeneity of regression

$F = .067$ $F_{.05} = 4.20$

TABLE 11

Student Responses
K-E

PRE

VIDEO	Responses Aud.	In.	Total	Total Words	M Length	AUDIO	Responses Aud.	In.	Total	Total Words	M Length
1	118	25	143	548	5	17	124	0	124	2721	22
2	158	3	161	821	5	18	145	0	145	1277	9
3	73	5	78	572	8	19	140	0	140	3019	22
4	200	37	237	2547	13	20	140	0	140	654	5
5	256	40	296	1449	6	21	112	0	112	872	8
6	82	1	83	1349	16	22	67	0	67	1387	21
7	68	4	72	1263	19	23	49	4	53	220	4
8	115	27	142	1300	11	24	68	1	69	390	6
9	48	8	56	538	11	25	109	0	109	1452	13
10	108	8	116	998	9	26	37	8	45	357	10
11	71	9	80	325	5	27	81	1	82	895	11
12	289	51	340	1841	6	28	187	2	189	1243	7
13	237	20	257	2194	9	29	90	0	90	573	6
14	150	42	192	2982	20	30	53	0	53	1028	19
15	127	50	177	922	7	31	95	0	95	2017	21
16	271	17	288	1901	7	32	101	1	102	736	7
					M =10						M = 12

POST

1	147	17	164	944	6	17	311	4	315	2471	8
2	145	4	149	1410	10	18	99	3	102	1558	16
3	56	2	58	997	18+	19	125	0	125	4212	34
4	157	13	170	1653	11	20	247	21	268	1899	8
5	109	13	122	1126	10	21	128	5	133	1747	14
6	76	1	77	1642	22	22	95	7	102	1433	15
7	69	4	73	1085	16	23	80	11	91	1294	16
8	47	1	48	1288	27	24	91	5	96	933	10
9	66	6	72	344	5	25	99	4	103	1333	13
10	70	1	71	920	13	26	80	1	81	934	12
11	85	5	90	717	8	27	53	0	53	1602	30
12	80	0	80	1937	24	28	38	0	38	666	18
13	271	15	286	1612	6	29	100	4	104	1849	18
14	86	9	95	1200	14	30	77	7	84	1061	14
15	104	19	123	1145	11	31	79	0	79	1283	16
16	55	3	58	436	8	32	105	8	113	775	7
					M = 13						M = 16
					Increase = 30%						Increase = 33%

PART B

AUDIOTAPE AND VIDEOTAPE FEEDBACK: REVIEW OF RELATED LITERATURE

Introduction

Video and audio feedback studies are reviewed in chronological order within this chapter. The first portable videotape recorder was available for field use in 1963, therefore all the literature within the chapter post dates this year. The early video recorders were heavy and expensive, but as they became lighter, more reliable, and less costly, one finds a corresponding increase in their use and accompanying research. The same is generally true for the audiotape recorder except that it was several decades ahead of the videotape recorder in its development.

Two of the earliest studies on microteaching were conducted by Acheson (1964).[1] The first compared the relative effectiveness of three types of feedback -- supervisor, pupil, and videotape self-evaluation. The second compared the relative effectiveness of videotape feedback and various forms of supervisor feedback using decreasing teacher monologue and increasing pupil participation as dependent variables. The findings supported the hypothesis that videotape self-evaluation and pupil feedback are superior to supervisor feedback in brining about changes in the teaching skills of interns.

In a later study, Dwight W. Allen (1966) researched the effects of feedback and practice conditions on the acquisition of teaching strategy.[2] His findings, although not entirely consistent, tended to favor massed practice-immediate feedback over distributed practice-reinstated feedback in learning probing techniques in questioning strategies. Retention inferences were also drawn from the fact that distributed practice-delayed feedback groups maintained higher probing response rates on the post-test than did massed practice-immediate feedback.

In a paper presented at the American Educational Research Association annual meeting, W. Dwayne Belt (1967) reported that his research indicated improved performance on the part of trainees following evaluation and feedback in a microteaching setting.[3] Belt's setting consisted of the presentation of a lesson by a college student teacher to a class of three to five high school students. If high school students were not available, the lesson was presented to peers in the college class. The lesson was videotaped and replayed immediately for the student teacher with evaluation coming from his college instructor, the college peers, and the microclass high school students. The instructor, with the trainee, decided upon one or two areas of major difficulty upon which the trainee should concentrate in his next presentation within a week's time in a

new microteaching setting. Ninety-six percent of the 490 college students involved in the training felt they benefited from the feedback in this early microteaching research.

A major early investigation of microteaching feedback dealt with modeling and feedback variables.[4] Directed by E.J. Orme (1966), the study indicated increasing effectiveness in the following order when modeling and feedback were manipulated:

Least Effective

1. Minimum symbolic modeling (saw pretest video tape playback alone studied written instructions, planned, and retaught).
2. Maximum symbolic modeling (saw playback with experimenter who gave cues and reinforcement, studied written instructions, planned and retaught).
3. Minimum perceptual modeling (saw playback and perceptual model alone, planned, and retaught).
4. Strong symbolic and maximum perceptual modeling (same as 2. but also viewed perceptual model alone).
5. Maximum perceptual modeling (viewed playback alone but saw perceptual model with experimenter).

Most Effective

6. Strong symbolic and maximum perceptual modeling (saw playback and perceptual model with experimenter).

Using "probing" as the dependent variable (scored by two trained raters), two interesting conclusions of the research were that perceptual modeling appeared superior to symbolic modeling and that self-feedback effectiveness was well beyond expectation, contrary to research done by Orme, McDonald, and Allen earlier.

In investigating the effects of feedback and modeling procedures of teaching performance in a series of experiments, McDonald and Allen (1967) found evidence that indicated feedback (as compared to no feedback) is more effective in a training design, yet not highly effective in producing behavioral change.[5] They

suggested that self-feedback might be improved with cueing procedures.[6] Their analysis lead to a decision rule: "Always include a feedback system in which the trainee views his own performance with supervision."[7] (italics added) Yet here they found it difficult to separate out the behavior of the experimenter (supervisor) and his cue-discrimination characteristics. The investigation could not show correlation with the information characteristics of the feedback. They did conclude that immediacy of feedback, as measured by time, was not a critical factor.[8] This was of importance both theoretically and practically, for it suggested that the feedback process was dependent upon the characteristics of the subject's information processing, not the time-space relations. This would allow a wide range of feedback systems which would be more manageable and economic.

Gilman (1968) explored several feedback methods for correcting errors using computer-assisted instruction.[9] His variables were: a) no feedback; b) feedback of "correct" or "wrong" responses; c) feedback of the correct responses; d) feedback appropriate to the student's responses; and e) a combination of modes (b), (c) and (d). He concluded:

1. Feedback guiding a subject to the correct responses was more efficient than feedback forcing the subject to "discover" the correct responses.
2. The most efficient feedback was that which provided both feedback of correct responses and feedback as to why the responses were correct.

Analysis of variance on post-test scores revealed that the combination of modes (condition (e) above) was slightly superior (but not statistically significant) in comparison to some of the individual modes listed above.

The effectiveness of feedback to the classroom teacher as a function of its source was studied by Bruce W. Tuckman and Wilmot F. Oliver (1968).[10] The authors divided 286 vocational education teachers (grades ten through thirteen) into years of teaching experience and subjected them to one of four experimental

conditions:

1. Feedback from students
2. Feedback from supervisors (vice-principal)
3. Feedback from both students and supervisors
4. No feedback

Effectiveness, as measured by change in students' ratings over a 12 week interval, was greatest when the source of feedback was students only. Supervisor feedback did not contribute to the effectiveness when added to student feedback. In fact, when given alone it resulted in change in a direction opposite to the feedback as compared to the no-feedback condition. Considering years of experience in relation to four conditions led to a fascinating conclusion. Student feedback was better received by less experienced teachers while more experienced teachers received supervisor feedback more receptively.

In one of the first attempts to investigate the effects of viewing video tapes of one's own teaching behavior, Salomon and McDonald (1968) found that in the absence of standards of models, a teacher's satisfaction with his own teaching performance was determined by initial self-attitides.[11] Low self-attitudes and low attitudes towards teaching performance in the initial interview and questionnaire resulted in predominately defensive reactions to self-viewing in the post-viewing questionnaire and interview. The study interpreted the finding as suggesting a differential use of self-viewing procedures in teacher education using personality variables of the viewer to determine the appropriate method of feedback.

A study dealing with low language aptitude and feedback in a second semester college French class was conducted by Theodore Mueller (1968).[12] Past research in language education had revealed that students with low language aptitude often have poor powers of auditory discrimination. Mueller concluded that audio and visual (written) feedback was significantly superior to audio feedback

alone.

Feedback via video-tape verses no feedback in a microteaching setting was researched by Borg, Kallenbach, Morris and Friebel (1968).[13] The hypothesis, "student teachers completing the entire minicourse sequence will display a greater number of significant changes in the teaching behavior covered in the minicourse than student teachers who complete the minicourse without videotape feedback," was supported. Change in behavior was measured by raters scoring coded 16 minute pre- and post-course videotape recordings of each student teaching his class, the change being the methods used in conducting class discussion. A comparison of audio and video feedback has been done outside the microteaching setting. Anthony Mulac's study (1968), An Experimental Study of the Relative Pedogogical Effectiveness of Videotape and Audiotape Playback of Student Speech for Self-Analysis in a Basic Speech Course, had as its hypothesis "the greater the completeness and accuracy of student speech performance feedback, the greater the degree of speech skill a student will later exhibit."[14] Three groups were compared. Using the completeness of the feedback as the manipulated variable, the three levels of feedback were described as:

1. Videotape replay of two class performances plus traditional (class and instructor) feedback for all performances.
2. Audiotape replay of two class performances plus traditional feedback for all performances.
3. No electronic replay of any class performances but traditional feedback for all performances combined with viewing videotapes of three other speakers.[15]

The dependent variable, speech skill, was judged using an eleven-point version of the Price multi-factor speech performance rating scale by judges with an overall reliability of .95 as estimated by the Ebel intra-class procedure.

The analysis of the data indicated that group one, those receiving video

feedback on two of their speeches, demonstrated significantly greater overall speech skill and bodily action, personality, language, and voice skills than either of the other two groups. There were no statistically significant differences between the first and final speeches of the other two groups.

In a study conducted by David Young (1968) Stanford secondary interns were randomly assigned to six experimental groups.[16] He made the hypothesis that a combination of viewing a specific illustration and a complete model with contingent focus, and the viewing of one's own performance with contingent focus would be the most effective type of modeling and feedback in a minicourse setting. A specific illustration was defined as a videotape of a teacher demonstrating a specific teaching skill without children and not in the context of a lesson. A complete model was defined as a videotape of a specific teaching skill in a short, complete lesson to genuine students. Contingent focus was defined as focusing an intern's attention on a specific teaching skill by a supervisor in person or by a pre-recorded commentary while the intern watched the performance on a videotape. The combination of the specific illustration and complete model with contingent focus was found to be superior at the .05 level when compared with the combination without contingent focus. Yet the importance of contingent focus was not significant for all variables.[17] The study did not show that the contingent focus of a lesson by a supervisor after viewing a lesson was superior to a contingent focus by a supervisor, live or recorded, during the self-viewing of a videotaped lesson by an intern.

> One result is quite clear. The effectiveness of modeling protocols varies with the nature of the dependent variable. That is, one type of model may be more effective for teaching subjects to use one specific teaching skill than another type of model would be. It is also suggested that for some skills a symbolic model may suffice.[18]

Philip Langer (1969), Senior Program Associate of the Far West Laboratory for Educational Research and Development, presented a paper as a part of a

symposium on "Microteaching and Minicourses: Rationales and Current Research" to the annual meeting of the American Educational Research Association.[19] Within the document he traced the development of microteaching and the minicourse. Of interest are his two basic reasons accounting for the success of the program:

1. The reinforcement (feedback) derived from seeing oneself on the videotape monitor.[20]
2. The reinforcement (feedback) derived from the emphasis on and perception of student behavior change in association with increased proficiency in a teaching skill.[21]

Another study (Birch, 1969), done in a microteaching setting, attempted to discover the effects of: a) a Social Studies curriculum course; b) self-confrontation by videotape; c) videotape-coding practice; and d) guided self-analysis. In this study the curriculum course, self-confrontation, and coding practice were all component parts of guided self-analysis.[22] Guided self-analysis consisted of two phases.[23] The first phase consisted of:

1. A videotape was recorded of the teacher interacting with his pupils.
2. The teacher viewed the videotape.
3. The teacher familiarized himself with the coding categories.
4. The teacher analyzed his own behavior on the videotape using the categories (identified specific behaviors and discriminated between behaviors in different but related categories.)
5. The teacher then summed the frequencies, computed the proportions, and constructed a profile of his teaching behavior.
6. He then compared the profiles with interpretive figures and characterized his own teaching behavior.
7. The teacher was asked to make inferences about the learning consequences of his observed teaching behavior.

8. Finally the teacher formulated operational goals and made a commitment to achieving them in his future teaching.

The second phase: Following this the teacher again taught a lesson which was recorded on videotape and the guided self-analysis re-occured. The second self-analysis differed from the first in that the student was asked to compare the results of this phase to the results of the first phase. This routine then became cyclic over a period of time.

It was concluded that guided self-analysis effected behavior change on the part of the teacher, but that self-confrontation and videotape coding did not. The behavioral change was explained by the desire for consonance. That is, the guided self-analysis induced dissonance by showing discrepencies between the teacher's ideal and his actual behavior. But the operational nature of the guided self-analysis furthered consonance.

In studying the effects of modeling and feedback treatments on the development of teachers' questioning skills, Karen E. Clause (1969) found evidence to support the hypothesis that during modeling and feedback, cued (as opposed to non-cued) treatments increased the frequency of teacher higher-order questioning behavior. She also found evidence to support the hypothesis that cued modeling is more effective than cued feedback. The result, the study reports, "lends support to the distinction that modeling is an acquisition variable and feedback is a performance variable."[24]

Charles Adair and Allan Kyle (1969) conducted a study on the effects of three types of feedback on the dependent variable, percentage of probing questions asked.[25] Three groups of randomly selected sixth-grade teachers were given one of the following types of feedback procedures:

1. Teacher-supervisor conference following the observation of the class by the supervisor (standard observation).

2. Self-analysis of their own videotaped teaching.

3. Directed self-analysis (assisted by supervisor)of their own videotaped teaching.

Contrary to some of the earlier studies of feedback, Adair and Kyle concluded that,

> Analysis of the data in this study indicates that feedback provided by videotape produces significant change in some aspects of question-asking behavior in classroom instruction. The methods involving videotapes appear to reduce the percentages of rhetorical questions that teachers asked while no significant differences were observed with respect to the percentage of probing questions. In addition to modification in question-asking behavior, other changes were observed in clothing sensitivity, alertness, and enthusiasm.
>
> The evidence that was collected in this study does not favor either self-analysis or directed analysis for changing teacher behavior as the methods were defined in this project. The amount and type of assistance given to the teachers who use the directed analysis approach might be crucial variables in determining the effectiveness of this method.[26]

A recent study on "The Effects of Mode of Feedback in Microteaching" was conducted by Shively, Van Modframs, and Reed (1970) of Purdue University.[27] Their study looked at effects on teacher performance and attitudes. Manipulations of the conditions under which the supervisor gave feedback were:

1. The supervisory critique of the microteaching lesson was based upon a videotape recording of the lesson.
2. The supervisory critique of the microteaching lesson was based upon an audiotape recording of the lesson.
3. The supervisory critique of the microteaching lesson was based upon the supervisor's watching the live lesson.
4. The supervisory critique of the microteaching lesson was based upon the responses of the microteaching students to the Stanford Teacher Competence Appraisal Guide. The STCAG measured the student's perception of the teacher's aims, planning, performance, and evaluation in the teacher's microteaching lessons.

Two measurements were used in the analysis of the data for all groups. The

Stanford Teacher Competence Appraisal Guide (STCAG) analyzed the performance of the teacher while an attitude scale measured attitudes towards various aspects of microteaching experience.

The authors concluded that:

1. Significant differences existed in the ratings of the performance of subjects (teachers) within the four treatment groups on all items of the performance measurement. (These items are listed in Table I that follows on page 11.)[28]
2. Performance was most affected by supervisory critiques based on audiotapes.
3. Performance was least affected by supervisory critiques based upon watching the actual lesson.
4. Generally, performance was affected more by supervisory critiques based on videotape than the live watching, but less than both the audiotapes and student response groups.
5. The attitude toward the audio-and videotape groups was significantly higher than the live lesson and student response groups.
6. That "Within the limits of this study the audiotape treatment appears to be the strongest treatment." [29]

In explaining the outcomes of the study the authors suggested that the skills focused upon by the measurements were verbal and the lecture method was most often used. Therefore the greater amount of critical information was verbal. The addition of non-verbal information added by the video feedback was irrelevant.

> It thus becomes apparent that the less expensive audio method of feedback may be substituted for the more expensive video method for inducing positive behavioral changes in teaching performance. It may even by possible to dispense with both audio- and videotape and focus attention upon the ratings of the students.[30]

Table I

Student Ratings of Microteaching Teachers' Performance

Variable	ANCCVA F-Ratio	Ordered means (P .05)
Clarity of purpose	F(3.50) 22.83, p<.0001	AT, SR>LL,VT*
Difficulty and appropriateness of the aims	F(3.50) 14.79, p<.0001	AT, SR>LL,VT
Organization of parts and whole of lesson	F(3.50) 24.61, p<.0001	SR, AT>VT>LL
Appropritaeness of content for aims, class level, and teaching method	F(3.30) 24.29, p<.0001	SR, AT VT>LL
Evidence of relation between materials and content	F(3.30) 8.00, p<.001	AT, SR, VT>LL
Tendency of pupils to come to attention and direct themselves to the task	F(3.29) 14.67, p<.0001	AT>SR>VT<LL
Presentation of content understandable using different points of view	F(3.29) 27.29, p<.0001	AT, SR>VT>LL
Movement from topic to topic governed by class tempo	F(3.28) 12.64, p<.0001	AT, SR, VT>LL
Attentive class and participates when appropriate	F(3.29) 6.31, p<.01	AT>VT,LL
Attempt to connect chance and planned events to immediate and long range aims	F(3.28) 11.21, p<.0001	AT>VT>LL AND SR>LL
Teacher-pupil relationships harmonious	F(3.30) 3.14, p<.05	N.S.D. between individual means
Use of a variety of procedures to evaluate progress	F(3.29) 15.29, p<.0001	AT>SR>VT AND AT>LL
Teacher and pupils review evaluations for improvement purposes	F(3.29) 15.07, p<.0001	AT>VT, LL, SR

* AT,SR LL,VT means that groups AT and SR are not different from each other but are rated significantly high than groups LL and VT on the variable described. Groups LL and VT are also not different from each other. Similar notation will be used for all 13 variables.

The Use of the Portable Videotape Recorder in Helping Teachers Self-Evaluate Their Teaching Behavior was the focus of a research study conducted by Phillip M. Ward (1970).[31] The stated null hypothesis of this study was "there will be no significant difference in criterion instrument scores which measure the number of types of questions (basic, leading, probing) which teachers ask their students among the following groups of inservice elementary teachers who purposefully self-evaluate their teaching by (1) self videotapes, (2) self audiotapes, (3) a combination of self videotapes and model videotapes, and (4) reflective evaluation only (i.e. without mechanical or electronic equipment)."[32] The author concluded that it would be possible to use audio tape feedback in the self-evaluative process designed to produce change in teaching behavior.[33] This conclusion was reached since the largest mean difference in numbers of probing questions asked by teachers between the pre and post tapes was found in the audiotape group. In explaining this Ward writes,

> Apparently the necessity to listen intently without visual concentration provides stimulation sufficient to significantly affect the questioning-skill ability of teachers. It is possible that audiotape recorders are grossly underrated and it is suggested that, based upon the findings of this study, school districts re-evaluate ways in which this device may be used to enhance teacher effectiveness.[34]

This review of literature could not be concluded without recognizing the valuable contribution of an Educational Resource Information Center (ERIC) computer search of relevant literature. The search listed 230 items of which only the most pertinent were reviewed in this chapter.

Footnotes

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[16]Young, David B., "The Effectiveness of Self-Instruction in Teacher Education Using Modeling and Video Tape Feedback" (unpublished paper presented to the annual meeting of the American Educational Association, Chicago, 1968).

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[19]Langer, Phillip, Minicourse: Theory and Strategy (Berkeley, California: Far West Laboratory of Educational Research and Development, 1969).

[20]Ibid., p. 8.

[21]Ibid., p. 9.

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[25]Adair, Charles H. and Kyle, Allan R., Effects of Feedback on Teacher Behavior: An Exploration into the Use of Videotaping in Teacher Education Programs. (Atlanta, Georgia: Southeastern Education Laboratory, 1969).

[26]Ibid., p. ii.

[27]Shively, Joe E., Van Modfram, Adrian P. and Reed, Cheryl L., "The Effects of Mode of Feedback in Microteaching" (unpublished paper presented to the American Educational Research Association, Minneapolis, 1970).

[28]Ibid., p. 11.

[29]Ibid., p. 8.

[30]Ibid., p. 10.

[31]Ward, Phillip M., The Use of the Portable Videotape Recorder in Helping Teachers' Self-Evaluate Their Teaching Behavior. (Berkeley, California: University of California, 1970).

[32]Ibid., p. i.

[33]Ibid., p. 93.

[34]Ibid., pp. 93-94.

PART C

VIDEOTAPE MINICOURSE VERSUS QUESTIONING STRATEGIES COURSE USING READING AND DISCUSSION

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1971

MINICOURSE - QUESTIONING STRATEGIES STUDY

This paper reports the results of studies conducted at the University of Oregon during Winter quarter of 1971, using Minicourse Nine, Thought Questions in the Intermediate Grades, developed by the Far West Educational Laboratory for Research and Development and Questioning Strategies, a program developed by the Northwest Regional Educational Laboratory. Both programs were in prototype form, but packaged in a format for field testing. The Minicourse included four videotapes for demonstration and instruction purposes and a participant's handbook, including directions for Micro-teaching, using videotape recorders. The categories of questions treated by the Minicourse were derived from Bloom's Taxonomy and consisted of Knowledge, Comprehension, Analysis, Synthesis and Evaluation. The Questioning Strategies package consisted of a participant's manual and provision for groups of three or four participants meeting together to work through the exercises cooperatively. The categories of questions used in the Questioning Strategies package were derived from the work of James Gallagher and consisted of Description, Explanation, Evaluation by Matching, Evaluation by Justification, and Expansion.

Minicourse Nine had previously been field tested in the format used here, with a control group who did not take the Minicourse. It had also

been tested using a format which included written instruction and demonstration instead of videotapes. Videotape was used for the Micro-teaching practice parts of the course. In another University of Oregon study, reported elsewhere, Minicourse Nine was used in written form with audiotape Micro-teaching. The Questioning Strategies materials had been used extensively in workshops which incorporated an instructor or workshop leader. The present study is the first test of the Questioning Strategies materials in a completely self-instructional format.

The subjects for the study were University of Oregon interns who were teaching in grades three through six in five Oregon communities. Thirty-two subjects were randomly assigned to one of the two groups. Group A (n=16) took Minicourse Nine using videotape demonstration and instruction with videotape Micro-teaching practice. Group C (n=16) took Questioning Strategies using the participant's handbook with group discussion and other learning activities in groups of three or four. Both groups received college credit for taking the course, and both groups completed the course during Winter quarter of 1971.

Two pre-tests were administered to each group. The first consisted of presenting the participants with three pictures involving sailing and people on sailboats and asking the participants to write 10 questions about the pictures which could be used in an intermediate grade lesson. This exercise is a part of the Questioning Strategies materials and had been used previously as a pre-test and post-test with the materials. The second pre-test consisted of making a 20-minute audiotape recording of a classroom discussion in each participant's classroom, using a topic chosen

by the participant. This activity had been used previously in Minicourse field tests, except that in previous tests the discussion topic had been assigned. Both kinds of pre-test were repeated as post-tests upon completion of the respective courses.

The pre- and post-test audiotape recordings were transcribed as typescripts and coded by two sets of coders. One set of coders had been trained in the Bloom categories, i.e., Knowledge, Comprehension, Analysis, Synthesis, and Evaluation. The other set of coders had been trained in the Gallagher categories, i.e., Description, Explanation, Evaluation by Matching, Evaluation by Justification, and Expansion. Coders were required to achieve reliability of .80 before leaving training and beginning actual coding. Reliability was checked periodically during the coding process, using standardized criterion typescripts. In the case of the Gallagher categories, retraining was necessary at one point before resuming the coding process. In the case of the Bloom categories, no retraining was necessary. In addition to categories of question, coders also counted length of response by students to categories of questions and frequency of student response. These kinds of data had been used in previous Minicourse field tests.

The numbers of questions in each category were converted to percents to adjust for any differences in total length of time among the audiotape recordings. The percent data were then analyzed using analysis of covariance, using the pre-test as covariate. Tests for homogeneity of regression were also applied to assure that analysis of covariance was appropriate.

The hypotheses for the study were all stated in terms of null hypotheses, i.e., that there would be no significant differences between the two groups in terms of the criteria which had previously been applied to either course. The criteria for the Minicourse are quite specific, namely, that participants will increase their use of higher cognitive questions (Comprehension, Analysis, Synthesis, and Evaluation), with at least two-thirds of the participants increasing their use of higher cognitive questions by at least 60 percent. If we eliminate the two individuals for whom a 60 percent increase was impossible, since they began with percents of 86 and 67, then the criterion was achieved for Group A. An equivalent way of testing change in use of higher cognitive questions is to look at the use of lower cognitive questions (Knowledge). In this category Group A moved from a mean of 63 to a mean of 40, a drop of 37 percent. Group C moved from a mean of 66 to a mean of 56, a drop of only 15 percent. As shown in Table 5, this difference between the two groups is significant at the .05 level of confidence. In terms of individual categories of higher cognitive questions, Group A asked a significantly higher percentage of Analysis questions (at the .01 level of confidence), as shown in Table 7, and a significantly greater percentage of higher cognitive questions (again at the .05 level) as shown in Table 10, as one would expect from the results for lower cognitive questions.

The objectives for the Questioning Strategies course are not as specific regarding movement among the Gallagher categories or question styles (Description, Explanation, Evaluation by Matching, Evaluation by Justification, and Expansion). Participants are expected to learn to use

a variety of styles, but these styles are not broken into higher and lower classifications, nor is any hierarchy intended. An additional dimension in the Gallagher model is the level of abstraction of questions (Data, Concept, Generalization). Analyzing the data from the transcribed 20-minute discussions, we find that Group C asked a significantly higher percentage of Description questions in the post-test than did Group A (at the .05 level, approaching .01), as shown by Table 11. Group A asked a significantly greater percentage of Explanation questions (.01 level) on the post-test than did Group C. Differences between the two groups were not significant in the Evaluation by Justification category nor in the Expansion category. Evaluation by Matching was not used by either group, hence is not compared statistically. If we lump together categories other than Description, as would be expected, Group A asked a significantly greater percentage of such questions in the post-test than did Group C (.05 level, approaching .01). See Tables 12-15.

For the 10 written questions, there were no significant differences between the two groups in the areas of: Knowledge (although both groups increased the percentage of such questions), Comprehension (both groups increased), Analysis (both decreased, difference approaches .05), Evaluation (both groups increased), or higher cognitive questions (both groups increased). In the category of questions calling for Synthesis, Group A increased and Group C decreased the percent of such questions between the pre- and post-tests. The difference here was significant at the .01 level, as shown in Table 23. The other non-significant differences are reported in Tables 20-25.

Using the Gallagher categories for the written questions, there were no significant differences in the changes from pre- to post-tests between the two groups. Both groups decreased the percentage of Description questions. Group A increased the use of Explanation questions and Group C decreased, but the difference was not significant. Both groups increased their use of Evaluation by Justification questions. Neither group used Evaluation by Matching. Group C increased their use of Expansion questions while Group A decreased their use, but the difference was not significant. The analysis of the foregoing data is presented in Tables 26-29.

Table 31 contains information about the length of student responses in both groups in the pre-tests and post-tests. The average of the mean lengths of student responses in the Minicourse group changed from 10 in the pre-test to 13 in the post-test, whereas the Questioning Strategies group changed from 11 in the pre-test to 10 in the post-test. The number of student responses in the Minicourse group dropped from a total of 2718 in the pre-test to 1736 in the post-test, while the total number of student responses in the Questioning Strategies group dropped from 2581 in the pre-test to 2224 in the post-test. These figures should be viewed with some skepticism as there is no assurance of precision. Although interns were asked to make 20-minute recordings of their pre- and post-discussion, the length varied somewhat, thus frequency counts are subject to variation. The mean length of student response figures are somewhat better, since they are expressed in the form of a rate (number of words per response) so that time is not an important factor. On the other hand,

there is also a built-in error, since student responses are not always audible, either because they are not loud enough or because more than one student is speaking at one time. Nonetheless, we can say that there was a tendency on the part of the Minicourse group to move toward considerably fewer student responses but longer ones, while in the Questioning Strategies group there was a less pronounced tendency to move to fewer student responses, but they tended to be shorter ones.

Tables 32 and 33 present another kind of information about the questions which were coded in this study. Each question was categorized as to level of abstraction. The three levels were Data, Concept, and Generalization, as defined by Gallagher. The numbers of questions at each level were then expressed as percents for each intern teacher in the pre- and post-tests of classroom discussions. It can be observed that both groups decreased the percent of Data-level questions. Both groups increased the percent of Concept-level questions, but at the level of Generalization, the percent of questions increased for the Minicourse group and decreased for the Questioning Strategies group. Analysis of covariance applied to these data failed to produce any statistically significant differences. One may say that both courses appear to have influenced the asking of questions at higher levels of abstraction. Such a conclusion is tenuous, however, since competing explanations, such as increased teacher experience, pupil growth, and the like, would be difficult to refute in the present design, which has no control group. Control groups have been used in previous tests of Minicourse Nine. However, those studies did not include any analysis of the level of abstraction of questions. Furthermore, level of abstraction is extremely difficult to code with reliability, and we are unwilling to draw any sweeping conclusions on the basis of such information.

The category Evaluation by Matching was used so infrequently that it was not included in the analysis of this study. A similar phenomenon occurred in the field testing of Minicourse Nine with the category Application, which comes from Bloom's Taxonomy. Omitting their presence in the analysis does not mean that the categories are unimportant, simply that if they are not used by teachers they cannot be statistically analyzed. One may ask if such categories as "Application" and "Evaluation (using external criteria)" are not being emphasized sufficiently in the questioning programs. Further study into the nature of these categories and experimentation with ways of presenting them to teachers is suggested. Another possibility is that the categories need to be defined in more explicit ways in order for trained coders to recognize them when they are being used in classroom discourse.

It seems to us likely that Application questions tend to be coded into the category Comprehension. It seems equally plausible that teachers are asking Comprehension questions which could just as well be phrased in terms of application to the real world, with increased motivational possibilities and more obvious "relevance". Evaluation by Matching is an interesting category of question. Bloom's Taxonomy classifies it as a sub-category of Evaluation where external criteria are used. Gallagher's model treats it as a separate category. It is possible that coders miss instances of this kind of question when they are not familiar with criteria that are customarily used in a given classroom. It is also likely that teachers are not giving students enough practice applying established criteria to topics of discussion in the classroom.

An implication of broader import to teacher education in general and off-campus internships in particular, is the successful application of self-instructional packaged materials which have a measurable effect on the classroom behavior of intern teachers. As the result of this and other related studies, the University of Oregon Intern Program will continue to use packaged self-instructional materials as a part of its regular curriculum. Where cost is a constraining factor, the substitution of cassette audiotape recordings for both instructional purposes and for Micro-teaching practice, in lieu of videotape recordings, appears feasible. Further investigation of the potentials and limitations of this medium should be pursued. Constricting the format to include only written material appears to produce results that are evident in written exercises, but not so evident in classroom performance.

A number of procedures employed in the conduct of the study are worth noting. First, although both courses were conducted as self-instructional packages, a considerable amount of coordination was necessary. The University of Oregon Intern Program is organized in such a way that there are several coordinators who are in continuous contact with interns, hence there was someone at all times to call on in case of questions, equipment failure, or the like. The coordinators were briefed in a two-day retreat preceding the pre-testing and the beginning of either course. They were familiar with the materials and contents of both courses.

Cassette audiotape recorders were supplied by the Northwest Regional Educational Laboratory for the pre-test and post-test discussion recordings. Materials for the Questioning Strategies course were supplied by the Laboratory and duplicated and bound into package form at the University of Oregon. Videotapes and the participant manuals for Minicourse Nine were supplied by the Far West Laboratory for Educational Research and Development. No equipment failures were experienced during the conduct of the study, and time schedules were maintained despite anticipated difficulties due to the rather broad geographic area involved and the amount of electronic equipment being used -- seven videotape recorders and 16 audiotape recorders. Instruction in the operation of equipment was provided for the interns, and the quality of recordings, as evidenced by those which were turned in for transcription by typists, was uniformly good. Typing, coding, and analysis of the data, using the Bloom categories, was completed during Spring quarter of 1971. Coding and analysis, using Gallagher categories, was completed during the Summer quarter of 1971. Additional treatment of the data reported in the present study may be found in Zigler (1971), unpublished doctoral dissertation, University of Oregon.

Several conclusions can be drawn from the statistical results of the study. Minicourse Nine achieves its specific objective of training teachers to ask significantly greater percents of higher cognitive questions. In the present study, it also appeared to be getting teachers to ask a strikingly greater percent of Analysis questions in comparison with the Questioning Strategies group. When analyzed using Gallagher's categories, the interns who took Minicourse Nine were asking significantly fewer Description questions and significantly more Explanation questions in terms of percents on the post-test. Significant differences were found between the two groups in the use of Knowledge, or lower cognitive questions as opposed to higher cognitive questions, particularly in the area of Analysis. Significant differences were also found in the use of questions calling for Description as opposed to questions calling for responses other than Description, particularly Explanation. The provision of in-class practice and application through Micro-teaching in the Minicourse may explain these significant differences in teacher behavior evidenced in the classroom taperecordings and transcribed typescripts.

As hypothesized, significant differences did not occur between the two groups in the analysis of written questions using Gallagher categories as taught by the Questioning Strategies package, or in the categories derived from Bloom with one exception. The Minicourse Nine group showed a significant gain over the Questioning Strategies group in the use of Synthesis questions. A possible explanation for this difference lies in the effects or impact of videotaped instruction combined with graphic demonstration via videotape as opposed to reading and discussion only.

Interpreting the results, as opposed to drawing conclusions, permits some speculation. The format of the two packages appears to us to have had an important effect on the participants. The videotaped portions of Minicourse Nine included professional-sounding narration and polished editing of soundtrack and picture. The written materials had been developed expressly for the self-instructional format. Materials for the Questioning Strategies package had been developed for use with an instructional leader, and were being tested in an auto-instructional format for the first time. The materials were in written form only, and employed no other media with the exception of group discussions.

Another difference in the nature of the two courses is in terms of structure and objectives. Minicourse Nine is quite highly structured, and the objectives are specific and explicit. The Questioning Strategies course follows an inductive approach to the process of questioning and is based on the assumption that the understandings and skills that are discovered by the participant will allow for greater personal meaning. About half of the material deals with the level of abstraction (data, concept or generalization) of questions. The other half deals with the styles of questions (Description, Explanation, Evaluation by Matching, Evaluation by Justification, and Expansion) used in the present study. Minicourse Nine also includes material which is not measured in the data or analysis, e.g., probing questions by the teacher.

TABLE 1

PRE-TEST

20-minute discussion lesson

	Intern Teacher Number	K	C	A	S	E	%K	%C	%A	%S	%E	C-E	K-E	%C-E
MINICOURSE NINE GROUP	1	3	1	7	3	8	14	5	32	14	36	19	22	86
	2	34	4	3	3	3	72	9	6	6	6	13	47	28
	3	19	3	1	1	4	68	11	4	4	14	9	28	32
	4	36	4	1	--	2	84	9	2	--	5	7	43	16
	5	25	--	--	1	8	74	--	--	3	24	9	34	26
	6	23	6	2	1	1	70	18	6	3	3	10	33	30
	7	9	3	4	1	1	50	17	22	6	6	9	18	50
	8	17	7	13	1	--	61	25	11	4	--	11	28	39
	9	15	--	--	6	--	71	--	--	29	--	6	21	29
	10	7	1	3	1	1	54	8	23	8	8	6	13	46
	11	25	7	1	--	2	71	20	4	--	8	10	35	29
	12	41	11	4	--	3	69	19	7	--	5	18	59	31
	13	32	2	10	1	8	60	4	19	2	15	21	53	40
	14	30	3	3	2	4	71	7	7	5	10	12	42	29
	15	11	--	11	4	7	33	--	33	12	21	22	33	67
	16	23	--	2	--	1	88	--	8	--	4	3	26	12
	Total of percents						1010	152	184	96	165			590
	Mean						63	10	12	6	10			37
GALLAGHER GROUP	33	20	2	3	--	10	65	6	10	--	22	15	35	48
	34	11	--	--	--	--	100	--	--	--	--	--	11	--
	35	27	2	15	--	2	59	4	33	--	4	19	46	41
	36	11	--	--	3	5	59	--	--	16	26	8	19	42
	37	25	--	8	1	5	64	--	21	3	13	14	39	36
	38	50	2	10	--	8	71	3	14	--	11	20	70	29
	39	13	2	13	4	4	36	6	36	11	11	23	36	64
	40	14	--	6	1	6	52	--	22	4	22	13	27	48
	41	11	1	5	3	4	46	4	21	13	17	13	24	54
	42	69	2	10	--	1	84	2	12	--	1	13	82	16
	43	14	--	2	6	12	41	--	6	18	35	20	34	59
	44	15	--	5	5	5	50	--	17	17	17	15	30	50
	45	33	1	4	2	6	72	2	9	4	13	13	46	28
	46	24	3	1	--	--	86	11	4	--	--	4	28	14
	47	53	--	--	--	1	98	--	--	--	2	1	54	2
	48	40	--	8	6	5	68	--	14	10	8	19	59	32
	Total of percents						1051	38	219	96	212			563
	Mean						66	2	14	6	13			35

TABLE 2

POST-TEST

20-minute discussion lesson

Intern Teacher Number	K	C	A	S	E	%K	%C	%A	%S	%E	C-E	K-E	%C-E	Percent Increase in Higher Cognitive
MINICOURSE NINE GROUP														
1	10	2	4	5	3	42	8	17	21	13	14	24	58	-67
2	32	5	13	3	5	55	9	22	5	9	26	58	45	61
3	14	2	6	1	1	41	6	18	3	3	20	34	59	84
4	23	2	8	1	5	59	5	21	3	13	16	39	41	156
5	8	1	12	--	15	22	3	33	--	42	28	36	78	200
6	10	2	7	4	2	40	8	28	16	8	15	25	60	100
7	9	2	5	1	2	47	11	26	5	11	10	19	53	6
8	7	1	3	3	1	47	7	20	20	7	8	15	53	36
9	10	1	3	2	--	63	6	19	13	--	6	16	38	31
10	6	--	2	4	--	50	--	17	33	--	6	12	50	9
11	9	1	4	3	1	50	6	22	17	6	9	18	50	12
12	1	1	17	4	8	3	3	55	13	26	30	31	97	213
13	31	4	9	5	5	57	7	17	9	9	23	54	43	8
14	12	1	8	2	6	41	3	28	7	21	17	29	59	103
15	4	2	17	2	10	11	6	49	6	29	31	35	89	33
16	8	2	6	6	8	27	7	20	20	27	22	30	73	508
Total of percents						655	95	412	191	244			963	(56%) 60%
Mean						40	6	26	12	14			60	
Percent gain						-37	-40	116	100	40			62	
33	9	6	1	3	3	41	27	5	14	14	13	22	59	23
34	30	2	5	1	3	73	5	12	2	7	11	41	27	2700
35	76	1	3	--	--	95	1	4	--	--	4	80	5	-88
36	10	2	5	--	6	43	9	22	--	26	13	23	57	36
37	48	3	3	3	6	76	5	5	5	10	15	63	24	-33
38	27	2	9	6	11	49	4	16	11	20	28	55	51	76
39	4	--	13	7	--	17	--	54	29	--	20	24	83	30
GALLAGHER GROUP														
40	14	2	1	8	--	56	8	4	32	--	11	25	44	-8
41	31	5	3	4	6	63	10	6	8	12	18	49	37	-31
42	34	1	6	--	2	79	2	14	--	5	9	43	21	31
43	29	5	2	2	5	67	12	5	5	12	16	43	33	-44
44	18	1	4	--	9	56	3	13	--	28	14	32	44	-12
45	10	6	3	12	6	27	16	8	32	16	27	37	73	161
46	17	7	7	3	--	50	21	21	9	--	17	34	50	257
47	50	4	11	4	20	56	4	12	4	22	39	89	44	2100
48	23	5	14	5	6	43	9	26	9	11	30	53	57	78
Total of percents						891	136	227	160	183			709	(38%) 60%
Mean						56	9	14	10	11			44	

TABLE 3

PRE-TEST

20-minute discussion lesson

Intern Teacher Number	D	E	J	M	X	D%	E%	J%	M%	X%	E-X	D-E	E-X%
MINICOURSE NINE GROUP													
1	10	3	8	0	1	45	14	36	0	5	12	22	55
2	26	0	22	0	2	52	0	44	0	4	24	50	48
3	15	3	9	0	0	56	11	33	0	0	12	27	44
4	29	2	13	0	0	66	5	30	0	0	15	44	34
5	26	0	8	0	0	76	0	24	0	0	8	34	24
6	26	3	0	0	4	79	9	0	0	12	7	33	21
7	12	4	2	0	0	67	22	11	0	0	6	18	33
8	23	4	1	0	0	82	14	4	0	0	5	28	18
9	13	0	2	0	6	62	0	10	0	29	8	21	38
10	4	2	6	0	2	29	14	43	0	14	10	14	71
11	33	0	2	0	0	94	0	6	0	0	2	35	6
12	35	2	8	0	4	71	4	16	0	8	14	49	29
13	20	8	20	0	3	39	16	39	0	6	31	51	61
14	26	3	10	0	4	60	7	23	0	9	17	43	40
15	20	2	9	0	6	54	5	24	0	16	17	37	46
16	13	2	8	0	3	50	8	31	0	12	13	26	50
						982	129	374	0	115			
						61.4	8.1	23.4	0	7.2			
							100						
GALLAGHER GROUP													
33	15	2	14	0	0	48	6	45	0	0	16	31	52
34	10	0	1	0	0	91	0	9	0	0	1	11	9
35	33	6	6	0	1	72	13	13	0	2	13	46	28
36	6	0	8	0	5	32	0	42	0	26	13	19	68
37	24	6	8	0	2	60	15	20	0	5	16	40	40
38	39	14	14	0	2	57	20	20	0	3	30	69	43
39	19	7	3	0	6	54	20	9	0	17	16	35	46
40	10	9	8	0	1	36	32	29	0	4	18	28	64
41	10	5	6	0	3	42	21	25	0	13	14	24	58
42	63	12	6	0	1	77	15	7	0	1	19	82	23
43	19	3	9	0	3	56	9	26	0	9	15	34	44
44	12	5	8	0	4	41	17	28	0	14	17	29	59
45	26	6	13	0	1	57	13	28	0	2	20	46	43
46	25	1	1	0	0	93	4	4	0	0	2	27	7
47	49	2	3	0	0	91	4	6	0	0	5	54	9
48	40	5	6	0	8	68	8	10	0	14	19	59	32
						975	197	321	0	110			
						60.9	12.3	20	0	6.9			

TABLE 4

POST-TEST
20-minute discussion lesson

Intern Teacher Number	D	E	J	M	X	D%	E%	I%	M%	X%	E-X	D-E	E-X%
MINICOURSE NINE GROUP													
1	9	4	9	0	2	38	17	38	0	8	15	24	63
2	32	15	8	0	4	54	25	14	0	7	27	59	46
3	14	4	6	0	0	58	17	25	0	0	10	24	42
4	22	8	8	0	0	58	21	21	0	0	16	38	42
5	13	9	12	0	2	36	25	33	0	6	23	36	64
6	15	5	2	0	3	60	20	8	0	12	10	25	40
7	13	3	1	0	2	68	16	5	0	11	6	19	32
8	4	3	4	0	4	27	20	27	0	27	11	15	73
9	12	1	2	0	1	75	6	13	0	6	4	16	25
10	4	2	4	0	2	33	17	33	0	17	8	12	67
11	12	2	1	0	3	67	11	6	0	17	6	18	33
12	17	7	3	0	5	53	22	9	0	16	15	32	47
13	33	5	4	0	12	61	9	7	0	22	21	54	39
14	20	2	7	0	1	69	7	21	0	3	9	29	31
15	7	14	8	1	3	21	42	24	3	9	26	33	79
16	13	6	8	0	4	42	19	26	0	13	18	31	58
						820	294	310	3	174			
						51 3	18 4	19 4	.2	10.9			
GALLAGHER GROUP													
33	16	0	1	0	4	76	0	5	0	19	5	21	24
34	32	4	3	0	1	80	10	8	0	3	8	40	20
35	75	5	0	0	0	94	6	0	0	0	5	80	6
36	12	0	10	0	2	50	0	42	0	8	12	24	50
37	51	2	5	0	6	80	3	8	0	9	13	64	20
38	39	6	8	0	2	71	11	15	0	4	16	55	29
39	7	10	1	0	6	29	42	4	0	25	17	24	71
40	24	0	0	0	0	100	0	0	0	0	0	24	0
41	31	2	13	0	2	65	4	27	0	4	17	48	35
42	33	3	7	0	0	77	7	16	0	0	10	43	23
43	33	0	12	0	0	73	0	27	0	0	12	45	27
44	21	2	4	0	4	68	6	13	0	13	10	31	32
45	16	3	11	0	5	43	8	35	0	14	21	37	57
46	24	4	2	0	5	69	11	6	0	14	11	35	31
47	48	9	29	0	3	54	10	33	0	3	41	89	46
48	30	9	6	0	10	55	16	11	0	18	25	55	45
						1084	134	250	0	134			
						67.8	8.4	15.6	0	8.4			

TABLE 5

Group A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Knowledge Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	2370.94	2068.56	302.375
2.	Sum of squares: X	10638.7	10581.2	52.531
3.	Sum of squares: Y	12054.9	10314.4	1740.5
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	11526.2	9909.98	1616.26
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 4.729$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.015$ $F_{.05} = 4.20$

TABLE 6

Group A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Comprehension Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	82.4375	228.5	-146.063
2.	Sum of squares: X	1549.88	1143.75	406.125
3.	Sum of squares: Y	997.469	944.938	52.531
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	993.084	899.287	93.797
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 3.025$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 5.24791$ $F_{.05} = 4.20$

TABLE 7

Group A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Analysis Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	470.594	672.938	-202.344
2.	Sum of squares: X	3611.72	3573.44	38.281
3.	Sum of squares: Y	5392.97	4323.44	1069.53
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	5331.65	4196.71	1134.94
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 7.84$ $F_{.05} = 4.18$ $F_{.01} = 7.64$

7. Homogeneity of regression

$F = 0.192$ $F_{.05} = 4.20$

TABLE 8

Group A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Synthesis Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	28.0	28.0	0.0
2.	Sum of squares: X	1544.0	1544.0	0.0
3.	Sum of squares: Y	3098.97	3068.94	30.0
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	3098.46	3068.43	30.031
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.284$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.235$ $F_{.05} = 4.20$

TABLE 9

Group A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Evaluation Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	991.031	1051.25	-60.219
2.	Sum of squares: X	3319.47	3250.44	69.031
3.	Sum of squares: Y	3432.47	3379.94	52.531
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	3136.6	3039.94	96.651
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.922$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.478$ $F_{.05} = 4.20$

TABLE 10

Groups A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Higher Cognitive Question Data
(Comprehension, Analysis, Synthesis, Evaluation)

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	1760.75	1546.44	214.313
2.	Sum of squares: X	10763.0	10770.2	22.781
3.	Sum of squares: Y	13030	11013.9	2016.13
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	12742.8	10791.8	1950.92
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 5.242$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.326$ $F_{.05} = 4.20$

TABLE 11

Groups A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Description Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	1185.5	1243.25	-57.75
2.	Sum of squares: X	10034.2	10032.7	1.53125
3.	Sum of squares: Y	11200.0	9022.0	2178.0
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	11059.9	8867.94	2192.0
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 7.168$ $F_{.05} = 4.18$ $F_{.01} = 7.64$

7. Homogeneity of regression

$F = 0.217$ $F_{.05} = 4.20$

TABLE 12

Groups A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Explanation Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	-325.25	14.75	-340.0
2.	Sum of squares: X	1942.88	1798.38	144.5
3.	Sum of squares: Y	3457.5	2657.5	800.0
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	3403.05	2657.38	745.672
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 8.138$ $F_{.05} = 4.18$ $F_{.01} = 7.64$

7. Homogeneity of regression

$F = 0.599$ $F_{.05} = 4.20$

TABLE 13

Groups A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Evaluation Justification Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	1820.5	1721.13	99.375
2.	Sum of squares: X	5498.47	5410.69	87.781
3.	Sum of squares: Y	4442.0	4329.5	112.5
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	3839.25	3782.01	57.232
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.439$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.016$ $F_{.05} = 4.20$

TABLE 14

Groups A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Expansion Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	197.375	191.125	6.25
2.	Sum of squares: X	1886.97	1886.19	0.781
3.	Sum of squares: Y	1857.5	1807.5	50
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	1836.85	1788.13	48.7212
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.790$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.653$ $F_{.05} = 4.20$

TABLE 15

Groups A and C (20-Minute Discussion Lesson)

Analysis of Covariance for Questions Other Than Description (Explanation, Evaluation Justification, Expansion)

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	1201.66	1259.63	-57.969
2.	Sum of squares: X	10034.2	10032.7	1.531
3.	Sum of squares: Y	11244.0	9049.44	2194.53
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	11100.1	8891.29	2208.77
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 7.204$ $F_{.05} = 4.18$ $F_{.01} = 7.64$

7. Homogeneity of regression

$F = 0.220$ $F_{.05} = 4.20$

TABLE 16

PRE-TEST
Written Questions

Intern Teacher Number	K	C	A	S	E	%K	%C	%A	%S	%E	C-E	K-E	%C-E
MINICOURSE NINE GROUP													
1	2	3	4	1	--	20	30	40	10	--	8	10	80
2	1	--	5	2	2	10	--	50	20	20	9	10	90
3	3	--	2	2	3	30	--	20	20	30	7	10	70
4	2	--	5	--	3	20	--	50	--	30	8	10	80
5	6	--	3	--	1	60	--	30	--	10	4	10	40
6	2	2	1	3	2	20	20	10	30	20	8	10	80
7	6	--	1	1	2	60	--	10	10	20	4	10	40
8	4	1	--	2	3	40	10	--	20	30	6	10	60
9	3	--	2	2	3	30	--	20	20	30	7	10	70
10	3	1	--	--	6	30	10	--	--	60	7	10	70
11	1	1	1	6	1	10	10	10	60	10	9	10	90
12	10	--	--	--	--	100	--	--	--	--	--	10	--
13	4	2	--	--	4	40	20	--	--	40	6	10	60
14	4	1	--	1	4	40	10	--	10	40	6	10	60
15	--	1	4	3	2	--	10	40	30	20	10	10	100
16	--	--	3	4	3	--	--	30	40	30	10	10	100
Total of Percents						500	120	310	270	390			
Mean						31	8	19	17	24			
GALLAGHER GROUP													
33	5	--	3	1	1	50	--	30	10	10	5	10	50
34	4	1	2	1	2	40	10	20	10	20	6	10	60
35	4	--	3	--	3	40	--	30	--	30	6	10	60
36	2	3	3	2	--	20	30	30	20	--	8	10	80
37	3	2	3	--	2	30	20	30	--	20	7	10	70
38	2	--	4	2	2	20	--	40	20	20	8	10	80
39	5	2	--	3	--	50	20	--	30	--	5	10	50
40	--	--	3	2	5	--	--	30	20	50	10	10	100
41	2	1	3	3	1	20	10	30	30	10	8	10	80
42	1	1	4	1	3	10	10	40	10	30	9	10	90
43	3	--	--	6	1	30	--	--	60	10	7	10	70
44	3	1	3	3	--	30	10	30	30	--	7	10	70
45	1	--	6	1	2	10	--	60	10	20	9	10	90
46	4	3	1	1	1	40	30	10	10	10	6	10	60
47	6	--	4	--	--	60	--	40	--	--	4	10	40
48	6	2	2	--	--	60	20	20	--	--	4	10	40
Total of percents						510	160	440	260	230			
Mean						32	10	28	16	14			

TABLE 17

POST-TEST
Written Questions

Intern Teacher Number	K	C	A	S	E	%K	%C	%A	%S	%E	C-E	K-E	C-E%
MINICOURSE GROUP													
1	2	3	2	0	3	20	30	20	0	30	8	10	80
2	1	2	1	4	2	10	20	10	40	20	9	10	90
3	2	1	2	3	2	20	10	20	30	20	8	10	80
4	2	1	4	0	3	20	10	40	0	30	8	10	80
5	3	1	2	1	3	30	10	20	10	30	7	10	70
6	2	2	1	3	2	20	20	10	30	20	8	10	80
7	3	0	0	2	4	33	0	0	22	44	6	9	67
8	1	1	1	6	1	10	10	10	60	10	9	10	90
9	2	0	0	4	3	22	0	0	44	33	7	9	78
10	1	0	1	2	6	10	0	10	20	60	9	10	90
11	1	1	0	2	6	10	10	0	20	60	9	10	90
12	5	0	0	1	4	50	0	0	10	40	5	10	50
13	5	1	1	0	3	50	10	10	0	30	5	10	50
14	5	2	1	1	1	50	20	10	10	10	5	10	50
15	2	1	2	3	2	20	10	20	30	20	8	10	80
16	0	4	4	2	0	0	40	40	20	0	10	10	100
						375	200	220	346	457			
						23.4	12.5	13.8	21.6	28.6			
GALLAGHER GROUP													
33	4	1	1	2	2	40	10	10	20	20	6	10	60
34	3	0	2	2	3	30	0	20	20	30	7	10	70
35	5	2	2	0	1	50	20	20	0	10	5	10	50
36	1	4	2	1	2	10	40	20	10	20	9	10	90
37	1	3	3	0	3	10	30	30	0	30	9	10	90
38	1	2	4	0	3	10	20	40	0	30	9	10	90
39	3	4	1	2	0	30	40	10	20	0	7	10	70
40	1	1	4	0	4	10	10	40	0	40	9	10	90
41	2	0	3	2	3	20	0	30	20	30	8	10	80
42	3	1	3	1	2	30	10	30	10	20	7	10	70
43	2	2	2	1	3	20	20	20	10	30	8	10	80
44	1	1	3	1	4	10	10	30	10	40	9	10	90
45	2	0	5	1	2	20	0	50	10	20	8	10	80
46	2	3	3	1	1	20	30	30	10	10	8	10	80
47	6	2	0	0	2	60	20	0	0	20	4	10	40
48	6	0	1	0	3	60	0	10	0	30	4	10	40
						430	260	390	140	380			
						26.9	16.3	24.4	8.8	23.8			

PRE-TEST
Written Questions

MINICOURSE
NINE GROUP

Intern Teacher Number	D	X	M	J	E	D%	X%	M%	J%	E%	X-E	D-E	X-E%
1	10	0	0	0	0	100	0	0	0	0	0	10	0
2	7	1	0	0	2	70	10	0	0	20	3	10	30
3	2	1	0	6	1	20	10	0	60	10	8	10	80
4	7	0	0	2	1	70	0	0	20	10	3	10	30
5	8	0	0	0	2	80	0	0	0	20	2	10	20
6	8	2	0	0	0	80	20	0	0	0	2	10	20
7	8	0	0	0	2	80	0	0	0	20	2	10	20
8	7	0	0	0	3	70	0	0	0	30	3	10	30
9	8	0	0	1	1	80	0	0	10	10	2	10	20
10	9	0	0	1	0	90	0	0	10	0	1	10	10
11	1	9	0	0	0	10	90	0	0	0	9	10	90
12	10	0	0	0	0	100	0	0	0	0	0	10	0
13	8	0	0	1	1	80	0	0	10	10	2	10	20
14	7	0	0	3	0	70	0	0	30	0	3	10	30
15	4	3	0	2	1	40	30	0	20	10	6	10	60
16	5	0	0	1	4	50	0	0	10	40	5	10	50
						1090	160	0	170	180			
						68.1	10.0	0	10.6	11.3			

TABLE 18

GALLAGHER
GROUP

33	4	2	0	2	2	40	20	0	20	20	6	10	60
34	10	0	0	0	0	100	0	0	0	0	0	10	0
35	7	0	0	2	1	70	0	0	20	10	3	10	30
36	7	0	0	0	3	70	0	0	0	30	3	10	30
37	5	0	0	3	2	50	0	0	30	20	5	10	50
38	6	0	0	1	3	60	0	0	10	30	4	10	40
39	6	3	0	1	0	60	30	0	10	0	4	10	40
40	5	0	0	2	3	50	0	0	20	30	5	10	50
41	5	2	0	1	2	50	20	0	10	20	5	10	50
42	6	0	0	2	2	60	0	0	20	20	4	10	40
43	8	2	0	0	0	80	20	0	0	0	2	10	20
44	10	0	0	0	0	100	0	0	0	0	0	10	0
45	5	1	0	1	3	50	10	0	10	30	5	10	50
46	10	0	0	0	0	100	0	0	0	0	0	10	0
47	6	1	0	2	1	60	10	0	20	10	4	10	40
48	8	0	0	0	2	80	0	0	0	20	2	10	20
						1080	110	0	170	260			
						67.5	6.9	0	10.6	15.0			

TABLE 19

POST-TEST
Written Questions

MINICOURSE NINE GROUP

Intern Teacher Number	D	X	M	I	E	%D	%X	%M	%I	%E	X-E	D-E	%X-E
1	7	0	0	0	3	70	0	0	0	30	3	10	30
2	6	3	0	0	1	60	30	0	0	10	4	10	40
3	5	0	0	2	3	50	0	0	20	30	5	10	50
4	5	0	0	4	1	50	0	0	40	10	5	10	50
5	4	2	0	1	3	40	20	0	10	30	6	10	60
6	8	1	0	0	1	80	10	0	0	10	2	10	20
7	8	0	0	2	0	80	0	0	20	0	2	10	20
8	4	2	0	0	4	40	20	0	0	40	6	10	60
9	3	1	0	2	1	43	14	0	29	14	4	7	57
10	7	1	0	2	0	70	10	0	20	0	3	10	30
11	6	4	0	0	0	60	40	0	0	0	4	10	40
12	8	0	0	1	1	80	0	0	10	10	2	10	20
13	9	0	0	0	1	90	0	0	0	10	1	10	10
14	4	0	0	3	2	44	0	0	33	22	5	9	56
15	5	0	0	1	3	56	0	0	11	33	4	9	44
16	5	1	0	0	4	50	10	0	0'	40	5	10	50
						963	154	0	193	289			
						60.2	9.6	0	12.1	18.1			

GALLAGHER GROUP

33	5	2	0	3	0	50	20	0	30	0	5	10	50
34	6	2	0	1	1	60	20	0	10	10	4	10	40
35	8	0	0	1	1	80	0	0	10	10	2	10	20
36	4	3	0	2	1	40	30	0	20	10	6	10	60
37	6	0	0	2	2	60	0	0	20	20	4	10	40
38	4	1	0	2	3	40	10	0	20	30	6	10	60
39	3	2	1	1	3	30	20	10	10	30	7	10	70
40	5	0	0	5	0	50	0	0	50	0	5	10	50
41	4	0	0	4	2	40	0	0	40	20	6	10	60
42	7	1	0	1	1	70	10	0	10	10	3	10	30
43	7	0	0	2	1	70	0	0	20	10	3	10	30
44	8	0	0	1	1	80	0	0	10	10	2	10	20
45	6	0	0	3	1	60	0	0	30	10	4	10	40
46	4	2	0	2	2	40	20	0	20	20	6	10	60
47	10	0	0	0	0	100	0	0	0	0	0	10	0
48	5	0	1	3	1	50	0	10	30	10	5	10	50
						920	130	20	330	200			
						57.5	8.1	1.3	20.6	12.5			

TABLE 20

Groups A and C (Written Questions)

Analysis of Covariance for Knowledge Question Data

	TOTAL	WITHIN	BETWEEN
1. Sum of products	7832.19	7815.0	17.188
2. Sum of squares: X	14821.9	14818.8	3.125
3. Sum of squares: Y	8222.22	8127.69	94.531
4. Degrees of Freedom	31	30	1
5. Adjusted y^2	4083.53	4006.27	77.256
6. Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.559$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 2.028$ $F_{.05} = 4.20$

TABLE 21

Groups A and C (Written Questions)

Analysis of Covariance for Comprehension Question Data

	TOTAL	WITHIN	BETWEEN
1. Sum of products	1475.0	1400.0	75.0
2. Sum of squares: X	3150.0	3100.0	50.0
3. Sum of squares: Y	4787.5	4675.0	112.5
4. Degrees of Freedom	31	30	1
5. Adjusted y^2	4096.83	4042.74	54.083
6. Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.388$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.069$ $F_{.05} = 4.20$

TABLE 22

Groups A and C (Written Questions)

Analysis of Covariance for Analysis Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	4203.13	3512.5	690.625
2.	Sum of squares: X	9121.88	8593.75	528.125
3.	Sum of squares: Y	5871.88	4968.75	903.125
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	3935.18	3533.1	402.088
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 3.300$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.018$ $F_{.05} = 4.20$

TABLE 23

Groups A and C (Written Questions)

Analysis of Covariance for Synthesis Question Data

	TOTAL	WITHIN	BETWEEN
1. Sum of products	2550.63	2486.25	64.375
2. Sum of squares: X	8121.88	8118.75	3.125
3. Sum of squares: Y	6638.88	5312.75	1326.13
4. Degrees of Freedom	31	30	1
5. Adjusted y^2	5837.87	4551.37	1286.5
6. Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 8.197$ $F_{.05} = 4.18$ $F_{.01} = 7.64$

7. Homogeneity of regression

$F = 0.578$ $F_{.05} = 4.20$

TABLE 24

Groups A and C (Written Questions)

Analysis of Covariance for Evaluation Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	753.125	368.125	385.0
2.	Sum of squares: X	6001.5	5201.5	800.0
3.	Sum of squares: Y	6132.22	5946.94	185.281
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	6037.71	5920.88	116.825
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.572$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.786$ $F_{.05} = 4.20$

TABLE 25

Groups A and C (Written Questions)

Analysis of Covariance for Higher Cognitive Question Data
(Comprehension, Analysis, Synthesis, Evaluation)

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	8016.25	7903.75	112.5
2.	Sum of squares: X	17980.9	17727.8	253.125
3.	Sum of squares: Y	10460.5	10410.5	50.0
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	6886.69	6886.69	0.0004
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.021$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 1.030$ $F_{.05} = 4.20$

TABLE 26

Groups A and C (Written Questions)

Analysis of Covariance for Description Question Data

	TOTAL	WITHIN	BETWEEN
1. Sum of products	3069.06	3055.63	13.438
2. Sum of squares: X	16946.9	16943.8	3.125
3. Sum of squares: Y	9318.22	9260.44	57.781
4. Degrees of Freedom	31	30	1
5. Adjusted y^2	8762.41	8709.39	53.027
6. Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.177$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.156$ $F_{.05} = 4.20$

TABLE 27

Groups A and C (Written Questions)

Analysis of Covariance for Explanation Question Data

	TOTAL	WITHIN	BETWEEN
1. Sum of products	951.875	118.75	-166.875
2. Sum of squares: X	4487.5	4375.0	112.5
3. Sum of squares: Y	4796.47	4548.94	247.531
4. Degrees of Freedom	31	30	1
5. Adjusted y^2	4394.56	4262.86	331.703
6. Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 2.257$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 3.990$ $F_{.05} = 4.20$

TABLE 28

Groups A and C (Written Questions)

Analysis of Covariance for Evaluation Justification Question Data

	TOTAL	WITHIN	BETWEEN
1. Sum of products	1718.13	1718.13	0.0
2. Sum of squares: X	5387.5	5387.5	0.0
3. Sum of squares: Y	6045.72	5751.69	294.031
4. Degrees of Freedom	31	30	1
5. Adjusted y^2	5497.79	5203.76	294.031
6. Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 1.639$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.749$ $F_{.05} = 4.20$

TABLE 29

Groups A and C (Written Questions)

Analysis of Covariance for Expansion Question Data

		TOTAL	WITHIN	BETWEEN
1.	Sum of products	2703.75	2666.25	37.5
2.	Sum of squares: X	10021.9	9943.75	78.125
3.	Sum of squares: Y	3975.5	3957.5	18.0
4.	Degrees of Freedom	31	30	1
5.	Adjusted y^2	3246.07	3242.59	3.479
6.	Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.311$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.984$ $F_{.05} = 4.20$

TABLE 30

Groups A and C (Written Questions)

Analysis of Covariance for Questions Other Than Description
(Explanation, Evaluation Justification, Expansion)

	TOTAL	WITHIN	BETWEEN
1. Sum of products	3069.06	3055.63	13.438
2. Sum of squares: X	15746.9	15743.8	3.125
3. Sum of squares: Y	9318.22	9260.44	57.781
4. Degrees of Freedom	31	30	1
5. Adjusted y^2	8720.06	8667.39	52.672
6. Degrees of Freedom for adjusted sums of squares	30	29	1

$F = 0.176$ $F_{.05} = 4.18$

7. Homogeneity of regression

$F = 0.084$ $F_{.05} = 4.20$

TABLE 31

Student Responses

	MINICOURSE GROUP					QUESTIONING STRATEGIES GROUP					
	Intern Teacher Number	No. of Responses Aud.	Inaud.	Total	Total Words	$\bar{M}$ Length	Intern Teacher Number	No. of Responses Aud.	Inaud.	Total	Total Words	$\bar{M}$ Length
PRE-TEST	1	118	25	143	548	5	33	118	21	139	2003	17
	2	158	3	161	821	5	34	73	20	93	380	5
	3	73	5	78	572	8	35	88	24	112	452	5
	4	200	37	237	3547	13	36	106	12	118	2070	20
	5	256	40	236	1449	6	37	103	12	115	1165	11
	6	82	1	83	1349	16	38	164	34	198	1206	7
	7	68	4	72	1263	19	39	173	34	207	1755	10
	8	115	27	142	1300	11	40	177	15	192	2754	16
	9	48	8	56	538	11	41	83	10	93	2011	24
	10	108	8	116	998	9	42	123	19	142	1381	11
	11	71	9	80	325	5	43	113	4	117	1726	15
	12	289	51	340	1841	6	44	204	38	242	2473	12
	13	237	20	257	2194	9	45	149	36	185	964	6
	14	150	42	192	2982	20	46	67	19	86	382	6
	15	127	50	177	922	7	47	263	81	344	1068	4
	16	271	17	288	1901	7	48	118	8	126	1597	13
	TOTAL	2371	347	2718	22150	$\bar{M}$ = 10	TOTAL	2122	459	2581	23377	$\bar{M}$ = 11
POST-TEST	1	147	17	164	944	6	33	181	14	195	1538	8
	2	145	4	149	1410	10	34	96	19	115	494	5
	3	56	2	58	997	18+	35	143	19	162	596	4
	4	157	13	170	1653	11	36	84	--	84	1433	17
	5	109	13	122	1126	10	37	135	13	148	1266	9
	6	76	1	77	1642	22	38	67	3	70	727	11
	7	69	4	73	1085	16	39	94	2	96	1109	13
	8	47	1	48	1288	27	40	144	--	144	2863	20
	9	66	6	72	344	5	41	105	1	106	1108	11
	10	70	1	71	920	13	42	59	7	66	361	6
	11	85	5	90	717	8	43	160	19	179	690	4
	12	80	0	80	1937	24	44	184	17	201	1040	6
	13	271	15	286	1612	6	45	126	10	136	1387	11
	14	86	9	95	1200	14	46	76	5	81	1186	16
	15	104	19	123	1145	11	47	300	33	333	1688	6
	16	55	3	58	436	8	48	106	2	108	1485	14
	TOTAL	1623	113	1736	18456	$\bar{M}$ = 13	TOTAL	2060	164	2224	19052	$\bar{M}$ = 10

TABLE 32

PRE-TEST
20-Minute Discussion Lesson

	Intern Teacher Number	Data 1	Con-cept 2	Genl-ztn 3	Tot.	% 1	% 2	% 3	%2+3
MINICOURSE GROUP	1	19	3	0	22	86	14	0	14
	2	42	8	0	50	84	16	0	16
	3	6	17	4	27	22	63	15	78
	4	34	9	1	44	77	20	2	22
	5	11	22	1	34	32	65	3	68
	6	14	14	5	33	42	42	15	57
	7	11	6	1	18	61	33	6	39
	8	1	21	6	28	4	75	21	96
	9	10	11	0	21	48	52	0	52
	10	2	11	1	14	14	79	7	86
	11	33	2	0	35	94	6	0	6
	12	6	41	2	49	12	84	4	88
	13	10	36	5	51	20	71	10	81
	14	13	29	1	43	30	67	2	69
	15	4	32	1	37	11	86	3	89
	16	7	16	3	26	27	62	12	74
	Total	223	278	31	532				
				Means		42	52	6	58
QUESTIONING STRATEGIES GROUP	33	2	26	3	31	6	84	10	94
	34	11	0	0	11	100	0	0	0
	35	11	22	13	46	24	48	28	76
	36	3	13	3	19	16	68	16	84
	37	17	19	4	40	43	48	10	58
	38	48	19	2	69	70	28	3	31
	39	8	25	2	35	23	71	6	77
	40	11	16	1	28	39	57	4	61
	41	4	11	9	24	17	46	38	84
	42	12	44	26	82	15	54	32	86
	43	8	18	8	34	24	53	24	77
	44	9	8	12	29	31	28	41	69
	45	11	20	15	46	24	43	33	76
	46	17	8	2	27	63	30	7	37
	47	39	12	3	54	72	22	6	28
	48	19	33	7	59	32	56	12	68
	Total	230	294	110	634				
				Means		37	46	17	63

TABLE 33

POST-TEST
20-Minute Discussion Lesson

	Intern Teacher Number	Data 1	Con-cept 2	Genl-ztn 3	Tot.	% 1	% 2	% 3	%2+3
MINICOURSE GROUP	1	1	21	2	24	4	88	8	96
	2	21	34	4	59	35	58	7	65
	3	3	13	8	24	13	54	33	87
	4	2	36	0	36	5	95	0	95
	5	3	16	17	36	8	44	47	91
	6	5	20	0	25	20	80	0	80
	7	3	14	2	19	16	74	11	85
	8	1	14	0	15	7	93	0	93
	9	4	8	4	16	25	50	25	75
	10	11	1	0	12	92	8	0	8
	11	6	7	5	18	33	39	28	67
	12	9	19	4	32	28	59	13	72
	13	35	18	1	54	65	33	2	35
	14	8	16	5	29	28	55	17	72
	15	18	15	0	33	55	45	0	45
	16	4	27	0	31	13	87	0	87
	Total	134	279	52	465				
				Means		28	60	12	72
QUESTIONING STRATEGIES GROUP	33	0	15	6	21	0	71	29	100
	34	29	12	0	41	71	29	0	29
	35	48	31	1	80	60	39	1	40
	36	4	20	0	24	17	83	0	83
	37	20	39	5	64	31	61	8	69
	38	27	26	2	55	49	47	4	51
	39	2	16	6	24	8	67	25	92
	40	3	19	2	24	13	79	8	87
	41	9	27	12	48	19	56	25	81
	42	17	24	2	43	40	56	5	61
	43	15	27	3	45	33	60	7	67
	44	0	23	8	31	0	74	26	100
	45	14	21	2	37	38	57	5	62
	46	12	19	4	35	34	54	11	65
	47	12	68	9	89	13	76	10	86
	48	9	41	5	55	16	75	9	84
	Total	221	428	67	716				
				Means		28	62	12	72