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ABSTRACT

The questioning behavior of college faculty is descriptively analyzed. The cognitive levels of questioning patterns of professors are described and the differences in these levels and patterns are examined across the variables of institution size (small or large), sector (public or private), course level (beginning or advanced), and discipline (humanities/social sciences/arts or science/mathematics/engineering). Relationships between the cognitive level of the professor's question and the overall cognitive levels of both the professors and students are analyzed. The sample included 40 professors in four institutions. Four audio tapes were made per professor in the course of a semester. The tapes were analyzed according to the Amidon Multiple Category System, the Florida Taxonomy of Cognitive Behavior, and the Aschner-Gallagher System. Statistical analyses of the results revealed that many of the classes were void of intellectual interchange between faculty and students, and lacked vigor. It is proposed that the technique of questioning is potentially more useful, and that faculty development programs could include training in this technique. (Author/MSE)

QUESTIONING: THE UNTAPPED RESOURCE

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Everyone who has ever been to college probably feels he or she can describe what "goes on" in college classrooms. However, thorough descriptive studies of what actually takes place in these classes are rather scarce. It is evident that without an accurate picture of basic teaching phenomena, further research will lack the necessary theoretical support.

The following study attempts to describe one aspect of the collegiate teaching process--questioning--and focuses on the cognitive levels and patterns of professors' questions. The study tries to answer the following:

1. What cognitive levels are elicited by the questions of college instructors?

2. What questioning patterns are present in college instruction? Do these cognitive levels and patterns differ across:

   a. Institution types--private and public?

   b. Institution size-small and large?

   c. Beginning and advanced courses?

   d. Subject areas--humanities/arts/social science and math/science/engineering?

3. In examining the data developed in the study:

   a. Is there a relationship between the cognitive level of the professor's questions and the general cognitive level of professor talk?

   b. Is there a relationship between the cognitive level of the professor's questions and the general cognitive level of student talk?

Descriptive Research on College Teaching

Although most professors declare that teaching is their major professional responsibility, relatively little research effort has been devoted to describing

what transpires in the college classroom. That research which has been do on the instructional process is limited and has yielded contradictory re s For example, when examining class size or structure in relation to studen achievement, it was generally found that class size is not a critical variable; no one general method of teaching produced more or better learning than another; and directed learning seems more effective than undirected learning. (Bigelow and Egbert, 1968; Dubin & Taveggia, 1968, Pullias, 1962).

McKeachie (1970) examined collegiate instruction in considerable detail. Although his overall conclusions were in agreement with the above researchers, he used a criterion other than student achievement, and his results were more definitive: for better retention, application, problem solving, attitude change, and motivation for further learning, small classes seem somewhat more effective than large, discussions are somewhat preferred over lectures, and student-centered instruction is generally preferable to teacher-centered.

Research examining teaching in relation to different subject areas is also limited. The work of Solomon, Bezdek and Rosenberg (1964), Kenny (1967), and Maddox (1970) seems to indicate that differences in teaching procedures do exist with regard to discipline, but extensive work in this area is lacking.

Studies comparing actual teaching behavior according to the level of the college course also appears to be sparce. Furthermore, several studies which investigated this variable on the Jr.-Sr. high school level often found contradictory results (Adams, 1964; Dahlberg, 1969; Goldbold, 1970; Moyer, 1965).

Because there was so little descriptive research on collegiate instruction, the variables selected for this study were carefully chosen. Research on student rating of instructors tends to show the potential value of instructor-student classroom interaction (Hartung, 1972; Hildebrandt, 1973; Hildebrandt, Wilson, and Dienst, 1971; Walsh, 1972; and others), and the research on class structure

suggests the value of discussions and student-centered instruction (McKeachie, 1970 and others). Consequently, instructor questioning seemed to be a variable which might reveal an accurate picture of a portion of the collegiate instructional process.

This decision to study questioning behavior is supported in studies of questioning in high school classes. Frequently the researchers found that the great majority of all teacher questions were on the lowest cognitive level (Adams, 1964; Bellack, 1966; Davis & Tinsley, 1967; Rogers, 1972 and others), yet questions eliciting abstract thinking seemed to be the most effective for moving students toward high levels of understanding (Furst, 1967; Gall, 1970; and others).

In general, the great bulk of research over the century has suggested that in fostering the important cognitive and affective outcomes to which colleges are committed, the instructor's questions may be a crucial factor. On both elementary and secondary levels, questions have been shown to relate to critical thinking, to achievement, and to attitude toward the subject. On the college level, however, their role in the teaching process has been only superficially evaluated.

Given the importance of analyzing a professor's questions, then, one must certainly ask how this behavior differs across a multiplicity of variables. Does instructors' questioning behavior change over the course level? Among subject areas? Across institution size? Among institution types? This study attempted to shed light on these questions.

Sample

In order to generate broad descriptive data, the study included one school from each of the following categories: large public, small public, large private, small private.

The schools included in the study were:

#1 Large public, enrollment approaching 20,000

#2 Small public, enrollment slightly less than 8,000

#3 Large private, enrollment over 10,000

#4 Small private, enrollment less than 700

There can never be a totally adequate sample, however, and one of the inadequacies of the current smaple concerns the range in the sizes of the institutions. Within the public and private categories, the range in size is sufficient. It was not possible, however, to maintain this range between categories. For example, the small public school is not substantially smaller than the large private school. This must be taken into account when interpreting the data on the institutional size variable.

Data Gathering Procedures

From each of the small schools, 5 professors were randomly selected; from each of the large schools 15 professors were randomly selected. No attempt was made to control for discipline.

Each randomly selected professor was telephoned to confirm his participation in the study and to establish which class would be audio-taped. In most cases, the professor had no preference, and this made it relatively simple to get an even distribution of beginning and advanced classes. The dates for taping were spread over the semester; one tape was made during the first week of class, one during the week before final exams, and two somewhat equally spaced between these.

Considerable discussion was given to the question of whether or not to inform the professors of the taping schedule. Lamb (1970) studied the effects of three different observers' presence in the classroom on the questioning pattern of second year probationary teachers. He concluded that different observation conditions do not affect the questioning pattern of teachers except in

one instance; teachers observed for an expressed administrative purpose of contract renewal asked a significantly higher number of opinion questions than teachers being observed for an inservice purpose. Since this study carried no overt threat, and since the professor had no knowledge of what was being studied other than "college teaching," it was assumed that knowing when he would be taped would not appreciably affect his teaching. One portable cassette recorder with an external condenser microphone was used.

Thus the study involved a sample of forty professors drawn from a population of full-time undergraduate faculty at four institutions. Thirty were from "large" schools, ten from "small" schools.

Data Analysis Procedures

Each tape was coded first using the Amidon Multiple Category System (MCS) (Appendix A). This data was then placed in a 24x24 matrix (Appendix B) and percentages computed for each category. While coding the MCS for each question asked by a professor, the researcher coded a further breakdown according to the Aschner-Gallagher System for Classifying Thought Processes in the Context of Classroom Verbal Interaction (A G) (Appendix C). These observations were then recorded on the Aschner-Gallagher tally sheet (Appendix D). A second researcher then coded a random sample of at least two tapes per professor using the Florida Taxonomy of Cognitive Behavior (FTCB) (Appendix E). Since each major category of the FTCB contains several items, and the developers of the system do not report that these are accurately sequential within the major categories, the total number of teacher and pupil tallies for each major category was computed.

Thus for each professor, four MCS matrices, four A-G tally sheets, and at least two FTCB displays were available for analysis.

The MCS matrices and coding sheets were then examined to ascertain the

professor's questioning pattern. It was possible to group these patterns into seventeen distinct groups, plus one group of "other"--patterns used very infrequently, and one group of "no questions asked."

Statistical Procedures

Several different statistical procedures were employed in examining the cognitive levels and questioning patterns: In dealing with the cognitive levels elicited by the questions of college instructors, frequency count, mean, and simple T test were used. To describe the questioning patterns present in college instruction, a cross-tabulated frequency count was made. And a chi square was used to describe the differences in these patterns across the variables of institution size and type, course level, and discipline.

To determine the relationship between the cognitive level of professor questions and the general cognitive level of teacher and student talk, a Pearson Correlation Coefficient was computed.

Instrumentation

Amidon Multiple Category System (Appendix A)

This system is a modification of the Flander's Interaction Analysis System. Sub-headings are added to six of Flander's categories and an eleventh category is added which breaks Flander's category ten (silence or confusion) into separate categories for each process. A person using the 24 categories described by the system enters the data into a 24x24 matrix instead of the 10x10 matrix used by Flanders.

Category 1--Accepts Feelings, Category 5--Lecture, and Category 6--Gives Directions, are identical to Flanders' system. Category 2--Praises or Encourages, is modified to reflect Hughes' ideas about public and private criteria (Hughes, 1959). Category 3--Accepts of Uses Student Ideas, was modified according to Taba's levels of thinking concept (Taba, 1964). It divides thought processes

into description, inference, and generalization.* The four major categories from Aschner and Gallagher's system--Cognitive memory, convergent, divergent, and evaluative-were used to modify Flander's category 4. Ultimately, these are based on Guilford's structure of the intellect (Guilford, 1956). Further discussion of these categories will be given under the discussion of the Aschner-Gallagher System. Category 7--Criticizes or Justifies Authority, is modified in the same manner as Category 2. Categories 8 and 9--Student Responses, are modified in the same manner as Category 3. Category 10 is now silence. Category 11 is confusion.

Because of these alterations, it appeared that the use of Amidon's system would yield a significantly more detailed description than would use of the more simple Flanders' system; this was especially important with respect to the questioning categories, as was noted previously.

Reliability--Light discusses the determination of inter- and intra-rater reliability with matrix systems (Light, 1973, pp. 318-381). He notes that the simplest measure of agreement between two observers is to take the raw proportion of an agreement, but that this measure is independent of the observed marginals (p. 331). He suggests that a more appropriate measure of reliability in such cases is a variation of chi square, Cohen's K.

$$K = \frac{f_o - f_e}{N - f_c}$$ where f_c = chance frequency

He writes that

> K essentially compares the observed entries on the main diagonal with the expected entries on this diagonal, where the expected number of entries is computed from the standard chi-square multiplicative model of independence. It thus avoids the problem

*The researcher experienced severe problems with the subscripts to category three and ultimately omitted these subscripts.

of being affected by the departures of observed n_{ij} number of responses in the i^{th} row and the j^{th} column from expected n_{ij} on the off-diagonal cells. K takes the value of zero when observed agreement equals expected agreement, and it takes the value of 1.0 when all responses fall on the main diagonal. It becomes negative when the observed responses have less than "chance" agreement; its limit depends upon the marginals of the table (p. 331).

The need to use such a computation rather than a single proportion of agreement is quite apparent when one considers that a great percentage of most classes is teacher lecture, and to ignore the fact that by pure chance one could obtain a very high reliability would render the computation invalid.

Even though K is an extremely conservative measure, an inter-rater reliability of .91 and intra-rater reliability of .92 were obtained. These were considered acceptable.

Florida Taxonomy of Cognitive Behavior (Appendix B)

The FTCB is a sign system (frequency of behaviors are not indicated, rather presence or absence of the behavior within a given time span) based on the theoretical model developed by Benjamin Bloom. It provides a framework for observing and recording the cognitive behavior of the instructor and students.

Aschner-Gallagher System for Classifying Thought Processes in the Context of Classroom Verbal Interaction (Appendix C)

This instrument was developed to assess the quality of thinking that is elicited and expressed in the classroom. There are five primary sets of categories for classifying what is said and done in the classroom. Four of them, cognitive memory, convergent thinking, divergent thinking, and evaluative thinking, are based on the theoretical model of the operations of the intellect developed by Guilford (1956). The Routine category contains behaviors of interest to the developers which were not included in the above four groups. Each of the five categories has a set of subcategories. Some of these subcategories are

further divided.

In using the A-G system, the researcher has reversed the developers' order of the Evaluative and Divergent categories for ease in coding. This reversal makes them parallel to the MCS 4a,b,c,d groups.

Reliability--Aschner and Gallagher give no instructions for computing reliability. Considering the nature of the present use of the system, a simple percentage agreement was considered sufficient. The inter-rater reliability was .37; the intra-rater reliability was .93.

RESULTS

General Descriptive Data

The portion of total class time spent in professor questioning was determined by ming the percentage in all subscripts of category 4 (Professors' Questions) on the Amidon Multiple Category System (MCS). Table 1 illustrates both means and standard deviations for each institution in the sample, for beginning and advanced courses and for the two discipline groups (humanities/social science/arts and math/science/engineering).

TABLE 1

PERCENT OF TOTAL CLASS TIME
SPENT IN PROFESSOR QUESTIONING

	$\bar{X}$	S.D.	N
By School			
Large Public	3.68	2.97	15
Small Public	4.99	3.32	5
Large Private	2.44	2.23	15
Small Private	5.81	8.49	5
By Discipline			
Math/Science	2.48	2.28	14
Humanities/ Social Science	4.27	4.40	
By Level			
Beginning	3.99	4.50	20
Advanced	3.30	3.16	26
Total	3.65	3.86	40

Results

The range of the percents of total class time spent questioning was .03 to 20.80. The values of .03 and 20.80 were single cases. If these two cases are omitted, the range is .20 to 9.20.

There is no significant difference in the mean percentage of the total class time occupied by professors' questions across any of the variables examined.

Cognitive Levels Elicited by the Questions of College Professors

The Amidon MCS was used to determine the cognitive levels elicited by the questions of college professors. In this system, questions are ranked according to the type of thinking elicited. Cognitive memory (4A), Convergent thinking (4B), Divergent thinking (4C), and Evaluative thinking (4D). The following tables describe the percent of questions present in each of these cognitive levels and how they vary across institution type, size, course level, and discipline.

TABLE 2

PERCENT OF TOTAL QUESTIONS IN EACH COGNITIVE LEVEL BY INSTITUTIONS

	Cognitive Questioning Level			
	Cognitive Memory (4A)	Convergent Thinking (4B)	Divergent Thinking (4C)	Evaluative Thinking (4D)
Large Public	80.13	15.42	1.99	2.45
Small Public	91.51	7.95	0.28	0.26
Large Private	81.95	12.89	3.60	1.56
Small Private	80.33	14.39	2.80	2.48
Column X	82.33	13.40	2.43	1.85

Results

The overwhelming percentage of all questions asked by college professors, regardless of institution were on the lowest cognitive level (4A-Cognitive Memory). The grand mean for this level was 82.33%. With the exception of the small public institution, the means for level 4A were between 80 and 82%. The small public college had a level 4A mean of 91.51%.

This same distribution was also seen across the levels of Convergent thinking (4B), Divergent thinking (4C), and Evaluative thinking (4D): the large public, large private, and small private colleges appear fairly close in percentages; whereas the small public school has consistently fewer of the higher level questions.

When using a t-test to determine the differences in cognitive level of questions between private and public institutions, no significant differences were found. Questioning level is thus independent of institution type.

When grouping the institutions as small and large and performing a t-test to determine the difference in cognitive level of questions, it was found that questioning level 4B (Convergent thinking) does differ across the variable of institution size, with large schools having a significantly higher percentage of questioning time spent at the 4B level.

Since there was little difference in the individual cognitive levels of questions across the variables of institution size and type, a chi square analysis was computed to determine whether discrete institutions were independent of questioning level.

When comparing all four institutions over the four questioning levels, it was found that institution is, in fact, not independent of questioning level. Whereas a t-test did not indicate a significant difference for each one of the cognitive questioning levels individually, taken together a lack of independent is shown: $X^2 = 27.09$. $df = 9$. $P \leq .01$ (Appendix F)

The large private institution has a high incidence of 4C (Divergent thinking) questions and the small public institution has a low incidence of 4C (Divergent thinking) and 4D (Evaluative thinking) questions.

Differences in Percent in Each Professor Cognitive Questioning Level Between Beginning and Advanced Courses

TABLE 3

PERCENT OF QUESTIONS IN EACH PROFESSOR COGNITIVE LEVEL BY BEGINNING AND ADVANCED COURSES

	Questioning Level			
	Cognitive Memory (4A)	Convergent Thinking (4B)	Divergent Thinking (4C)	Evaluative Thinking (4D)
Beginning	82.43	12.71	3.05	1.81
Advanced	82.22	14.08	1.81	1.88
Total	82.33	13.40	2.42	1.85

Results

When performing a t-test for difference between means in the questioning levels between beginning and advanced courses no significant difference was found. It should be noted that level 4A (Cognitive memory) is almost identical on the two levels and that level 4D (Evaluative thinking) is also almost identical. Level 4C (Divergent thinking) is somewhat higher in the beginning courses but not significantly higher.

T-tests of the differences in percent in each cognitive questioning level between beginning and advanced courses within each discipline group (science/math/engineering and humanities/social sciences/arts) were also calculated. No significant differences were found on any questioning level.

Differences in Percent in Each Professor Cognitive Questioning Level Between Disciplines

TABLE 4

PERCENT OF QUESTIONS IN EACH COGNITIVE LEVEL BY DISCIPLINE

	Questioning Level			
	Cognitive Memory (4A)	Convergent Thinking (4B)	Divergent Thinking (4C)	Evaluative Thinking (4D)
Humanities	79.74	14.40	3.35	2.51
Math/Science	87.08	11.57	0.73	0.63

Results

Cognitive questioning level 4A (Cognitive memory) is significantly different; (at the .03 level) between the two major discipline groups--humanities and math/science. In the math/science/engineering group professors asked significantly more low level (4A. Cognitive memory) questions than did the humanities/social science/arts professors (Table 4). It must be noted, however, that both groups essentially asked a high number of low level questions.

On the other questioning levels, however, no significant differences were found.

Alternative Descriptive Data on Professor Questioning

In order to examine the questioning behavior of professors in a somewhat more detailed manner than was possible with the MCS, the Aschner-Gallagher system was employed to analyze only the professors' questions, not the entire class session.

This system in general yields a more detailed breakdown of each subscript of the questioning category (4) in the Amidon MCS. Additionally it adds a fifth

category, "Routine." As noted in the description of the instrumentation, the MCS groups most routine questions into the 4A (Cognitive memory) category. It treats rhetorical questions as lecture and humorous questions as 2A (Praise, no criteria). The A-G system brings both of these (rhetorical and humor) under the major heading "Routine"; each has its own coding category. Although these differences account for only a small portion of the questioning, they do give a slightly different picture of professor questioning than the MCS gives. If a future researcher is particularly interested in routine questions as separate from cognitive memory questions, he may wish to add this fifth category to the MCS.

It must also be noted that with the MCS a single question may be tallied three times if it is of nine seconds duration, whereas with the A-G system questions are not tallied by duration but by a shift from one category or subcategory to another. Thus a nine second question calling for fact-stating would receive only one Cognitive memory/fact stating code whereas in the MCS it would be coded as three Cognitive memory tallies (4A, 4A, 4A). This accounts for the slight differences in percentages in the major categories.

TABLE 5

PERCENT OF PROFESSOR QUESTIONING EPISODES IN MAJOR CATEGORIES OF ASCHNER-GALLAGHER SYSTEM

	Percent of Total Questioning Episodes
Cognitive Memory (I)	62.67
Convergent Thinking (II)	13.72
Divergent Thinking (III)	2.34
Evaluative Thinking (IV)	2.50
Routine (V)	18.71

Results

It is seen that regardless of the classification system used, the majority of all professors' questions are on the lowest cognitive level. Using the A-G system, it is further noted that of those questions on the lowest level, 56.10 percent of these are designed to elicit a statement of facts from the students. No other particularly unusual findings are seen.

No correlations were made between the data obtained from the A-G system and the MCS or FTCB systems. A-G was used simply to provide a more descriptive analysis of the overall sample.

Discussion of Results

Cognitive levels of professors' questions

A small portion of most college classes is spent in professor questioning ($\bar{X}$ = 3.65%, S.D. 3.26), with little variation across institution type, size, course level, or discipline. This percentage is considerably lower than has been observed at the high school level. The percentage alone is not sufficient as an index, however, but juxtaposed with other variables which will be discussed later, this figure becomes important. The great majority of the questions asked by professors are at the lowest cognitive level ($\bar{X}$ = 82.33%). In fact, over 56% of all professors' questions ask for a simple recall of facts. These findings are congruent with past research on questioning.

Since the literature on questioning suggests a relationship between professors' higher level questions and student outcomes such as achievement, positive attitudes toward the subject, and critical thinking, this may have implications for faculty development. Because it is apparent that professors ask mostly very low level questions, it appears that they are not generally utilizing

questioning to its fullest extent. The current level may be effective for knowledge acquisition, but if critical thinking, for instance, is valued as an outcome, then different levels of questioning need to be considered. It may be of interest to future researchers to study whether or not such outcomes as critical thinking and positive attitude are, in fact, stated goals, and to study whether or not professors' questioning differs in relation to the variability of these goals.

Added to the problem of goals is that of institutional type. In examining these data, it was found that although there appears to be no significant difference in the cognitive levels of professors' questions between public and private institutions, there does appear to be a difference in professor questioning levels between small and large schools. A chi square analysis performed over the entire data sample showed that questioning levels were not independent of institution; that is, they did in fact differ across each separate institution. One sees that professors at large schools ask more convergent thinking questions (such as "What is there about the position of New York City which accounts for its importance?") than do professors at small schools which may indicate, as suggested earlier, a difference in institutional goals, or it may indicate that professors are adapting their teaching to different types of students. Future researchers might be interested in how much impact the academic or social characteristics of the students have on teaching.

Although differences in professors' cognitive questioning levels were discovered between institutions, these were not present between beginning and advanced courses. Not only was there no significant difference between course levels, but there was, in fact, a very close relationship. One might expect beginning courses to deal with more factual information than advanced courses and for advanced courses to synthesize and relate these concepts

and to draw hypotheses and conclusions from them; but this did not happen. The study then tested the possibility that there was a difference in questioning levels between beginning and advanced classes within each discipline group, the assumption being that in linear and sequential disciplines such as mathematics, science, and engineering, one might find more low level questions in the beginning courses and more high level questions in advanced courses. No questioning differences were found, however, between the course levels within the two discipline groups. Apparently professors' general questioning strategies do not change from beginning to advanced courses, regardless of the subject being taught.

When examining the differences in questioning level between disciplines, the only variability was found at the cognitive memory level, with science/math/engineering professors asking a significantly larger proportion of low level questions than the humanities/social science/arts professors. These results concur with those from other studies: the disciplines of science, math and engineering put strong emphasis on the memorization of low level concepts and facts.

There are several possible explanations for this heavy reliance on low-level questions: 1) low-level questions are by far the easiest to ask, 2) professors may often use low level questions simply to "wake up" the class (such questions as "Are you with me?" and "Did you all get that?" sometimes serve this function), 3) low level questions generally bring predictable responses from the students and thus may create a more comfortable situation for the professor, 4) professors may not recognize higher order questions. Thus, if the professor is actually attempting to facilitate critical thinking, for example, but is uncomfortable with higher order questions or cannot easily formulate them, faculty developers may wish to include the topic of questioning

in their programs.

Researchers may also find curvilinear relationship between critical thinking, for example, and higher level questions. There may well be an optimum proportion of high and low level questions and that either extreme is less than optimally productive.

Questioning Patterns Present in College Instruction

Another potentially important aspect of questioning behavior is the questioning pattern. What does a professor say immediately before he asks a question? What kind of question does he ask? What happens immediately after the question is asked? To begin to answer these questions, the primary (most frequent) and secondary (next most frequent) questioning patterns were isolated from the MCS tally sheets. These were combined into nineteen groups.

TABLE 6

ORDER OF FREQUENCY OF SUMMED PRIMARY AND SECONDARY QUESTIONING PATTERNS OF COLLEGE PROFESSORS

1. 5-4A-5 (5-4B-5)
2. 5-4A-10-5
3. 5-4A-8-3-5
4. 5-4A-9-5
5. 5-4A-8-5
6. 5-4A-8-4 (5-4A-9-4)
7. 5-4A-9-2A-5 (5-4A-9-3-5)
8. 5-4B-8-2A-5 (5-4B-8-3-5)
9. 5-4A-8-2A-5
10. 5-4A-10-4A
11. 5-4B-9-9-5
12. 5-4A-9-3-4A(b) (5-4A-8-3-4A(B)
13. 5-4B-10-5
14. 5-4A-8-2A (3A)-8 (9)-5
15. 5-4B-8-2A-4 (5-4B-8-2A-4)
16. 5-4B-9-9-2A-3-9-5
17. 5-4A-10-10-9
18. No questions asked
19. Unusual patterns used only once.

Legend

2A = Professor praises

3 = Professor uses or accepts student ideas

4A = Professor asks cognitive memory question

4B = Professor asks convergent thinking question

5 = Professor lectures

8 = Student gives answer to a question directed specifically to him

9 = Student gives answer to a question which was asked of the total class (a question which any student was free to answer)

10 = Silence

(A detailed cross tabulation of the frequency of each pattern across each institution, course level, and discipline may be obtained from the

researcher.) A brief description of the five most frequent patterns appears below.

1. 5-4A-5 (5-4B-6) Professor lecture followed by cognitive memory or convergent thinking question followed by more lecture.
2. 5-4A-10-5 Professor lecture followed by cognitive memory question followed by silence followed by lecture.
3. 5-4A-8-3-5 Professor lecture followed by cognitive memory question followed by a restricted* student response followed by an acceptance or use of the student's idea followed by lecture.
4. 5-4A-9-5 Professor lecture followed by cognitive memory question followed by unrestricted** student response followed by lecture.
5. 5-4A-8-5 Professor lecture followed by cognitive memory question followed by restricted student response followed by lecture.

Results

The most feequent questioning pattern of college professors involves lecturing, asking a low level question, and then lecturing some more. Often this return to lecturing after a question was to give additional information to aid the students in answering the question. At other times the professors simply

*Restricted student response - statement or answer to a question directed specifically to a particular student.

**Unrestricted student response - statement or answer to a question which was asked of the total class and which any student was free to answer.

answered their own questions. It must be noted that these were not rhetorical questions, since rhetorical questions are coded as lecture with the MCS.

Consistent with both primary and secondary questioning patterns, the professor's question followed a section of lecture. On occasion professor questions would follow student responses, but these were not of primary or secondary frequency.

TABLE 7

FIVE MOST FREQUENT SUMMED PRIMARY AND SECONDARY PROFESSOR QUESTIONING PATTERNS

Pattern Number	Percent of Total Primary and Secondary Patterns
1	18.08
2	13.85
3	10.77
4	10.38
5	8.46
Total 1-5	61.54

These five most frequent summed primary and secondary professor questioning patterns accounted for 61.54% of all patterns. When summing patterns 1 and 2, neither of which involve any student response, 31.93% of all questioning patterns of professors elicit no student participation.

Due to the small expected frequencies in patterns 6-19, further analyses were performed using only patterns 1-5.

Differences in Professors' Questioning Patterns Across Institutions

TABLE 8

FREQUENCY OF SUMMED PRIMARY AND SECONDARY QUESTIONING PATTERNS 1-5 BY INSTITUTION

	Pattern Number				
	1	2	3	4	5
Large Public	17	6	11	17	8
Small Public	12	9	4	1	4
Large Private	14	20	13	3	7
Small Private	4	1	0	6	3

^{2} = 43.6329 df = 12 p .001

Table 8 shows that with summed primary and secondary questioning patterns 1-5, questioning patterns are not independent of institutions (p≤ .001). The large private institution has a high frequency of patterns 2 and 3 and a moderate frequency of pattern 1. The large public institution has a high frequency of patterns 3 and 4. The small public institution has a high frequency of pattern 1, and the small private has a high frequency of pattern 4. (For patterns descriptions, see page 26.)

Differences in Professors' Questioning Patterns Across Course Levels

TABLE 9

FREQUENCY OF SUMMED PRIMARY AND SECONDARY QUESTIONING PATTERNS 1-5 BY COURSE LEVEL

	Pattern Number				
	1	2	3	4	5
Beginning	9	17	15	7	7
Advanced	22	6	8	9	13

^{2} = 14.8234 df = 4 p≤ .01

Results

Primary and secondary questioning patterns 1-5 were summed for beginning and advanced courses. Table 9 suggests that the summed patterns 1-5 are not independent of course level ($p \leq .01$). Beginning courses have more patterns 2 and 3; advanced courses have more patterns 1 and 5.

Differences in Professors' Questioning Patterns Across Disciplines

TABLE 10

FREQUENCY OF SUMMED PRIMARY AND SECONDARY QUESTIONING PATTERNS 1-5 BY DISCIPLINE

	Pattern Number				
	1	2	3	4	5
Humanities	17	13	14	7	15
Math/Science	14	10	9	9	5

$\chi^2 = 3.93515$ df = 4 $p \leq .4$

Results

Primary and secondary questioning patterns 1-5 were summed for the two discipline groups. From Table 10 it is clear that even when comparing the five most frequent patterns, questioning patterns are independent of discipline.

Discussion of Questioning Patterns

The analysis of the questioning patterns present in college instruction shows that the five most frequently used patterns accounted for 61.54% of all questioning patterns. The first two of these patterns accounted for nearly 32% of all questioning patterns, and neither of them elicit any student response. The analysis of the first five questioning patterns indicated no differences across the two discipline groups. Differences were found across institutions and course levels, however.

In the large private schools, professors had a higher frequency of pattern #2 (lecture--low level question--silence--lecture). In the large public school, professors used a high frequency of patterns #1 (lecture--low level question--lecture) and #5 (lecture--low level question--unrestricted student response--lecture).

The small public school professors had high frequencies of the first two patterns (the patterns which elicit no student responses). One might think that in a smaller school, because of its supposed intimacy, professors would conduct more student-oriented classes, calling on particular students to answer, praising their responses or using their ideas. This was not found, however.

In the small private school, questions were more often addressed to the total class. In this school the most frequent pattern was #4 (lecture--low level question--unrestricted student response--lecture). Seldom was a specific student called on to respond in these classes.

Differences in questioning patterns were also found between beginning and advanced courses. In beginning courses, professors wait more often after a question (pattern #2: lecture--low level question--silence--lecture), perhaps having more patience with the beginning student. They also tend to call on specific students (pattern #3: lecture--low level question--restricted student response--use of student's idea--lecture) and accept or use the students' ideas more often.

Professors in advanced courses, on the other hand, tend to use pattern #1 (lecture--low level question--lecture) and pattern #5 (lecture--low level question--restricted student response--lecture) more frequently. The higher frequency of these patterns may suggest that the material is more difficult and thus each question needs elaboration before the student can answer it. The restricted student responses may suggest that by the advanced courses,

professors know the students' names and call on specific people, rather than addressing the question to the class as a whole.

The general finding that professors seem to rely on fairly restrictive questioning patterns -- those eliciting no student response or those which are a simple lecture--question--answer--lecture sequence--might imply that professors are not aware of the potential of their own questioning patterns. During conferences with several of the professors in the study, most indicated they had never given any particular thought to this aspect of the questioning process and consequently relied on a few patterns which seemed comfortable to them.

Although the potential impact of questioning pattern has not yet been determined, it seems possible that what precedes and follows a professor's question may well determine how that question affects students. That is, the pattern "lecture--low level question--student response--lecture" may give the impression that the professor is checking up on the students' preparation for the class; whereas if the professor followed the response by an elaboration of the student's idea, it might suggest that he was attempting to involve students in the actual content of class session--two totally different strategies. The sequence of questions over a class period may also be an important area for investigation.

Relationship Between the Cognitive Level of Professors' Questions and the General Cognitive Level of Professor Verbal Behavior and Student Verbal Behavior

Since the literature on questioning in elementary and secondary education seemed to point to a relationship between student thinking skills and/or achievement and the cognitive level of the teacher's questions, I attempted

to relate the cognitive level of professors' questions as measured by the Amidon MCS to both student and professor cognitive levels as measured by the FTCB.

A Pearson Correlation Coefficient* was calculated between each cognitive questioning level of each professor (4A,B,C,D) on the MCS and each professor's specific cognitive levels (1.0 to 7.0) as identified by the FTCB. No significant correlations were found between questioning levels 4A or 4C and any cognitive level of professors.

Two possible relationships were found at each of the 4B (Convergent thinking) and 4D (Evaluative thinking) levels. 4B showed a positive correlation with professor cognitive level 3.0 (Interpretation) ($r = .3354$, $p = .003$); it also showed a positive relationship with level 4.0 (Application) ($r = .9009$, $p = .018$). Questioning level 4D (Evaluative thinking) was positively related to cognitive level 2.0 (Translation) ($r = .4475$, $p = .027$); it was also positively related to cognitive level 3.0 (Interpretation).

It must be noted, however, that since a 4 x 20 table was computed, by chance one would expect to obtain four correlations significant at the .05 level--the exact number obtained. Thus one must regard these significant correlations with caution.

The same calculations were performed between professor's cognitive questioning level and student cognitive level. No significant relationships were found.

*Note: Labovitz (1970) indicates that even if assumptions concerning equal interval data are violated, as they are in this study, the Pearson r may still be used. It is a more powerful statistic than the Spearman Rank Order or the Kendal and the results are nearly identical. This was tested and found to be true in this study.

Correlation Between Level of Professor's Questions and Modal and Median Professor Cognitive Level

TABLE 11

PEARSON CORRELATION COEFFICIENT BETWEEN COGNITIVE LEVEL OF PROFESSOR'S QUESTIONS (BASED ON MCS) AND MODAL PROFESSOR COGNITIVE LEVEL (BASED ON FTCB)

	Questioning Level			
	Cognitive Memory (4A)	Convergent Thinking (4B)	Divergent Thinking (4C)	Evaluative Thinking (4D)
r	.0541	.0785	.0083	.0224
N	147	102	33	28
p	.258	.216	.482	.455

TABLE 12

PEARSON CORRELATION COEFFICIENT BETWEEN COGNITIVE LEVEL OF PROFESSOR'S QUESTIONS AND MEDIAN PROFESSOR COGNITIVE LEVEL

		Questioning Level			
		Cognitive Memory (4A)	Convergent Thinking (4B)	Divergent Thinking (4C)	Evaluative Thinking (4D)
Professor Median	r	-0.1436	0.1876	0.1072	-0.0989
	N	147	102	33	28
	p	$\leq .041$	$\leq .029$	$\leq .276$	$\leq .308$

Results

Correlations were computed between the modal cognitive level for each professor and the questioning level of that professor. No significant relationships were found (Table 11). When comparing the median professor cognitive level with the level of professors' questions, some relationships were found however. In Table 12 it is seen that as the median professor cognitive level goes up, the frequency of questions in level 4A (Cognitive memory) goes down; and as the median professor cognitive level goes up, the frequency in professor questioning level 4B (Convergent thinking) goes up. Thus it seems that professors' questioning is related in some respects to their overall cognitive level.

Correlation Between Level of Professors' Questions and Modal and Median Student Cognitive Level

TABLE 13

PEARSON CORRELATION COEFFICIENT BETWEEN COGNITIVE LEVEL OF PROFESSORS' QUESTIONS AND MODAL STUDENT COGNITIVE LEVEL

	Questioning Level			
	Cognitive Memory (4A)	Convergent Thinking (4B)	Divergent Thinking (4C)	Evaluative Thinking (4D)
r	-.2362	.19	.3394	.1952
N	147	102	33	28
p	.002	.028	.027	.16

Results

When comparing the modal student cognitive level and the professor questioning levels, several possible relationships were revealed (Table 13). It is seen that as the percent of professor questioning in level 4A (Cognitive memory) increases, the cognitive level of the student tends to decrease ($r = -.2362$, $p = .002$). As the percent of professor questioning at the 4B level (Convergent thinking) increases, the student cognitive level tends to increase ($r = .19$, $p = .028$). As the percent of professor questioning at the 4C (Divergent thinking) level increases, the student cognitive level tends to increase ($r = .339$, $p = .027$). Thus when viewing the modal student cognitive level, it appears to be positively correlated with the level of the professor's questions.

TABLE 14

PEARSON CORRELATION COEFFICIENT BETWEEN COGNITIVE LEVEL OF PROFESSOR'S QUESTIONS AND MEDIAN STUDENT COGNITIVE LEVEL

		Questioning Level			
		Cognitive Memory (4A)	Convergent Thinking (4B)	Divergent Thinking (4C)	Evaluative Thinking (4D)
Median Student	r	-0.1894	0.1133	0.2415	-0.1417
	N	147	102	33	28
	p	.011	.128	.088	.236

When comparing the median student cognitive level with the cognitive level of professor's questions, a significant relationship is seen only in the 4A (Cognitive memory) category. As the frequency of professors' low level (4A) questions goes down, student cognitive levels go up.

Discussion of Relationship of Cognitive Level of Professors' Questions to the Overall Cognitive Level of Professors and Students

When examining the association of the level of a professor's questions to both his and the students' overall cognitive levels, a positive correlation was found between the cognitive level of the professor's questions and both his and the students' overall cognitive levels. An inverse relationship was found between the professor's frequency of low level questions and both his and the students' overall cognitive levels.

These relationships were more clear at some cognitive levels than at others, however, and were not found to exist across all variables. For example, when comparing each single professor and student cognitive level with each single professor questioning level, relationships were found only between 1) a professor's convergent questions and the cognitive levels of interpretation and application and 2) his evaluative questions and the cognitive level of translation. However, even these may be suspect because of the number of comparisons made. Using this single comparison model, no relationships were found between any one cognitive level of students and any one level of the professor's questions.

On the other hand, when computing both modal and median scores of the overall professor and student cognitive levels and comparing these to the cognitive levels of the professor's questions, there were several significant relationships. These measures of central tendency yielded an overall picture of the cognitive level of each class depicting more accurately the differences between classes. Thus they revealed relationships not found when comparing each single cognitive level and each questioning level. Consequently one might conclude that there appears to be some relationships between the cognitive level of professors' questions and the overall cognitive level of the class, but the exact nature of this relationship is not totally clear.

In this study the specific relationships which were found between the professor's overall cognitive level and the levels of his questions were: 1) as the percent of a professor's low level questions goes down, his median cognitive level goes up, 2) as the percent of the professor's convergent thinking questions goes up, his median cognitive level goes up. No relationship was found between professor modal cognitive level and professor questioning level.

The specific relationships between the overall student cognitive level and the professor's questioning levels were generally consistent with the findings concerning overall professor cognitive levels. It was found that 1) as the percent of professors' low level (cognitive memory) questions increase, the students' median and modal cognitive levels decrease, 2) as the percent of professors' convergent thinking questions increase, modal student levels increase, and 3) as the percent of professors' divergent questions increase, modal student cognitive levels increase.

Summary of Results.

While a variety of descriptive information was obtained from this study, the following seem to be the most important findings:

1. A very small portion of most college classes is spent in professor questioning (X = 3.65%). This percent of time spent questioning does not vary significantly across institution type, size, course level, or discipline.

2. Of the questions asked by college professors, the great majority are at the lowest cognitive level (X = 82.33%).

3. There appears to be no significant difference in the cognitive level of professors' questions between public and private institutions.

4. When comparing questioning levels of professors according to the size of the institution, only level 4B (Convergent thinking) appears to differ: large school professors ask significantly more convergent thinking questions than do small school professors.

5. In an overall chi square analysis of questioning levels, questioning level is not independent of the individual institutions in the sample.

6. Questioning level is not only not significantly different between beginning and advanced courses, but is surprisingly similar across the course levels.

7. Questioning level varies between disciplines only at the Cognitive memory (4A) level, with science/math/engineering professors asking significantly more low level questions than humanities/social sciences/arts professors.

8. Primary questioning patterns do not vary significantly across institution size, type, course level, or discipline.

9. The most common questioning pattern is professor lecture followed by a low level (Cognitive memory) question followed by more lecture.

10. Five questioning patterns account for 61.54% of all primary and secondary questioning patterns of college professors.

11. 31.93% of all questioning patterns of college professors in this sample elicit no student participation.

12. Summed primary and secondary patterns 1-5 are not independent of institution or course level, but they are independent of discipline.

13. When comparing each professor and student cognitive level with each professor questioning level, few relationships are found.

14. When comparing the modal professor cognitive level with the professor's questioning level, no significant relationships were found; but comparing the

median cognitive level of the professors with questioning levels revealed that professors' median cognitive levels decrease as their low level questions increase, and their median cognitive levels increase as the frequency of their convergent thinking questions increase.

15. As the frequency of professors' questions in the 4A (Cognitive memory) level increases, the modal student cognitive level decreases. As the frequency in professor questioning level 4B (Convergent thinking increases, the modal student cognitive level increases.

16. As the frequency of professors' questions in level 4A (Cognitive memory) increases, the median student cognitive level decreases.

CONCLUSIONS

This study of the questioning behavior of college professors was designed to generate basic descriptive data on the questioning process in college instruction. No cause and effect relationships were sought nor were teaching processes evaluated; rather, the study provided precise descriptive data on professor questioning and a basis for further research.

As a result of the study, several questions arise. Probably most fundamental is why are the majority of the professors' questions at such low cognitive levels? Second, why are significant differences found among institutions? Is it simply a matter of institutional goals or are different types of students responsible? Do small public institutions ignore the goal of critical thinking or do they simply have less able students?

Another aspect of the data which merits attention is the great similarity of questioning between beginning and advanced courses. Seemingly one would

expect beginning courses to deal with more factual information than advanced ones, and for advanced courses to attempt, then, to synthesize and relate concepts, to draw hypotheses and conclusions; but this did not happen. Furthermore, there was no difference in questioning levels between beginning and advanced classes within each discipline group. Apparently professors' general questioning strategies do not change from beginning to advanced courses regardless of the subject being taught. Needed, though, are studies examining courses taught by the same professor at both beginning and advanced levels. Perhaps each individual professor does change questioning strategies, but that these differences are buried by computing group means.

Also of potential interest is the possibility of a curvilinear relationship between outcomes such as critical thinking, and higher level questions. It may well be that there is an optimum proportion of high and low level questions to reach this goal, and that either extreme is less than optimally productive.

In examining the data on the relationship of the cognitive levels of student and professor, two additional questions arise; foremost among these is why is there an apparent lack of relationship between the highest levels of professors' questions (divergent and evaluative) with any general cognitive levels? It may well be that due to the low frequency of professors' questions at these levels, significant relationships will be difficult to uncover and that controlled experiments will be necessary to investigate this relationship further. Second, because of its methodology, this study could not reveal which is the dependent variable: do higher student and professor general cognitive levels cause the professor's cognitive questioning levels to rise, or do higher level professor questions cause the overall cognitive levels to rise? This certainly needs to be determined.

In general, then, when viewing the questioning process in the college classroom, one sees that professor questioning occupies a very small portion of the total class time, the cognitive level of the professors' questions is usually very low, but appears to be related to overall cognitive level of both professor and students; and often professors' questioning patterns elicit no student response. Overall there are very few major differences in questioning across any of the variables examined. Additional studies of questioning patterns are warranted in which causal relationships between levels of questioning and student achievement may be established.

Definition of Terms

The following terms used throughout the study require definition:

1. Teaching behaviors: According to Ryans (1960) behavior can be defined as "the activity of a person as they (sic) go about doing whatever is required of teachers, particularly those activities concerned with guidance--direction of the learning of others (p. 15)." For this study, teaching behavior will include whatever the teacher did or said during a designated class session.

2. Question: Any verbalization which either semantically or contextually calls for an answer from another person.

3. Cognitive level: The level of intellectual functioning exhibited by teacher or student. Based on the work of Benjamin Bloom (1956), this is sequentially arranged from the lowest level (knowledge) to the highest (evaluation). The higher levels are presumed to involve more complex and abstract thought processes than the lower levels.

4. Questioning pattern: The sequence of teacher and student verbal behaviors which occur before, during and after a teacher question. For example, teacher

lecture (5), followed by teacher low level question (4a), followed by restricted student response (8), followed by teacher lecture (5) is depicted as a questioning pattern 5-4a-8-5.

5. Verbal interaction: Talk between two or more people.

6. Teacher talk: All teacher verbalizations.

7. Student talk: All student verbalizations.

8. Cognitive memory question: A question which attempts to elicit thought processes such as recognition, rote memory, and selective recall; e.g. "What is the largest city in New York State."

9. Convergent thinking question: A question which attempts to elicit thought processes which involve reasoning based upon given and/or remembered data; e.g. "What is there about the location of New York City which accounts for its importance?"

10. Divergent thinking question: A question which attempts to elicit thought processes from a definite but "data poor" framework or structure. The respondent generates his own ideas or associations in response to the question. There is no uniquely right or correct answer to such a question; e.g., "Suppose that starting tomorrow there were no institutions called 'school.' How will this change your life?"

11. Evaluative thinking question: A question which attempts to elicit thought processes of a judgmental rather than a factual nature; thought processes which deal with matters of value not fact. "Do you think school is useful?" What or why not?"

12. Routine question: A question which attempts to elicit reaction to the day-to-day direction and conduct of the class. Also included are those verbal manueverings which modify the course or direction of a discussion. e.g.,

"How many of you brought your work books to class today?"

Epilogue

Our sense of mythology suggests that in colleges one would expect to find inquiring young minds being challenged by the intellectual and perceptive questions of learned professors--extensive Socratic dialogues and active interchange of ideas. In this respect, the findings of this study were disappointing. Not only were many of the classes void of intellectual interchange between professor and students, but they also lacked excitement and vigor. One of the primary tools at the professor's disposal to infuse this atmosphere into his classroom is questioning, an age-old technique but one which has not yet been tapped for its full potential.

Since faculty development is currently in vogue in many institutions of higher education, it seems justified that such development include an analysis of questioning patterns in college classrooms. This study, although not exhaustive, does suggest topics for study in faculty development. It may be that questioning levels and patterns are <u>not</u> what is important, that instead we should look harder at cognitive levels. The main point however; is that today little of the actual teaching <u>process</u> is being examined at all. The results of this study clearly indicate that whatever we achieve with faculty development could not be any worse than what we are doing by habit. We may be in a situation where it is better to be ineffective and <u>trying</u> than to be ineffective and <u>not</u> trying.

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