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ABSTRACT

Teaching and learning activities that occurred in large university classes were studied with attention to the extent students are being involved and whether that involvement makes a difference in their attitudes and performance. At the University of Texas at Austin, 19 large (100 students and larger) classes, representing the college of liberal arts, natural sciences, engineering, and business, were studied. Each class was observed at least once a week for one semester. A trained observer recorded the verbal interactions using the Expanded Cognitive Interaction Analysis System. The observation data were analyzed to determine whether differences occurred in the teaching techniques used in different disciplines or by different instructors. Students also ranked instructors according to their effectiveness. Findings include the following: students rated instructors more highly who tested at higher cognitive levels (e.g., gave essay exams); instructors who relied heavily upon visuals were rated lower than those who used them only at strategic points; all of the instructors lectured an average of 80-95 percent of each class session; and there was more student talk per instructor question in the higher-rated classes. Appendices provide numerous statistical tables and graphs of the results. (SW)

WHAT REALLY HAPPENS IN LARGE UNIVERSITY CLASSES?

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by

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What Really Happens in Large University Classes?

Abstract

Economics are currently dictating the use of large classes taught by a single instructor rather than smaller multiple sections of the same course taught by several instructors. The increasing use of these large classes has brought up a number of pedagogical questions:

1. What teaching techniques are currently being used by instructors who teach large classes?
2. Which teaching techniques are percieved as most effective by the students who take these classes?
3. What teaching techniques are utilized by instructors who require their students to think and perform at higher cognitive levels?

In this study 19 large (100+ students) classes from the colleges of Liberal Arts, Natural Sciences, Engineering, and Business at the University of Texas at Austin were studied in-depth to determine what happens in these classrooms. Each class was observed at least once a week for one semester. During each observation a trained observer recorded the verbal interactions which occurred (using the Expanded Cognitive Interaction Analysis System). The data from these observations were then analyzed and compared to determine whether or not there were differences in the teaching techniques used in different disciplines or by different instructors. The students in these classes also responded to an attitude survey which allowed us to rank the instructors according to their effectiveness (from the students' point of view).

Several of the most interesting findings are:

1. Students rate instructors more highly who test at higher cognitive levels (e.g., give essay exams).
2. Instructors who rely heavily upon visuals are rated lower than those who use them only at strategic points.
3. All of the instructors lecture an average of 80-95% of each class session while students participate an average of only 5% of the time.
4. There are more purposful uses of silence in the classrooms of higher-rated instructors.
5. There is more student talk per instructor question in the higher-rated classes.
6. The most frequently asked questions in all classes were either rhetorical or process related (e.g., "Does everyone have a copy of the handout?").

Additional findings and suggestions for further research are contained in the paper which follows.

What Really Happens in Large University Classes?

Introduction

Over the years there has been a great deal of discussion concerning the type of teaching which occurs in the very large classes which are becoming so numerous at many institutions of higher education across the country. It has frequently been difficult to obtain substantive data to verify what has been stated in these discussions because university instructors have not been extremely willing to allow an outside observer access to their classrooms. This barrier is being lowered somewhat as more emphasis is being placed on the improvement of instruction in higher education, but gaining access to university classrooms to "watch" is still looked upon with suspicion by many.

Though researchers have indicated that a variety of teaching methods should be used in large classes and that the methods chosen should be appropriate to the size class being taught (Moore, 1977; McKeachie, 1980; Connor, 1977), very few studies have actually involved having a trained observer sit in on the classes. Usually, what goes on in university classrooms has been determined by interviewing the instructors or having them fill out questionnaires. The only study which was located in which in-class observations were made was conducted by Lea Ebro in 1977. In this study observers attended the classes of 17 faculty members at Ohio State University who were recipients of the Alumni Awards for Distinguished Teaching. The Observational System for Instructional Analysis (OSIA) was used to analyze and describe the instructional behavior patterns. It was found that the instructors in this study exhibited the following characteristics:

1. They get right down to business.
2. They teach at a fast pace.
3. They use a variety of instructional strategies.
4. They stay with their subjects.
5. They use humor.
6. They have command of their classes.
7. They interact with the students.
   a. Give immediate response to student question or answer.
   b. Provide corrective feedback.
   c. Use probing questions.
   d. Praise correct answers with an observation based on the answer (i.e., an explanation of why the answer was correct).
8. Provide a "warm classroom climate."
   a. Students free to interrupt at any time.
   b. Spontaneous introduction of humor.
9. Nonverbal behavior.
   a. Use gestures frequently.
   b. Walk around as they talk.
   c. Extensive use of eye-contact.

Though this study provides a great deal of information about the teaching/learning activities which occur in the classes of distinguished

instructors, the size of the classes observed is unknown: it is mentioned that several of the classes were seminars but no definite numbers are given.

Most of the studies which have been conducted to compare the effectiveness of the teaching/learning in large and small classes have been summarized by McKeachie (1980) in his review of research on class size. At the end of this review McKeachie concludes that

> ...large lectures are not generally inferior to smaller lecture classes when traditional achievement tests are used as a criterion. When other objectives are measured, large lectures are on shakier ground. Goals of higher-level thinking, application, motivation, and attitudinal change are most likely to be achieved in small classes. Moreover, both students and faculty members feel that teaching is more effective in small classes (p.26). ...analysis of research suggests that the importance of size depends upon educaional goals. In general, large classes are simply not as effective as small classes for retention of knowledge, critical thinking, and attitude change (p.27).

On the other hand, Connor (1977) reviewed the research evidence on the effectiveness of various methods of teaching used at the university level and concluded that the size of the class need not be a major factor in the effectiveness of teaching. He stated that the teaching/learning process can be individualized and learning can be done independently if the correct procedures are used. There is, however, no single instructional method which is the most effective for all situations and all subjects. His review also cites several studies which report that students' attitudes toward large classes are not necessarily influenced by the size of the class but by the course content and the ability of the instructor to handle large groups.

Student attitudes toward large classes were also studied by Moore (1977). She found that student negative attitudes toward a large class could be changed if the instructor varies the method of presentation from class period to class period and establishes a set of instructional and student objectives. In the Large Class Analysis Project (LCAP) (Lewis, 1982) it was found that the students gave higher ratings for learning/enjoyment to classes in which the instructors tested at higher cognitive levels. The implication is that students who are challenged to use higher-level cognitive processes enjoy their courses more and, consequently, are more motivated to learn.

Handling large groups and encouraging higher-level thinking process are the focus of a number of more recent studies (Moss & McMillen, 1980; Weaver, 1983; Haber, 1979; Stanton, 1978; Cornwell, 1979, Hunsaker & Roy, 1977; and Bell & Lewis, in progress). Instructors have become interested in doing more than just disseminating information and having the students parrot it back on the exams. They want students to learn to think and communicate well. By dividing their large classes into small study/working units (usually 5-8 students each) they are finding that they are able to promote the development of problem-solving and communication skills which just were not possible in a total-lecture or typical lecture-discussion format. In addition, the students in these classes become more responsible for their own learning; they have to do the readings, problems, etc. before they come to class or they won't know what is going on.

Wales and Nardi (1981) present four variables which were defined by Benjamin Bloom (1980) as means by which instructors can improve their teaching, even in crowded classrooms. These four variables are Time, Intelligence, Testing, and Personality. It was hypothesized that the appropriate manipulation of these four variables would positively influence student success. The first variable, TIME, concerns increasing the time a student spends learning outside of class. Bloom (1980) states that this time can be dramatically increased by improving the quality of the instructional materials (e.g., text appropriate to the needs of the student, objectives to guide the students' study, and handouts whch model the skills the instructor expects the students to master). The second variable, INTELLIGENCE, deals with the cognitive entry characteristics which serve as the foundation for learning new concepts. This means that the instructor would focus on helping students develop the cognitive skills they will need to successfully master the content of the course (e.g., problem solving skills for students in Engineering). The third variable, TESTING, can be used to provide corrective feedback to the students instead of using it only to assign grades. If students have this kind of frequent feedback, Bloom claims that up to 90 percent of them can be successful in a course. The fourth variable, PERSONALITY, can be changed if the instructor changes the teaching-learning process. This can be done by increasing the cues to important material, providing variety, frequency and quality in the reinforcement given to each student, and encouraging student participation. Data collected from an engineering program at West Virginia University indicates that manipulating these variables as indicated above produces very high student performance. In their conclusions, Wales & Nardi suggest that "class size may be a constraint to accomplishing these ends but it should not be a deterrent" (p.340).

In the end, the effectiveness of an instructor or any particular teaching method appears to depend upon the objectives he/she has for the course. It is important to note, however, that students who are "involved" -- by whatever method -- are learning more than those who are passively attending a class. The major purpose of the study being reported in this document is to determine to what extent students are being involved in typical large university classes and whether that involvement makes a difference in their attitudes and performance in those classes.

Methods

Objectives

This study was conducted primarily to accumulate and compile direct observational data concerning the methods and procedures used by instructors as they teach large classes at the university level. These data, which were gathered as one part of a larger study[1], provide cues as to the types of

[1]The larger study was The Large Class Analysis Project which was conducted by the Center for Teaching Effectiveness at the University of Texas at Austin.

interaction patterns which encourage student participation. Because the learning research definitely indicates that students learn more if they are actively involved in the learning process, ways need to be found to involve students as much as possible in these large classes. By using an objective observation system to verify what actually happens in these large classes we will then be in a better position to prescribe changes which will enhance student participation and, thus, their learning.

Instrument Development

The primary instrument which was used to gather data during this study was an expansion of the Cognitive Interaction Analysis System (CIAS) which was originally developed by Dr. Glenn Ross Johnson (1978) at Texas A&M University. Johnson's original instrument consists of 10 categories into which the verbal interactions which occur in a classroom may be coded (see Table 1). However, a more detailed description of the interactions was needed by the staff of the Center for Teaching Effectiveness to provide both a more complete picture of what was taking place in the classrooms of clients (for consultation purposes) and to assist in determining the quality as well as the quantity of the verbal activities which took place in the classes being observed for this study. The final system which was developed consists of the basic ten categories with the addition of 35 subcategories (see Table 2).

To calculate the inter-observer reliability of the adapted CIAS, two observers were trained in its use using a programmed workbook and an audio-tape (which were developed for this purpose). After approximately 10 hours of training/practice the two observers were obtaining reliability agreements of .80 or over. During the summer and fall of 1979 this observation system was tested to determine its usefulness in the observation and analysis of large classes. The Coordinator of this study, Dr. Karron Lewis, and one trained observer coded the verbal interactions in the following classes: 2 Chemistry classes, 1 General Studies class, 1 Radio-TV-Film class, 1 History class, 1 Art History class, and 1 Music Appreciation class. It was determined from these observations and subsequent consultations with the instructors that the Expanded CIAS was definitely a useful tool for the in-depth analysis of classroom interactions in large university classes. For the Large Class Analysis Project two additional observers were trained in CIAS observation and analysis techniques. At the end of the one-week training period, these observers were obtaining reliability agreements of .80 or over between themselves and with the two original observers.

To obtain information concerning the attitudes of the students in these large classes a Student Attitude Survey was also developed for the larger study (mentioned above). Item #9 on this instrument surveyed the students' attitudes toward the particular large class in which the survey was conducted. The findings from that item will be refered to several times throughout this report to provide additional information. (If you are interested in finding out more about the larger study, please feel free to contact Dr. Karron Lewis.)

Observation and Data Collection Sequence

To enlist the help of instructors who teach large classes at the University of Texas at Austin, letters were sent to 120 faculty members in the colleges of Liberal Arts, Natural Sciences, Business, and Engineering,

TABLE 1

Cognitive Interaction Analysis System (CIAS)*

TEACHER TALK	1.	Accepting student attitudes. Comments that communicate a non-threatening acceptance of student attitudes; student attitudes may be positive or negative; "You appear to be upset about this." "I'm glad to see you all are happy about the results from last week's test."
	2.	Positive reinforcement. Praising students; communicating a definite value judgment indicating that the instructor really likes what the student said or did; "Excellent!" "Very good!"
	3.	Corrective/feedback. Includes negative statements which are nonpunitive and nonthreatening; saying "no" or "yes" or "that's correct" in a manner that provides feedback to students; repeating a student's response so all students know the answer was correct or acceptable.
	4.	Questions. Includes rhetorical questions; all questions raised by the teacher; calling on student by name to respond to a question.
	5.	Lecture. Communicating facts, expressing ideas, giving examples.
	6.	Providing cues/directions. Words that signal importance; "This is important to remember." "These next four items are very important in our study." Directions the instructor expects the students to follow; includes procedural directions.
	7.	Criticism. Negative, punitive comments; strong criticism; blaming students; saying "Ridiculous" or "That's silly" or "Don't interrupt me when I'm giving my lecture."
STUDENT TALK	8.	Cognitive student talk. Talk by students which is subject-matter oriented; recalling facts; responding to teacher questions or directions with subject-matter responses or subject-matter questions; expressing opinion or ideas about topics under study; analyzing, synthesizing, evaluating; subject-matter questions raised by students.
	9.	Non-cognitive student talk. Talk by students which is not related to subject matter; management comments by students; "Can we leave now?" or "Can we take a break?" or "Will we have the quiz tomorrow?" or "I went to the game Saturday and didn't have time to prepare my lesson."
SILENCE	0.	Silence. Three seconds or more of silence; pauses, when no communication exists.

*No rating scale is implied; the numerals merely indicate the particular category of interaction in use during each three seconds. (Johnson, 1978, p.3)

TABLE 2

Expanded CIAS Categories

1 - Accepting Student Attitudes
    1h - Humor

2 - Positive Reinforcement
    2f - Affective Instructor Comments

3 - Repeating a Student Response
    3f - Corrective Feedback
    3b - Building on Student Response

4 - Questions
    4c - Knowledge/Comprehension
    4e - Application (Examples)
    4a - Analysis
    4y - Synthesis
    4j - Evaluation/Judgment
    4f - Affective
    4s - Process or Structure
    4r - Rhetorical
    4p - Probing
    4d - Calling on a Student

5 - Lecture
    5v - Simultaneous Visual and Verbal Presentation
    5e - Examples, Analogies
    5r - Review
    5x - Answering a Student Question
    5m - Mumbling
    5t - Reading from Visual or Text

6 - Providing Cues
    6m - Focusing on Main Points
    6d - Directions
    6s - Assignments, Process

7 - Criticism

8 - Cognitive Student Talk
    8c-8s - Answers to Instructor Questions
    8n - Doesn't Know
    8q - Student Question
    8h - Student Laughter

9 - Non-cognitive Student Talk

0 - Silence
    0b - Writing on Board without Talking
    0m - Mumbling (General low roar)
    0l - Listening/Watching

requesting permission to observe the interactions which typically take place in their classrooms. Out of those 120 faculty members who received letters, 19 volunteered to be observed (5 from Business, 5 from Natural Sciences, 7 from Liberal Arts, and 2 from Engineering). (This low response rate reinforces the statement that few instructors in higher education are willing to allow researchers into their classes to study what takes place.) Nine of these classes were observed during the Fall semester, 1980 and ten during the Spring semester, 1981. NOTE: Due to the amount of class time needed to administer the Student Attitude Survey, two of the instructors asked not to be included in that portion of the larger study. They did, however, allow an observer to record the interactions which took place in their classrooms and provided copies of all exams, homework, etc. for cognitive level analysis.

Each trained observer attended from 1-4 courses throughout each semester. During the first class a descriptive Classroom Observation Form was filled out (see Figure 1). This form allowed the observer to become familiar with the techniques and style of the instructor's teaching and to acquaint him/herself with the room and the students. During all subsequent classroom observations the observer used the Expanded CIAS to code what was taking place in the classroom. Each observer attended at least one class meeting per week, per course being observed. To ensure that each day of the week the class met was represented in the data, the observations were made such that the class was observed on Monday the first week, Wednesday the second week, and Friday the third week. Then the cycle began again. Classes which met on Tuesday and Thursday were observed Tuesday one week and Thursday the next week. Thus, each class was observed at least 13-14 times over the course of the semester.

CIAS Coding and Compiling Procedures

The Expanded CIAS category system allows an observer to code the verbal interactions which occur in a classroom. Each verbal statement which is made is placed into one of the 45 categories. A category is recorded every three seconds or when the interaction changes (whichever occurs first). Thus, in a typical 50-minute class an observer would record approximately 950 categories and in a 80-minute class approximately 1250 categories would be recorded.

Because it would be almost impossible to generate and analyze a 45 x 45 matrix, the subcategories were condensed to the original 10 categories for data analysis purposes. Four of the subcategories which appeared to influence classroom climate and student attitudes were then extracted and coded as categories 11 (1h - Humor), 12 (5v - Use of visuals with lecture), 13 (8q - Student questions), and 14 (Ob - Writing on board or overhead without talking).

To compile and analyze these data a computer program was developed with assistance from the Computation Center. After the data were entered, the program generated the percent of teacher talk (%TT) which took place, the percent of student talk (%ST), and a 14 x 14 matrix which showed the totals for each category as well as the percentage of the total tallies for each category (see Figure 2). The teacher-talk categories consist of Categories 1-7, 11, and 12 while the student-talk categories consist of Categories 8, 9, and 13. (The numbers in the individual cells of the matrix and the actual coding were only used in our one-to-one consultations with the participant instructors and not in the overall data analysis, with one exception -- the subcategories for Category #4-"Questions" were analyzed to determine the cognitive level at which students were asked to respond in class.)

CENTER FOR TEACHING EFFECTIVENESS
CLASSROOM OBSERVATION FORM

1. THE COURSE. Number:_____ Title:_____ Meeting time:_____

2. LEVEL. Freshman Sophomore Junior Senior Graduate

3. CLASS. Size:_____ Description of room:_____
_____ Where students congregate:_____

4. SUBJECT FOR THE HOUR._____

5. METHOD:

6. THE INSTRUCTOR.
   Speaking style:

   Use of Movement/Gestures:

   Use of Media:

   Enthusiasm:

   Handouts:

7. THE STUDENTS.
   Attentiveness (beginning vs. end):

   Questions:

   Evidence of Understanding:

   Notetaking:

8. GENERAL COMMENTS.

FIGURE 1 -- Classroom Observation Form.

INTERACTION ANALYSIS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1/	2	0	0	0	2	1	0	0	0	0	0	0	0	0
2/	0	3	13	4	20	0	0	0	0	0	0	5	0	2
3/	0	11	2	8	19	2	0	1	0	0	0	3	0	1
4/	0	1	0	40	6	2	0	53	0	30	0	1	3	1
5/	2	7	0	39	530	31	0	2	0	11	0	36	0	11
6/	0	0	0	8	29	136	0	1	0	6	1	7	0	2
7/	0	0	0	0	0	0	0	0	0	0	0	0	0	0
8/	0	21	30	2	5	0	0	6	0	3	0	0	0	2
9/	0	0	0	0	0	0	0	0	0	0	0	0	0	0
10/	0	1	1	19	13	7	0	6	0	16	0	0	0	3
11/	0	0	0	0	0	1	0	0	0	0	0	0	0	0
12/	1	1	0	11	34	7	0	0	0	0	0	86	0	9
13/	0	1	1	0	0	1	0	0	0	0	0	0	2	0
14/	0	1	0	6	10	2	0	0	0	0	0	12	0	24
SUM	5	47	47	137	668	190	0	69	0	66	1	149	5	55
%	.3	3.3	3.3	9.5	46.4	13.2	0	4.8	0	4.6	.1	10.4	.3	3.8

****
TOTAL ENTRIES: 1439
% TT: 86.449
% ST: 5.142
% PSSR: 10.811
% TSSR: 64.228
% ID : .191
****

FIGURE 2 - Computer-generated CIAS matrix.

Results

Overall mean percentages. The overall mean percentages for the 14 CIAS categories are shown in Table 3 and Figure 3. As would be expected in a large university class, the bulk of the class time was spent in Categories 5 (Lecture) and 12 (Lecture with visuals). The interactions which occurred least frequently are represented by Category 9 (Non-cognitive student talk) and Category 7 (Criticism). The total represented by Teacher Talk categories is 88.46% of the class time; the total represented by the Student Talk categories is 5.02% of the class time, and, the total represented by the Silence Categories is 6.36% of the class time. Thus, overall, the amount of student participation is quite limited.

By college. One of the goals of the study was to determine whether instructors in different disciplines used different types of verbal interactions. As you can see in Table 4 and Figure 4 there is really very little variation in the amount of time spent in each category by the participant instructors from each college. The most noticeable differences are:

Category 5 (Lecture) - The instructors in Liberal Arts and Business seem to lecture without the use of visuals almost 20% more of the time than do the instructors in Natural Science and Engineering. However, when you combine this category with Category 12 (Lecture with visuals) we find that, overall, all of the instructors lecture approximately 80%-90% of the total class time.

Category 8 (Cognitive student talk) - Though the variation isn't extreme, it is noteworthy that the students in Liberal Arts participate in class more frequently than do those in the other colleges. Even so, an average of 5% of the total class time is not a great deal of student participation.

Category 10 (Silence) - There appears to be about 5% more silence in Engineering classes than in the classes in the other colleges. This occurred because the students in Engineering took frequent in-class quizzes. The silence which occurred in the other classes was usually a result of instructor pauses during the lecture.

Category 12 (Lecturing with simultaneous use of visuals) - The amount of time spent in this category by the instructors in Natural Science and Engineering can be accounted for primarily in their writing on the board and talking at the same time.

Category 14 (Writing on the board without talking) - Because the instructors in Natural Science and Engineering tend to use the blackboard as a visual aid (or use the overhead as a board) rather than slides or prepared transparencies it stands to reason that they would also write on the board/transparency without talking more frequently. It should be noted, however, that "talking to the board" (which occurred quite frequently) is definitely undesirable in large

TABLE 3

Overall Means for CIAS Categories

Teacher Talk Category	Mean	Student Talk Category	Mean	Silence Category	Mean
1	.77	8	2.93	10	5.03
2	.99	9	.03	14	1.33
3	2.18	13	2.06	Total	6.36
4	3.12	Total	5.02		
5	52.59				
6	8.94				
7	.04				
11	.90				
12	18.93				
Total	88.46				

1 - Accepting student attitudes
2 - Positive reinforcement; affective instructor comments
3 - Repeating a student response; providing corrective feedback; building on a student response
4 - Questions asked by instructor
5 - Lecture
6 - Providing cues; focusing on main points; giving directions; assignments, process
7 - Criticism
8 - Cognitive student talk
9 - Non-cognitive student talk
10 - Silence; listening or watching
11 - Teacher use of humor
12 - Simultaneous visual and verbal presentation
13 - Student question
14 - Writing on board without talking

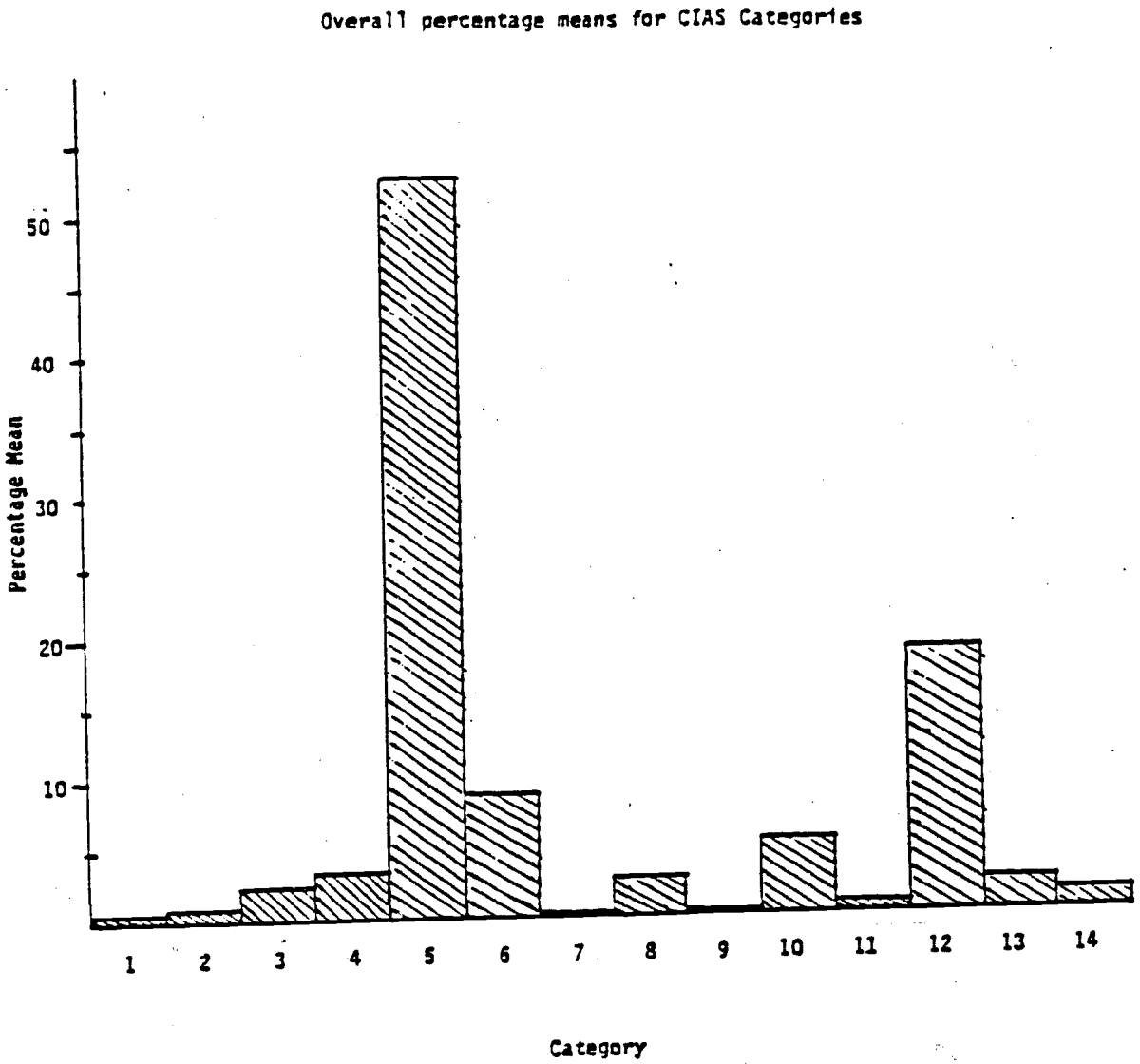

FIGURE 3 - Overall percentage means for CIAS categories.

TABLE 4

CIAS Means by College

Category	Nat. Sci.	Engineering	Business	Liberal Arts
1	.69	.096	1.14*	.83
2	.95	.68	.99	1.08*
3	1.22	4.09*	1.33	2.86
4	3.21	2.10	3.33*	3.25
5	42.20	36.10	60.20*	59.90
6	9.76	10.61*	8.12	8.38
7	.03	.19*	.04	.009
8	1.63	1.92	2.56	4.36*
9	.02	.01	.07*	.02
10	2.98	10.75*	5.04	4.86
11	.71	.50	1.29*	.92
12	33.31*	29.18	13.27	8.61
13	1.07	2.76*	2.39	2.29
14	12.83*	1.04	.04	1.61

*Highest mean percentage for each CIAS Category.
1 - Accepting student attitudes
2 - Positive reinforcement; affective instructor comments
3 - Repeating a student response; providing corrective feedback; building on a student response
4 - Questions asked by instructor
5 - Lecture
6 - Providing cues; focusing on main points; giving directions; assignments, process
7 - Criticism
8 - Cognitive student talk
9 - Non-cognitive student talk
10 - Silence; listening or watching
11 - (1h) - Humor
12 - (5v) - Visual and verbal presentation
13 - (8q) - Student question
14 - (10b) - Writing on board without talking

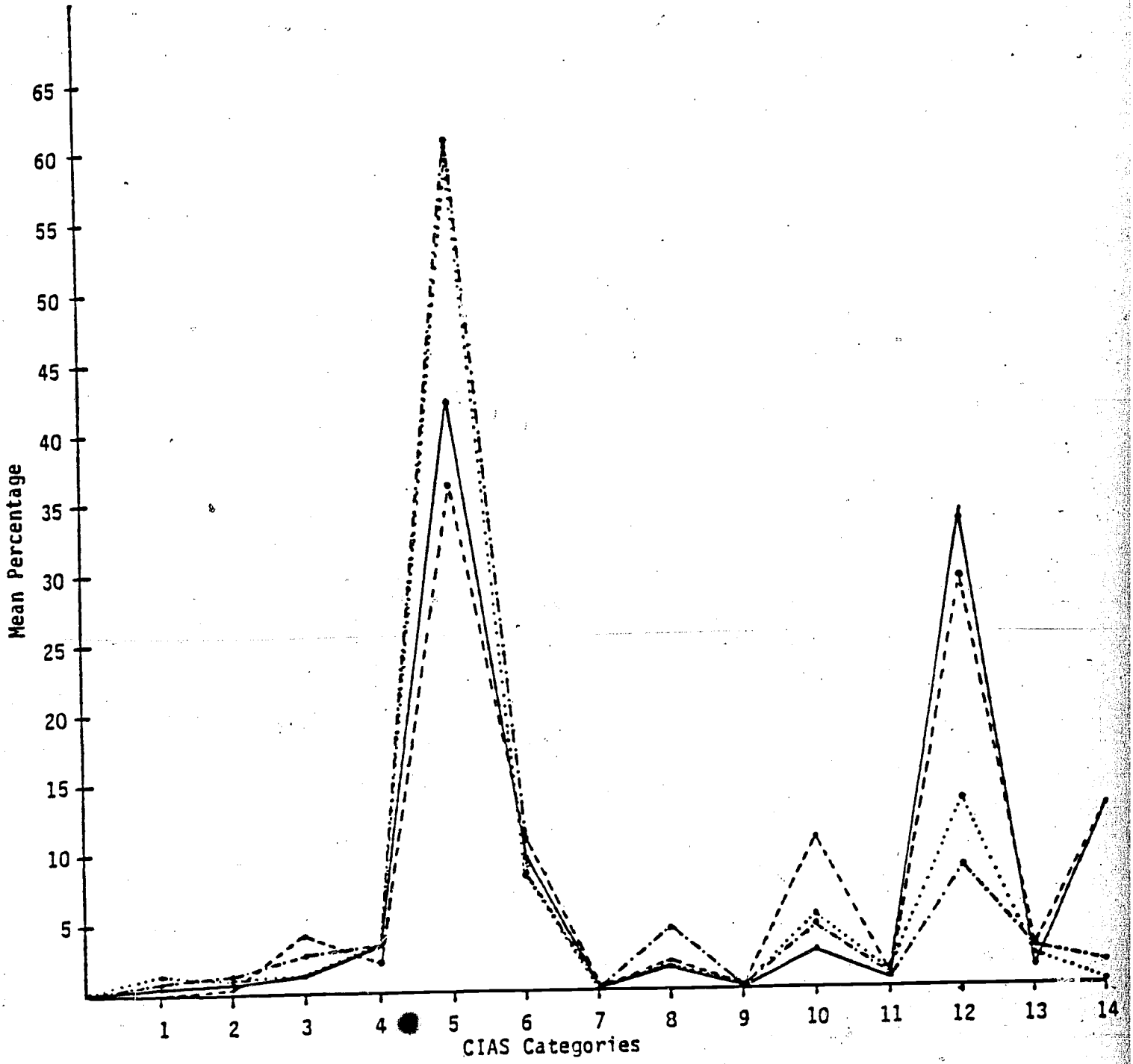

Figure 4 - CIAS Category means for each College.

Key

—— Natural Science - - - Engineering ···· Business -·-·- Liberal Arts

classes because the students in the back of the room cannot hear what is being said unless the instructor is wearing a mike.

It is interesting to note (though not unreasonable to expect) that as the average class size decreases, the amount of student participation increases:

Class Size	Avg.%ST	Min.T/T	Min.MWF	# Classes of that size by College				
				LA	E	B	NS	Total
90-140	6.08	4.86	3.04	4	1	3	2	10
141-250	5.12	4.10	2.56	2	1	1	1	5
251-350	2.53	2.02	1.27	1	0	1	2	4

By instructor - ratings. As noted before, the average amount of time spent in each category did not show a great deal of variation when looked at by college. However, we were also interested in seeing whether there were differences which distinguished the better instructors (as indicated by the Student Attitude Survey) from those who were not rated so highly by the students. Table 5 lists the instructors by student rankings (1=most effective instructor, 17=least effective instructor)[2] along with the mean percentages for each CIAS category. The highest mean percentage for each category are underlined and the lowest are marked with an asterisk (*). The following figures highlight some of the interesting findings from our analysis of these data.

The average percentages of teacher talk (Categories 1-7, 11 and 12) per instructor are shown first in Figure 5. Though it appears that there is not a great deal of difference among the instructors in the amount of time they spend

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[2] Item 9 on the Student Attitude Survey:

How did you enjoy attending this class?

Very much 1 2 3 4 5 Not at all

TABLE 5

Mean Percentages for CIAS Categories by Instructor Rank

Instr. Rank	Subj.	Rating	Class GPA	#Stu.	% TT	% ST	CIAS Category 1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Anthro.	1.355	2.74	130	86.3	8.5	0.1	2.4	0.5	2.6	70.1	5.6	0.0	5.1	0.0	4.7	1.6	3.5	3.4	0.5
2	Soc.	2.000	2.32	200	85.4	5.5	0.2	1.5	4.0	2.1	63.2	9.5	0.0	4.3	0.0	8.3	0.3	4.7	1.2	0.9
3	Govt.	2.006	2.90	220	79.9	10.4	0.1	0.9	3.3	4.3	53.6	8.9	0.0	5.4	0.1	8.3	1.3	2.1	4.4	1.3
4	EdPsy.	2.119	2.51	90	80.5	7.7	0.1	0.9	2.5	1.9	54.1	9.4	0.0	4.1	0.0	7.5	0.4	11.3	3.6	4.3
5	Astr.	2.169	2.40	200	95.4	4.1	0.8	1.4	2.4	4.4	52.9	11.5	0.0	2.8	0.0	0.2	0.9	21.8	1.2	0.3
6	H.E.	2.211	2.87	140	96.1	2.4	2.2	2.5	1.4	1.2	67.3	10.2	0.0	1.2	0.0	1.4	0.1	10.3	1.3	0.0
7	Hist.	2.228	2.17	300	98.0	1.3	4.2	0.4	0.4	1.5	80.2	9.5	0.0	0.5	0.0	0.6	1.7	0.1	0.9	0.0
8	P.Eng.	2.383	2.01	140	79.3	5.1	0.0	0.6	5.9	2.7	44.7	8.6	0.3	2.6	0.0	15.1	0.6	15.6	3.0	0.1
9	Calc.	2.574	2.18	130	85.1	3.7	0.1	0.9	0.7	3.5	20.2	10,7	0.0	2.1	0.0	6.2	0.8	48.2	1.3	5.3
10	Adv.	2.706	2.78	140	79.4	9.2	0.1	3.0	0.1	2.4	51.7	8.6	0.1	3.3	0.2	11.3	1.1	12.3	3.6	0.2
11	Mark.	2.711	2.95	350	82.2	5.7	0.1	1.1	0.3	2.3	60.1	7.6	0,1	1,1	0.2	12.1	2.5	8.1	4.5	0.0
12	E.Eng.	2.830	2.74	250	89.1	3.5	0.2	0.9	1.7	1.3	24.8	13.2	0.0	1.0	0.0	5.1	0.3	46.8	2.5	2.3
13	I.Bus.	2.836	2.47	110	94.8	4.4	2.2	0.8	2.2	1.9	63.7	9.6	0.0	3.2	0.0	0.7	1.2	13.2	1.2	0.0
14	Acct.	2.991	2.37	200	96.1	2.1	1.9	1.8	1.4	6.7	57.1	9.0	0.0	1.5	0.0	1.8	0.6	19.0	0.6	0.1
15	Insur.	3.266	2.39	120	94.7	5.0	1.0	0,3	2.4	2.9	67.0	5.4	0.0	2.5	0.0	0.3	0.9	14.9	2.6	0.0
16	Eco.	3.302	1.47	120	85.5	11.6	0.9	0.7	6.6	5.6	34.2	7.0	0.0	9.0	0.0	0.7	0.1	29.5	2.6	2.3
17	Eco.	4.056	1.83	130	92.7	3.2	0.1	1.1	2.6	5.5	62.9	8.1	0.0	2.8	0.0	2.0	0.2	12.2	0.4	2.1

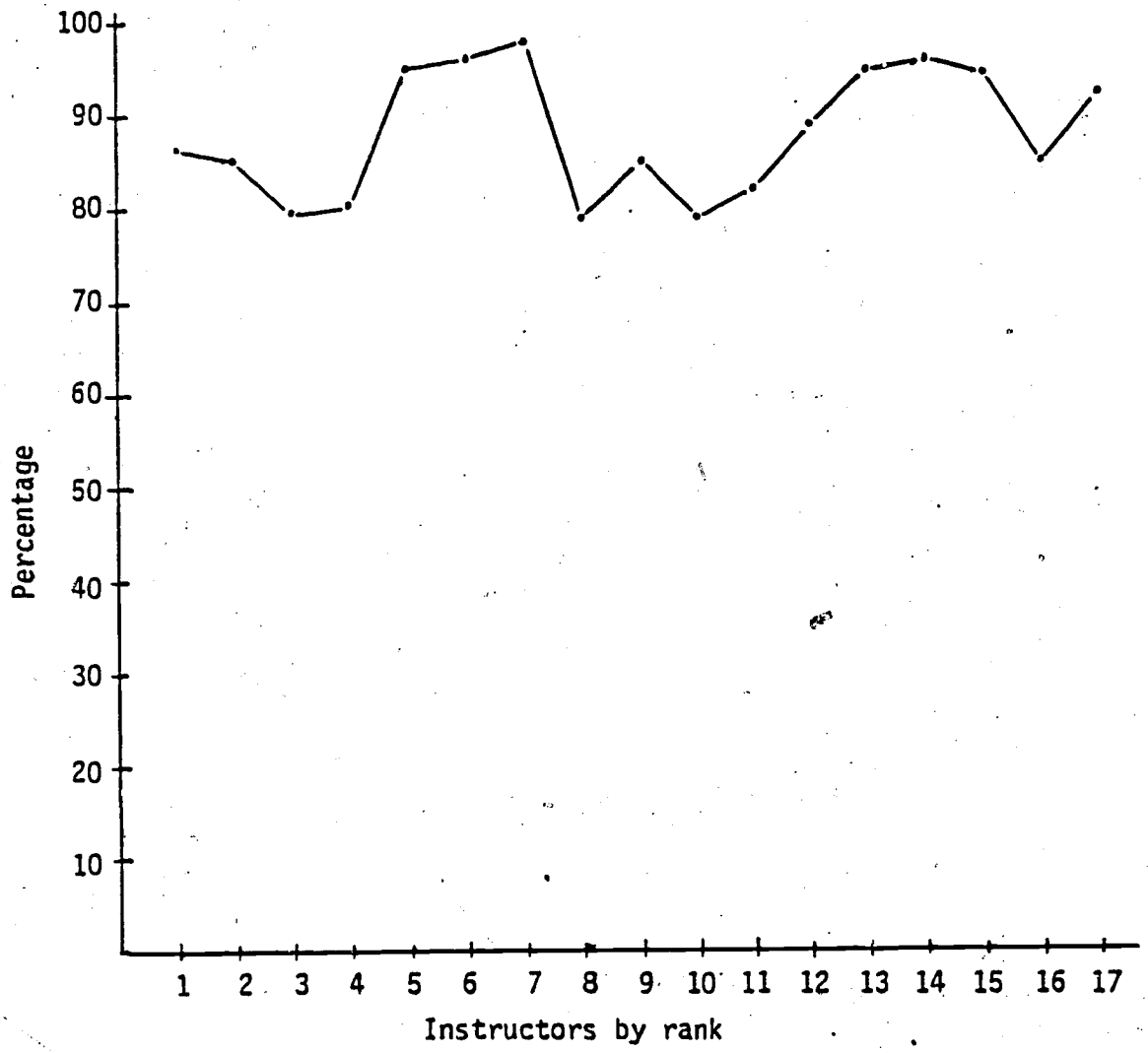


Figure 5 - Average percentage of teacher talk by instructor.

talking, the four highest-rated instructors spend less time talking than do most of the instructors who were ranked lower. The range of the average percentages for all of the instructors is from 79.3% for the 8th ranked instructor to 98.0% for the 7th ranked instructor. This 18.7% difference would amount to 9.4 minutes in a 50-minute class while in an 80-minute class it would be 15 minutes.

The average percentage of student talk (Categories 8, 9 and 13) per instructor are graphed next (Figure 6). Here we note that the four highest-rated instructors allow more student participaton than most of the lower-ranked instructors. Further examination of specific interactions are examined below.

First, when we compare the mean percentages in each category for the four highest- and four lowest-ranked instructors, we find a great deal of similarity (Figure 7 a,b). The major differences which can be observed are that:

(1) the four highest-ranked instructors have more periods of silence (Category 10) in their classes than do the four lowest-ranked instructors and, even more noticeable,

(2) the four lowest-ranked instructors lecture much more <u>with</u> visuals than do the four highest-ranked instructors.

By studying the actual coding data we discovered that the silences in the four highest-ranked instructors' classes occur primarily

1. after an instructor asked a question (to provide "think time" for the students),
2. after the instructor had stressed something which was important (to give the students time to write it in their notes), and
3. after an instructor had given directions or an assignment (to provide time for the students to do what has been asked).

The infrequent periods of silence which occur in the four lowest-ranked instructors' classes usually occurred...

1. during the lecture (as if the instructor were searching for words to continue),
2. after the instructor had placed an overhead transparency on the overhead (to allow students time to copy the information),
3. when handouts/homework/exams were being passed in or returned, and
4. when students were copying assignments which had been written on the board.

As you can see, the silences occurred under fairly different circumstances. There are constructive uses of silence and non-constructive uses of silence; the former appearing more frequently in the classes of higher-ranked instructors.

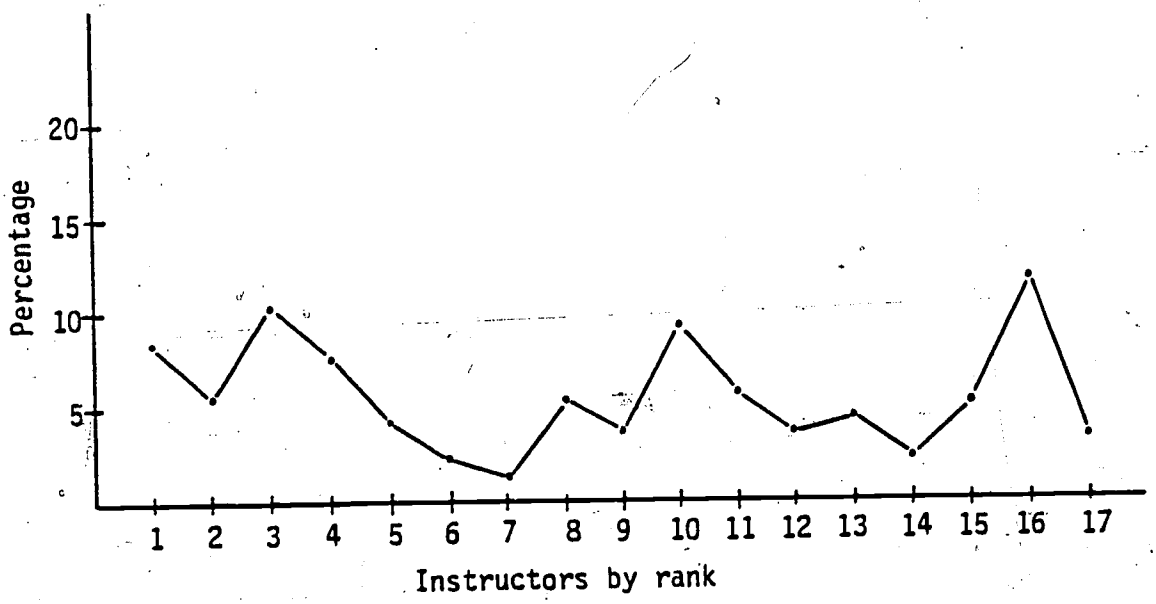
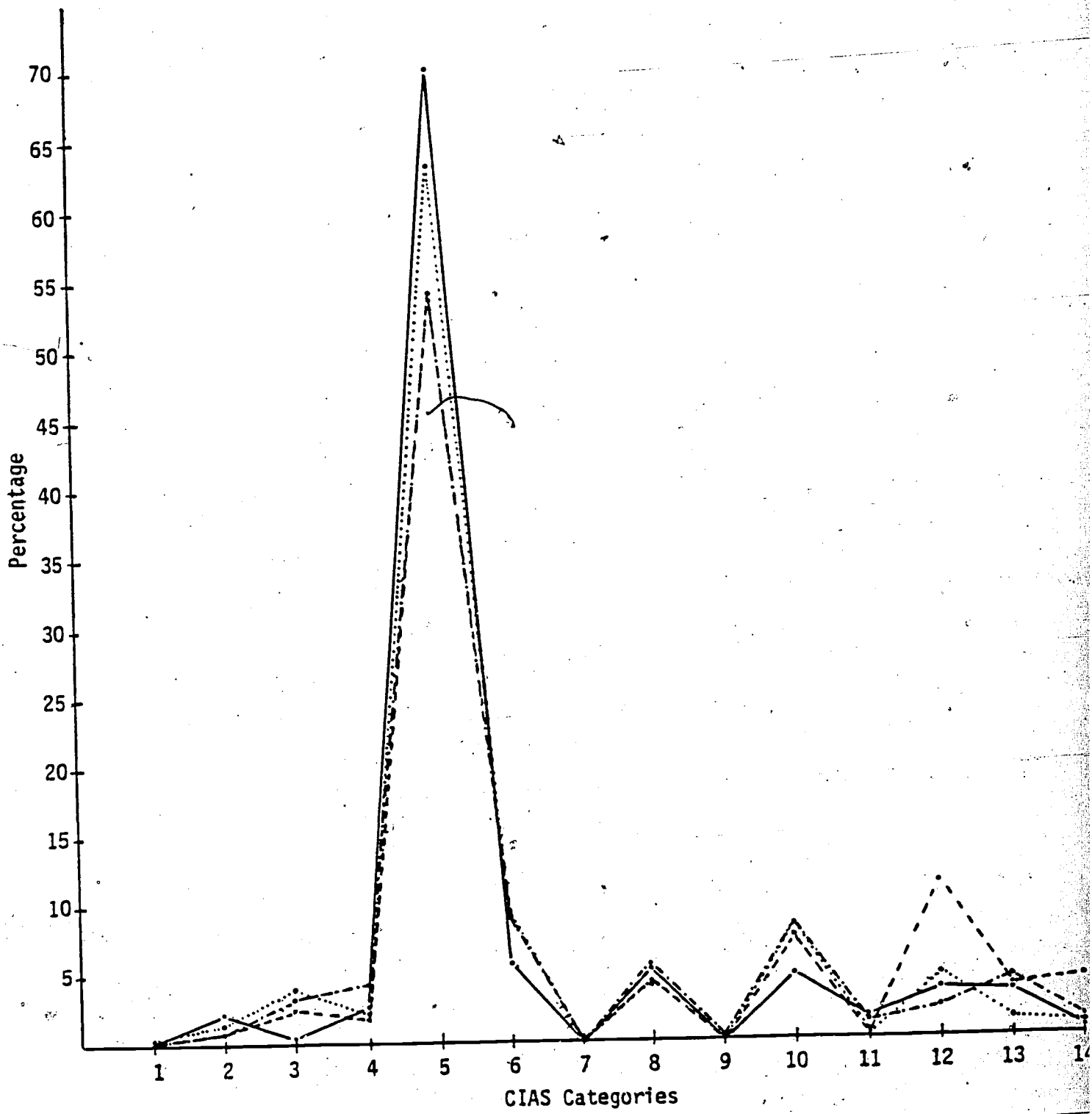


Figure 6 - Average percentage of student talk by instructor.



Instructor ranks: #1 - ——— ; #2 - ····· ; #3 -·—·— ; #4 - - - - -

Figure 7(a) - Mean percentages in each CIAS Category for the four highest-ranked instructors.

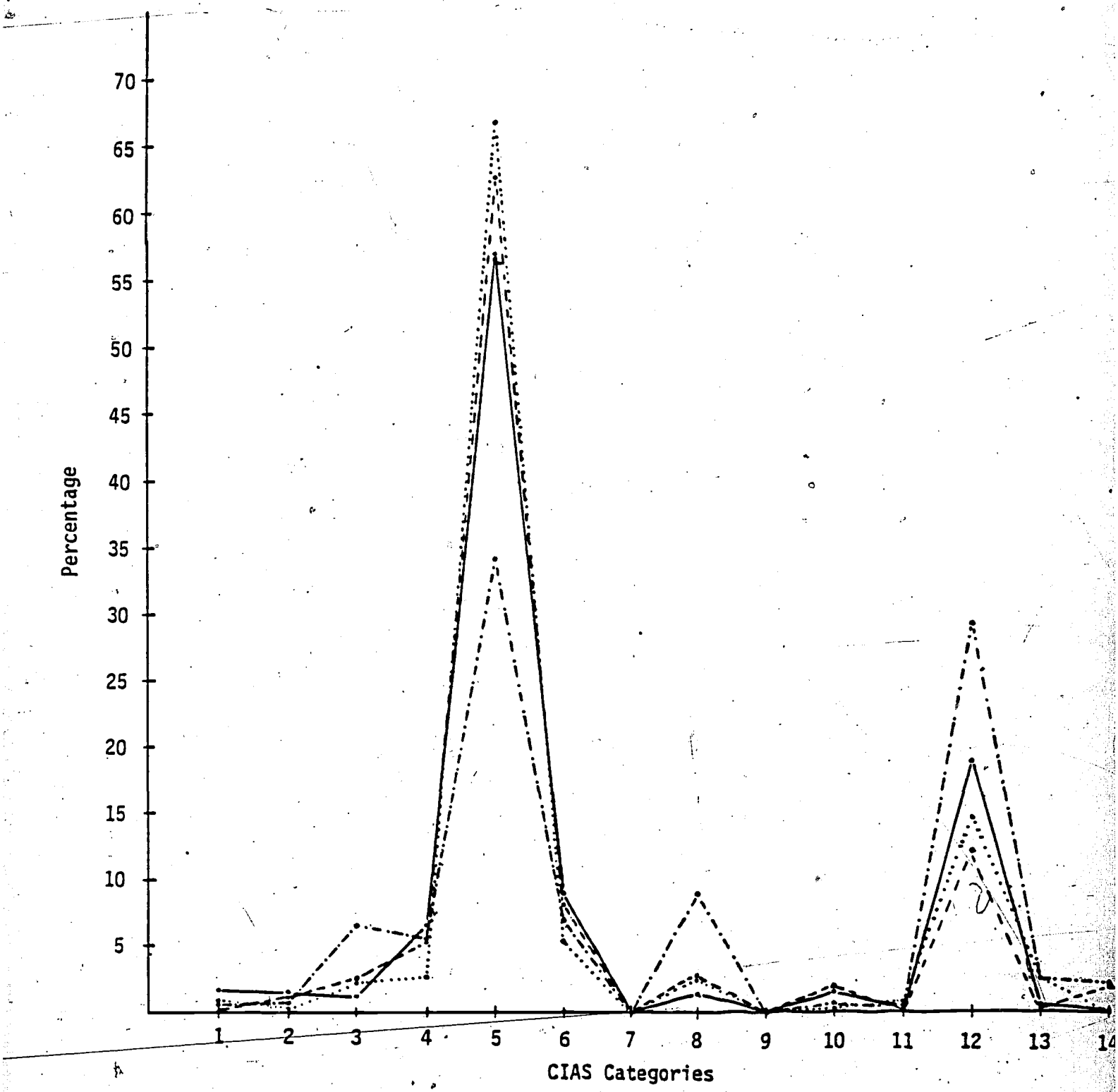


Figure 7(b) - Mean percentages in each CIAS Category for the four lowest-ranked instructors.

We were quite surprised to find that the lower-ranked instructors lecture with the aid of visuals more frequently than do the higher-ranked instructors. Because most of the learning literature shows that visuals enhance learning, one would expect the students to feel they were learning more in the classes in which visual aids are used frequently. Looking at the different ways in which the visual aids were used in the highest- and lowest-ranked classes may provide the answer to this incongruency. First, in the higher-ranked classes, the visuals were used primarily to...

1. illustrate a concept (e.g., a film, slides, sample problems) or

2. emphasize key terms/ideas (e.g., unfamiliar words written on board, a flow-chart to show how an idea progresses from one stage to another, etc.).

On the other hand, in many of the lower-ranked classes...

1. virtually all of the instructors' notes were on a series of prepared overhead transparencies which were placed on the overhead and discussed while the students were frantically trying to copy everything they saw. (Some of the instructors used slides in this same manner.)

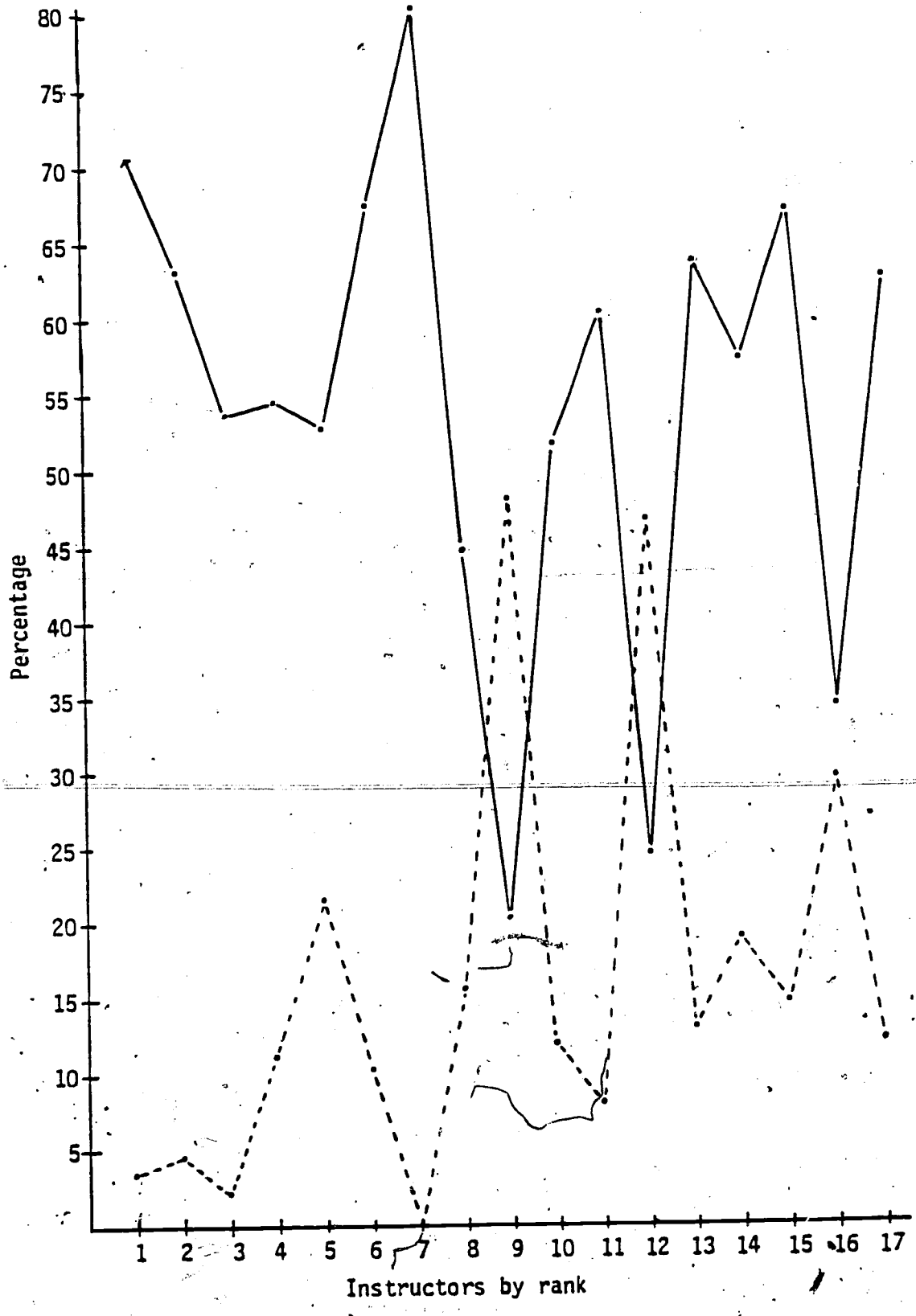
Thus, it is not the quantity of visual aids or time which is spent using visual aids but the quality which visual aids add to the lecture which determine whether the students react favorably or negatively to their use.

The instructors we observed showed a definite preference for either lecturing with the aid of visuals or without them. Figure 8 shows the mean percentages for Category 5 (Lecture) and Category 12 (Lecture with visuals). As you can see, only the 16th ranked instructor used approximately equal amounts of each method.

Another interesting phenomenon was observed when the mean percentages for Categories 4 (Questions) and 8 (Cognitive student talk) were compared (Figure 9). Though the four highest-ranked instructors spent relatively little time asking questions, the students spent quite a bit of time providing answers and/or comments. This indicates that the questions which were asked by these instructors were at higher cognitive levels and required that the students answer at length. On the other end of the spectrum, the students in all but one of the four lowest-ranked classes participated very little when compared to the the amount of time the instructors spent asking questions.

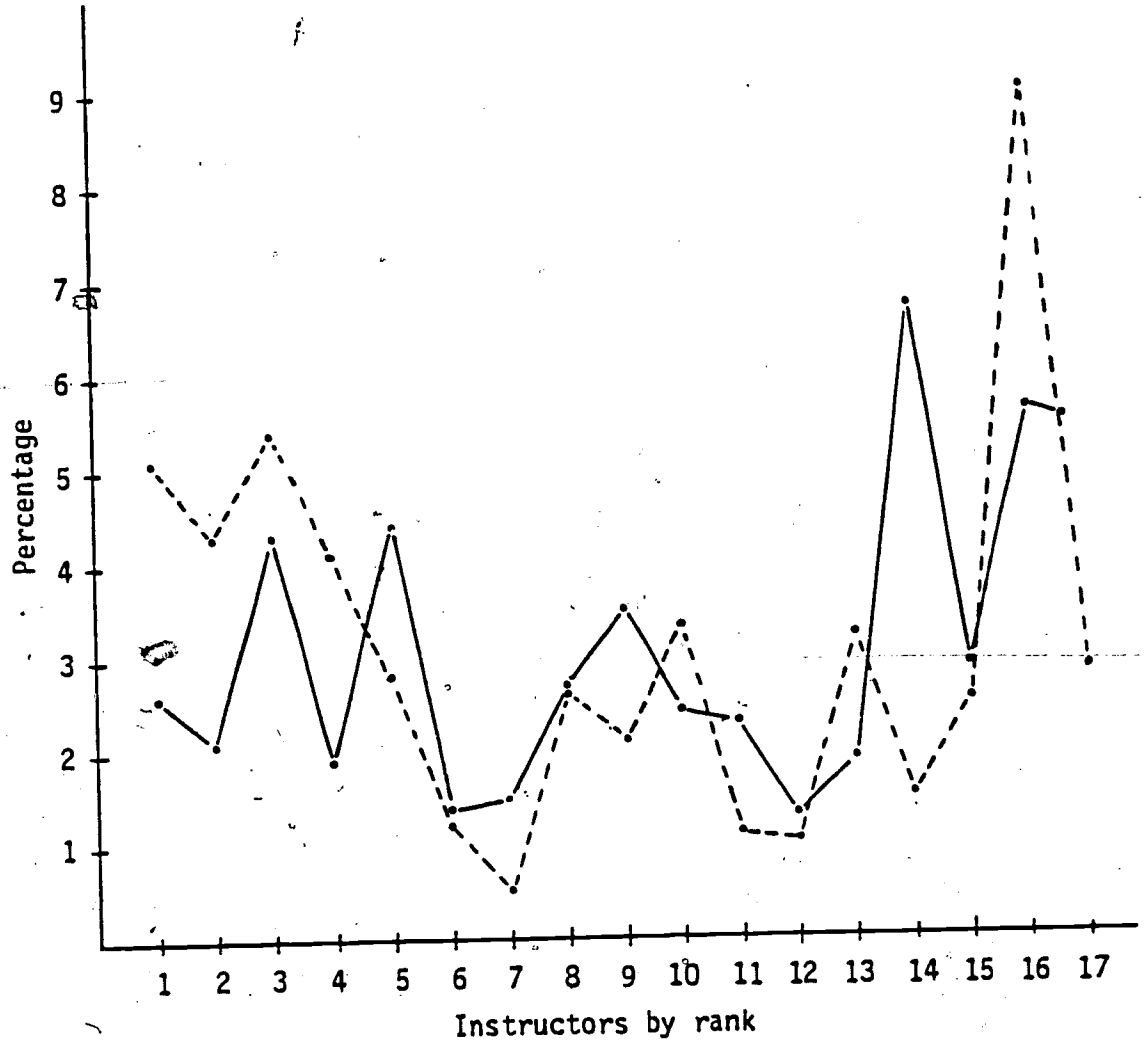
As each observer was coding the classroom interactions the cognitive levels of the questions asked by each instructor were recorded. It was found that the most frequently asked questions dealt with process/structure (e.g., "Do you need more time?", "Does everyone have a copy of the handout?") or were rhetorical. (See Figure 10.) Overall, as we had hypothesized, most of the questions dealing directly with the content only required the students to respond at the knowledge/comprehension level.

Frequently we hear that it is the instructors who tell a lot of jokes in their classes who are rated most highly by the students. Well, according to our data, that isn't necessarily so. Figure 11 shows that there is a fairly



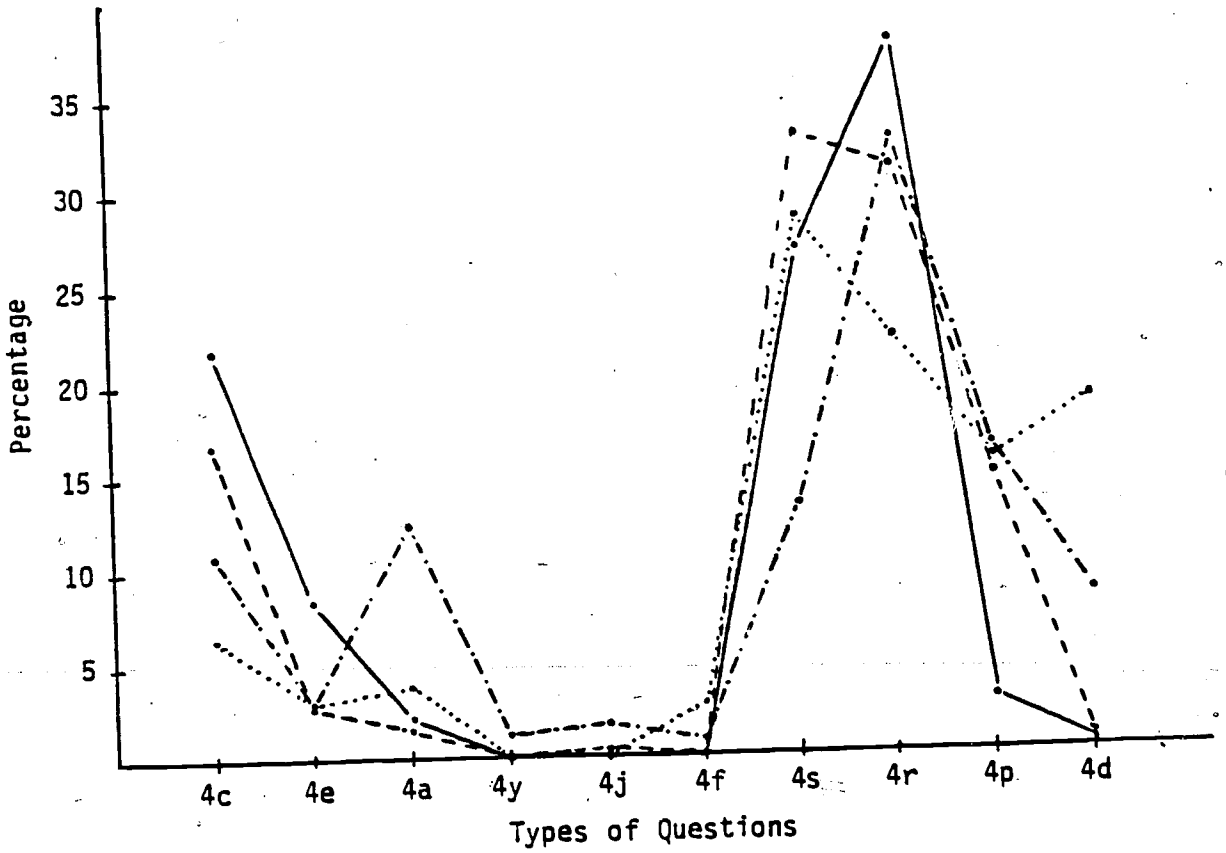
Category 5 (Lecture) ———
Category 12 (Simultaneous use of visual and verbal presentation) ------

Figure 8 - Mean percentages for categories 5 and 12 by instructor rank.



—— Category 4 (Instructor asked questions)
– – – Category 8 (Cognitive student talk)

Figure 9 - Mean percentages for categories 4 and 8 by instructor rank.



4c - Knowledge/Comprehension
4e - Application
4a - Analysis
4y - Synthesis
4j - Evaluation
4f - Affective
4s - Process
4r - Rhetorical
4p - Probing
4d - Calling on a student

——— Natural Science
– – – Engineering
····· Business
—·—·— Liberal Arts

Figure 10 - Mean percentage of types of questions asked during class by College.

wide amount of variation in the number of humorous statements made by the observed instructors with those using the most humor falling in the middle of the rankings.

One would suppose that there would be a discipline problem in these large classes. The data graphed in Figure 12, however, indicate that the observed instructors spent very little, if any, time criticizing/disciplining the students (Category 7). It is also interesting to note that there were negligible amounts of non-cognitive student talk (Category 9) in these classes and there seemed to be no correlation between the amount of non-cognitive student talk and the amount of time the instructors spent criticizing/disciplining.

Although one might assume that an instructor who provides frequent praise and reinforcement would tend to have more student participation, Figure 13 illustrates that that may not be the case. As you can see, instructors ranked #1, 6, 10, and 14 used more reinforcement than did the other instructors but only in the case of the #1 ranked instructor did the students participate more. Thus, again, the quality of the reinforcement may be more important than the quantity.

Finally, Figure 14 shows the mean percentages for Category 13 (Student Questions). This indicates that the higher-ranked instructors did more to encourage students to ask questions in class than did most of their lower-ranked counterparts. This willingness to answer questions in class is one of the distinguishing characteristics of effective teachers as cited in the literature (Eble, 1971; Sheffield, 1974; Smith, 1980).

By instructor - first half of semester vs. second half. Several trends were noted when a comparison of the mean percentages of use from the first and second half of the semester for each of the CIAS categories for each instructor were analyzed. Most of the instructors increased their use of:

Category 1 (Accepting student attitudes)
Category 2 (Positive reinforcement)
Category 9 (Non-cognitive student talk)
Category 13 (Student asked questions)
and Category 10 (Silence)

It appears that the use of the first three categories listed above depend on the instructor and students getting to know each other, and, thus, becoming comfortable with these more personal interactions. On the other hand, decreases were found in the instructors' use of:

Category 3 (Repeating a student response, providing corrective feedback)
Category 6 (Providing cues, giving directions)
Category 8 (Cognitive student responses)
and Category 11 (Use of humor).

Categories 3 and 6 were used more at the beginning of the semester to help guide the students; this probably didn't seem as vital in the second half of the semester. Category 11 was used more at the beginning of the semester to "break the ice." And, finally, Category 8 occurred less often in most classes as the semester progressed because instructors found themselves falling behind in "covering the content" so they allowed less time for student interactions.

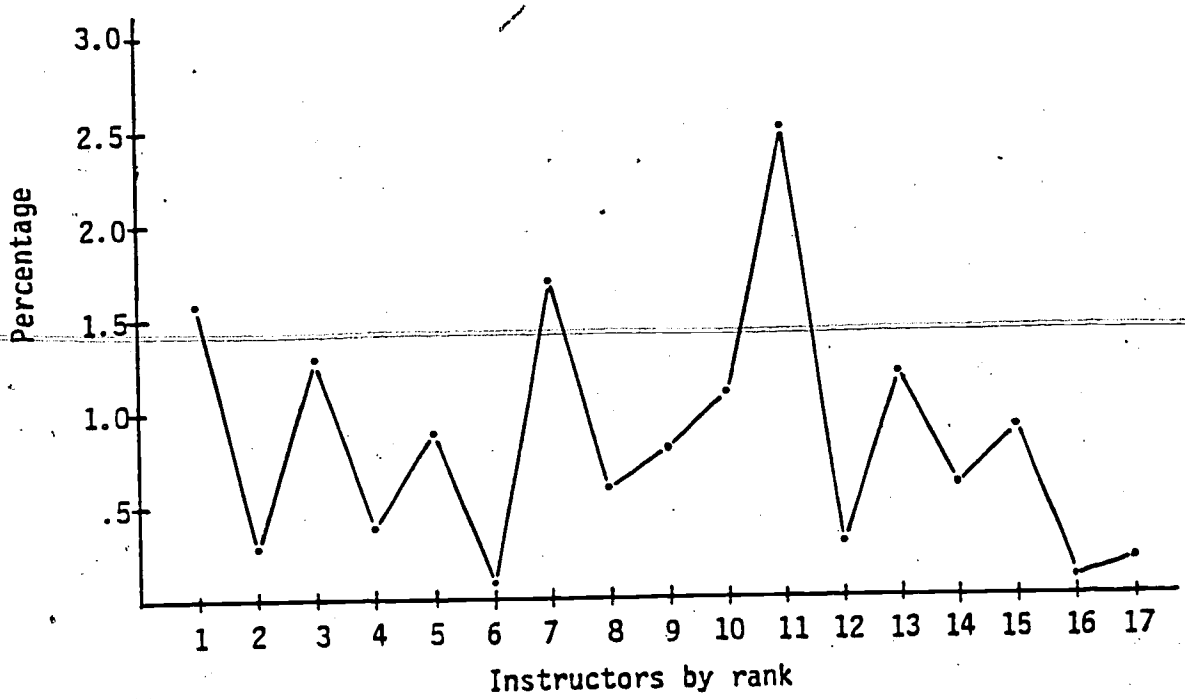
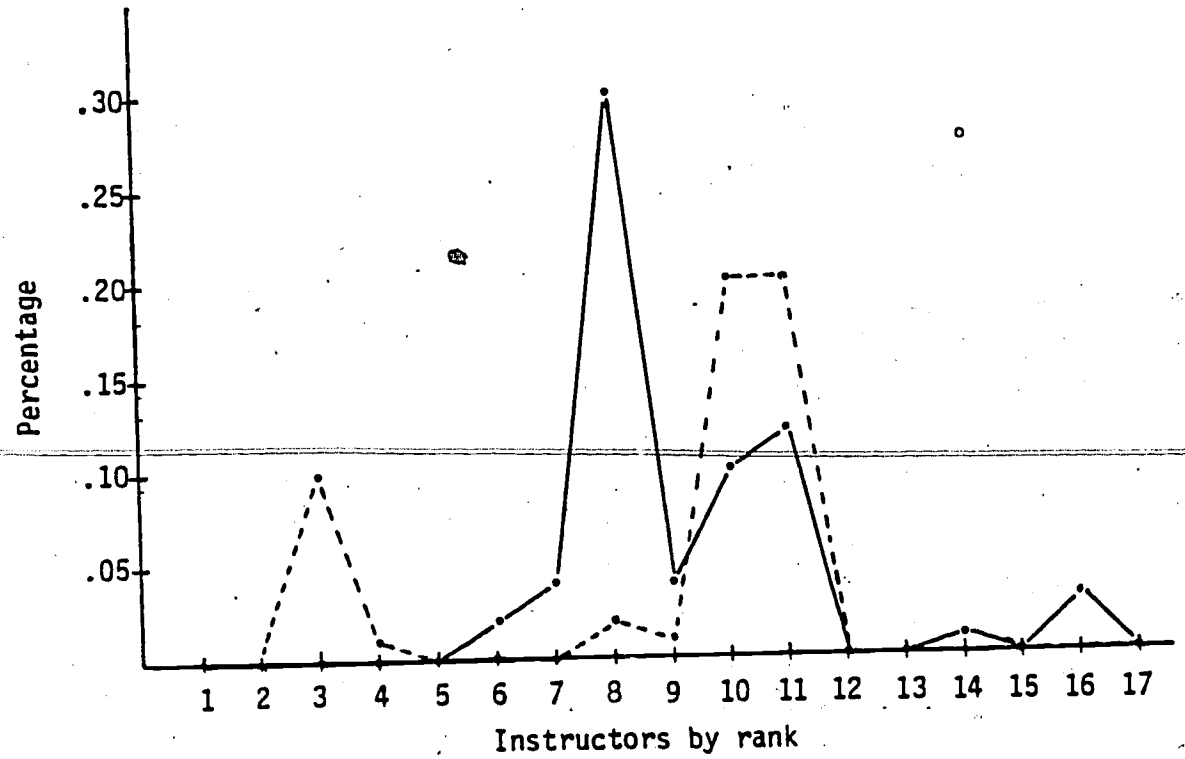


Figure 11 - Mean percentages for Category 11 (Humor) by instructor rank.



—— Category 7 (Criticism)
---- Category 9 (Non-cognitive student talk)

Figure 12 - Mean percentages for Categories 7 and 9 by instructor rank.

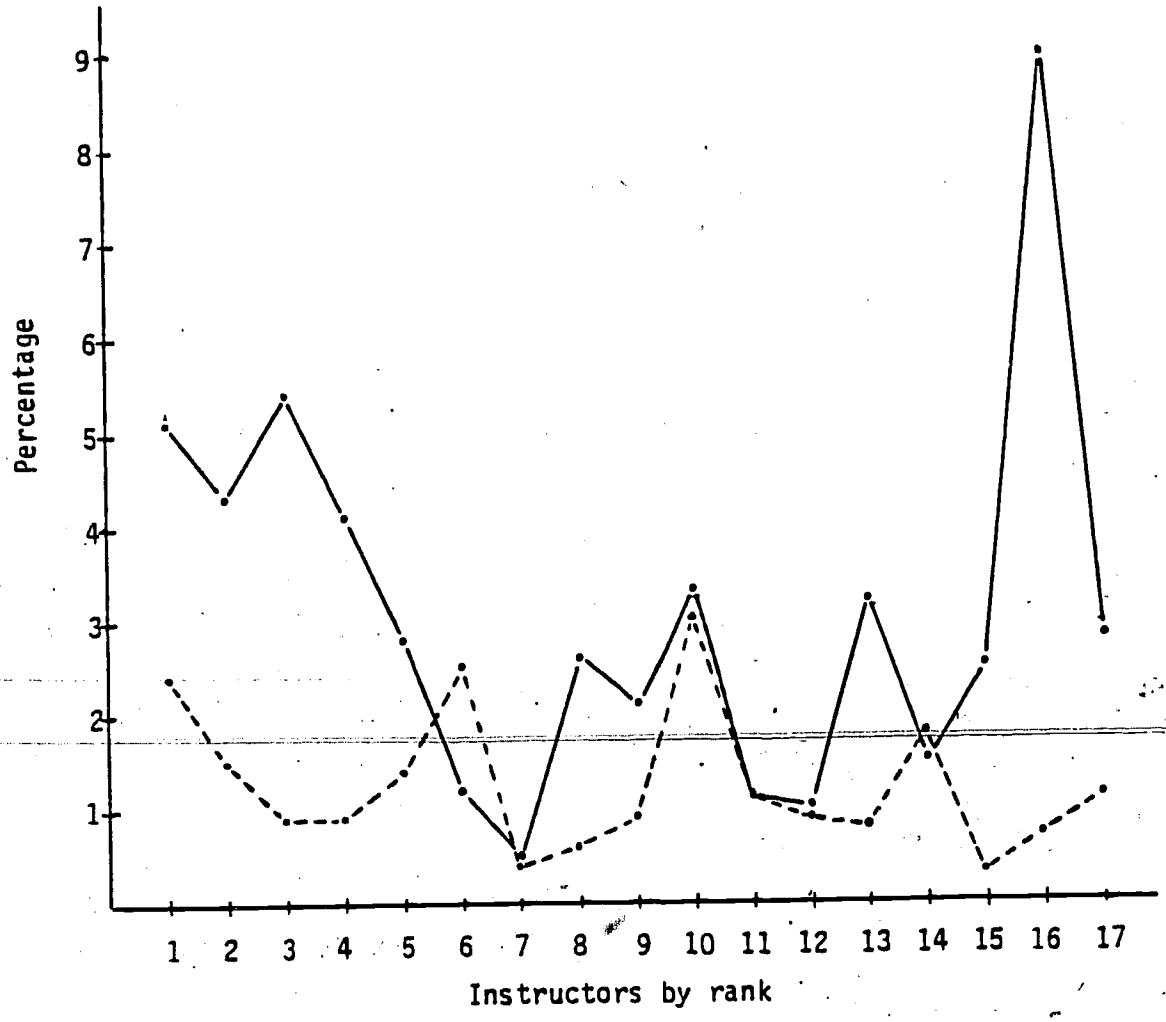


Figure 13 - Mean percentages for Categories 2 and 8 by instructor rank.

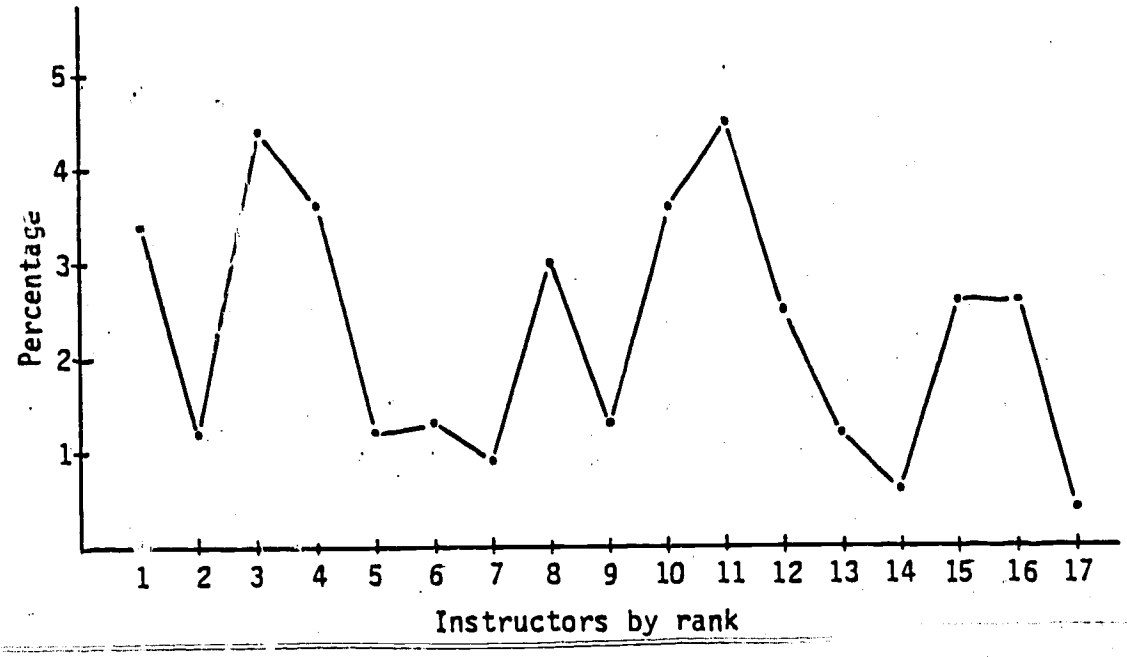


Figure 14 - Mean percentages for Category 13 (Student asked questions) by instructor rank.

(A noteable exception is illustrated in Figure 15 where we found that the amount of cognitive student talk increased in the two highest rated classes.)

The use of

Category 4 (Instructor asked questions)
Category 5 (Lecture)
Category 7 (Criticism)
Category 12 (Simultaneous use of visual and verbal presentation)
and Category 14 (Writing on the board or overhead without talking)

remained constant over the semester.

By instructor - Upper-division vs. Lower-division courses. When comparing the verbal interactions in lower-division vs. upper-division courses, it was found that instructors teaching lower-division courses seem to be more student oriented in that they use the following types of statements significantly more than do instructors teaching upper-division courses (Table 6):

Category 3 (Repeating student response; providing corrective feedback; building on a student response)
Category 4 (Asking questions)
Category 6 (Providing cues; focusing on main points; giving directions; assignments, process)
Category 12 (Simultaneous visual and verbal presentation)
and Category 14 (Writing on the board or overhead without talking).

Cognitive Levels of Instructors' Evaluative Instruments

Each instructor who participated in this study was asked to provide copies of his/her exams, quizzes, homework assignments, and written assignments so we could analyze the cognitive levels at which the students were being asked to perform. Each item on these exams, etc. was examined and classified according to Bloom's Taxonomy of the Cognitive Domain (Bloom, 1972). The overall percentage of each cognitive level required was then calculated for each instrument. It was found that the instructors in the College of Liberal Arts used the widest range of cognitive levels in their evaluative instruments and the most narrow range, utilizing the lowest cognitive levels, was found in Business and Engineering.

The cognitive levels found in each instrctor's evaluative instruments were then compared with the instructor's ranking on Item 9 on the Student Attitude Survey (Table 7). From this comparison it was found that the instructrs whose evaluation instruments required that the students use analysis-, synthesis-, and/or evaluation-level thinking processes were rated in the top half of the list. The implication is that students who are challenged to use higher-level cognitive processes feel those courses are more effective.

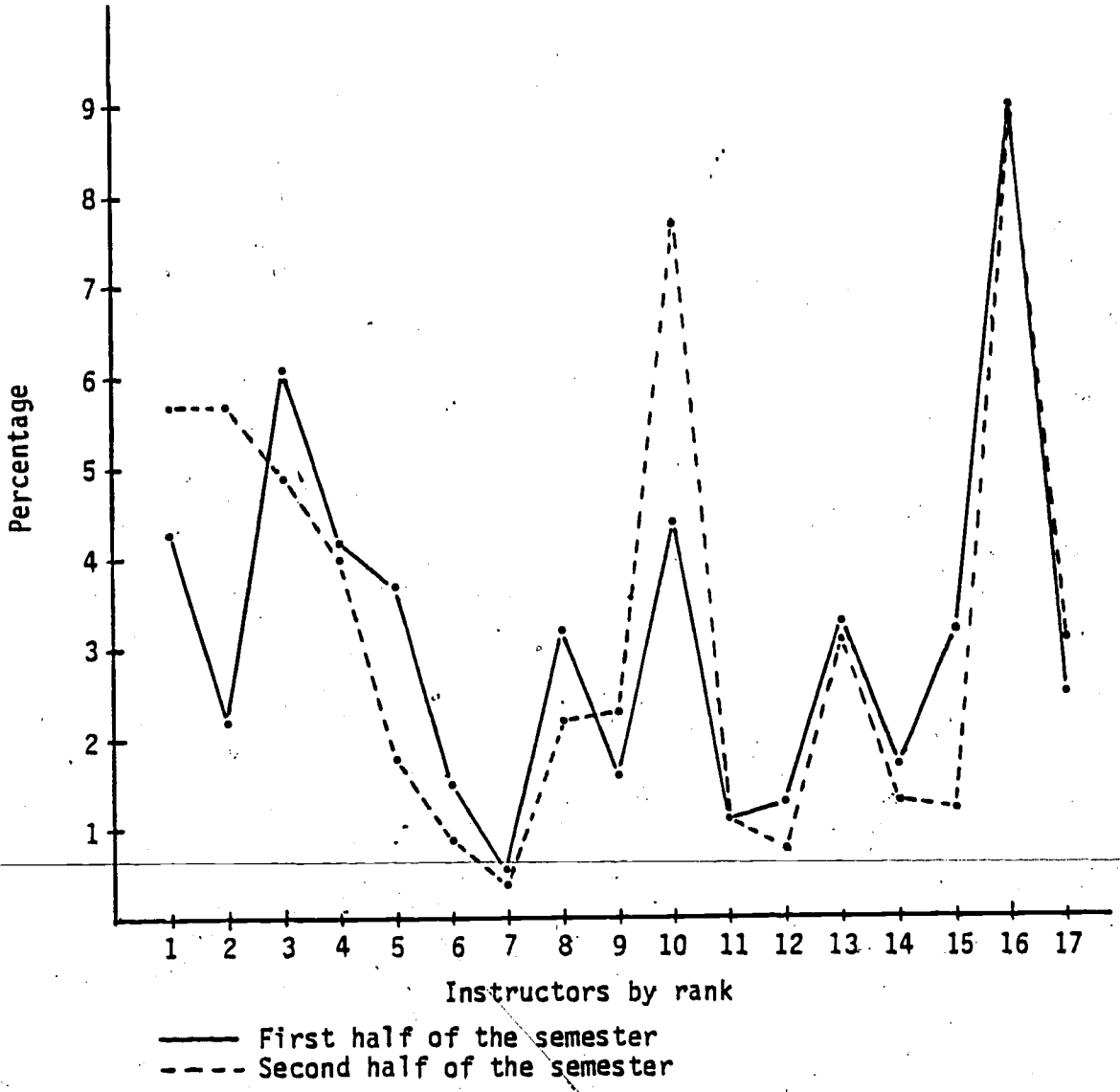


Figure 15 - Mean percentages for Category 8 (Cognitive student talk) for first and second half of the semester by instructor rank.

TABLE 6

One-way ANOVA of Mean Frequency of Use for Each CIAS Category by Course Level

Category	Lower-Division	Upper-Division	Fvalue	p
1	.8355	.6867	.494	.48
Δ2	.8673	1.1444	3.699	.0559
*3	2.6309	1.6356	4.255	.04
*4	3.5100	2.6467	6.315	.01
*5	48.1845	57.9789	13.286	.0003
*6	9.5527	8.1967	5.904	.02
7	.0527	.0278	.8979	.34
8	2.8536	3.0289	.152	.70
9	.0227	.0367	.476	.49
10	4.8611	5.2289	.076	.78
11	.8627	.9400	.356	.55
*12	22.1845	14.9478	8.833	.003
13	1.8345	2.3411	2.747	.10
*14	1.6382	.9456	5.9739	.02

*Significant difference at $p \leq .05$

ΔApproaching significance.

TABLE 7

Cognitive Levels Tested by Instructor/Enjoyment Rating

	Mean	Type Class*	Required?	# Students	% Given A	B	C	D/F	Cr	Avg GPA	Instr. Code	Cognitive Levels** K	C	Ap	An	S	E
1.	1.3548	U	N	130	20	35	26	5	6	2.74	28					X	X
2.	2.0000	U	N	200	8	28	22	11	24	2.32	24	X	X			X	X
3.	2.0057	L	R	220	27	43	16	8	-	2.90	25		X		X		X
4.	2.1186	U	N	90	20	23	26	13	9	2.51	27	X	X	X			
5.	2.1688	L	N	200	13	29	35	14	1	2.40	12		X	X	X		
6.	2.2110	U	N	140	26	43	16	5	9	2.87	11	X	X				
7.	2.2281	L	R	300	10	30	31	21	-	2.17	20				X	X	X
8.	2.3826	L	R	140	10	30	28	29	-	2.01	13	X	X	X			
9.	2.5739	U	R	130	18	21	30	27	1	2.18	15			X			
10.	2.7059	U	N	140	13	54	26	3	-	2.78	17	X	X				
11.	2.7113	U	R	350	32	36	23	5	1	2.95	22	X	X	X			
12.	2.8296	L	R	250	30	32	17	14	1	2.74	29	X	X	X			
13.	2.8356	U	N	110	13	28	31	11	3	2.47	26	X	X	X			
14.	2.9914	U	R	200	9	36	31	15	3	2.37	21		X	X			
15.	3.2658	U	N	120	12	31	36	13	3	2.39	14	X	X	X			
16.	3.3016	L	R	120	6	12	22	44	2	1.47	23		X	X			
17.	4.0561	L	R	130	10	12	33	38	1	1.83	16	X	X	X			
18.		U	R	300	13	19	31	18	1	2.23	18			X	X		
19.		L	R	300	8	28	37	16	-	2.23	19	X	X	X			

*Type Class
U = Upper division - Jr/Sr
L = Lower division - Fr/Soph

**Cognitive Levels
K - Knowledge
C - Comprehension
Ap - Application
An - Analysis
S - Synthesis
E - Evaluation

Discussion

Because it appears that large classes are going to be a part of the teaching and learning environment in universities for some time, it is essential that ways be found to make these classes more productive, in terms of student learning, and more conducive to the transmission of positive attitudes toward learning. Though we have "known" for some time that what happens in large classes is not the same as what happens in smaller classes, very little research has been done in higher education to determine exactly what the differences are, and more importantly, to evaluate whether the teaching techniques used in smaller classes can be transferred to large group instruction.

This study has given us some "hard" data concerning some of the techniques whch are currently being used in large unversity classes. As the data presented above indicate, in large classes the instructor usually dominates the class time as an information disseminator. Very little time, if any, is spent actively engaging the students in discussions or poblem-solving activities which lead to higher cognitive levels of learning. We now need to gather similar data from smaller classroom settings to determine the major differences. Once these differences have been isolated perhaps techniques can be developed which will enable large-class instructors to construct a learning environment in which university students can learn to think rather than just memorize.

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