DOCUMENT RESUME

ED 085 372 SP 007 551

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TITLE Reinforcing and Questioning Behavior of Teachers as a Measure of Teacher Effects. Final Report.
INSTITUTION Johnson State Coll., Vt.
SPONS AGENCY National Center for Educational Research and Development (DHEW/OE), Washington, D.C. Regional Research Program.
BUREAU NO BR-2-A-099
PUB DATE Oct 73
GRANT OEG-1-72-0019(509)
NOTE 45p.

EDRS PRICE MF-$0.65 HC-$3.29
DESCRIPTORS Academic Achievement; Effective Teaching; *Negative Reinforcement; *Performance Based Teacher Education; *Positive Reinforcement; *Questioning Techniques; *Teacher Behavior; Teaching Techniques

ABSTRACT

This study attempts to generate hypotheses concerning teacher performance in the classroom. Seventeen teachers were videotaped while teaching a lesson. Pupils completed an achievement test and a rating scale of these teachers which placed the teacher in a high-, medium, or low-effect group. A comparison of the frequency and types of questioning and reinforcing behavior between high- and low-effect teachers was then made. The data from this show that a) high-effect groups ask more rhetorical questions than the low-effect groups; b) high-level questions distinguished groups from one another more than low-level questions; c) high-effect groups provide more positive verbal reinforcement than low-effect groups; and d) frequency of negative reinforcement does not distinguish one group from another. When using IQ as an aptitude measure and frequency of any teacher behavior as a treatment, results show that a) more able students perform better with low-frequency questions and low-frequency positive reinforcement and b) less able students show greater achievement with a high frequency of negative reinforcing behavior. (Thirty-six figures and 12 tables of data are presented.) (BRB)

Final Report

Project No. 2A099
Grant No. OEG-1-72-0019(509)

REINFORCING AND QUESTIONING BEHAVIOR OF TEACHERS AS A MEASURE OF TEACHER EFFECTS

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October 1973

The research reported herein was performed pursuant to a grant with the Office of Education, U.S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgment in the conduct of the project. Points of view or opinions do not, therefore, necessarily represent official Office of Education position or policy.

U.S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
National Center for Educational Research and Development

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REINFORCING AND QUESTIONING BEHAVIOR OF TEACHERS AS A MEASURE OF TEACHER EFFECTS

PROBLEM AND OBJECTIVES

Rosenshine and Furst (1971) have carefully reviewed the more recent and fruitful research on teacher effects and have presented eleven variables of which nine are specific teacher behaviors which show some promise of fruitfulness. Of these eleven variables, five clearly evidence relationship to accepted criteria of effectiveness of teaching, the remaining six variables are less clearly related. The eleven variables presented by Rosenshine and Furst are: clarity of presentation, variability in presentation, enthusiasm of the teacher, task orientation or businesslike manner of the teacher, student opportunity to learn the criterion material, teacher indirectness, teacher criticism (negative relationship), use of structuring comments, types of questions asked by the teacher, probing activity of the teacher, and level of difficulty of instruction.

It is entirely possible that a partial reason for failure to establish relationships of these variables to a criterion of effectiveness may be due to lack of sophistication in our research models. Most of the findings reported by Rosenshine and Furst were obtained from a model suggested by Fortune (1967) based upon Gage's search for a theory of teaching (Gage, 1963). The model provides a viable strategy for studying teacher effects but may require some judicious modification as it is applied to a particular variable under study.

It is suggested that two of the assumptions underlying the research into teacher effects need to be examined. First is the assumption of linearity of teacher behavior as related to the product, usually identified as achievement. Second, the assumption is frequently made that achievement is the criterion variable.

Considering the first assumption, it is not only possible but is probable that the product is not linearly related to the process. Though we know that reinforcing behavior on the part of the teacher produces increased achievement, it is obvious that at some point as increment in reinforcing behavior will not result in an increment in achievement but probably will result in a decrement. It is likely that the relationship is crescent shaped. The same may be said for the variable clarity. At some point, making something more clear may result in boring the students to the point that they no longer pay attention to the process thereby causing a reduction in achievement.

The second assumption presents a more complex situation. There is no agreement as to what is the criterion variable. More likely we must seek multiple criteria variables. If achievement were the only or the primary criterion, we know of more effective ways of making gains than through classroom teaching. While we cannot ignore teaching, we must consider it in relation to other criteria. Pupil satisfaction with the lesson may be one of the more pertinent variables to be considered. In fact, Gage (1963) lists a hierarchy of criteria wherein the first immediate criteria (short range effects on pupils) are listed as "pupil's achievement of current educational objectives"

and next "pupil's satisfaction with the teacher". Rosenshine and Furst (1971) also state unequivocally that "the most promising results have been obtained in studies in which teacher behavior was described using rating scales" ... either observer or pupil.

This paper describes a study which builds upon the findings cited above, extends that research, and considers alternatives to the assumptions cited as possibly influencing earlier findings. Findings within this study should add to our knowledge of teaching and become the foundation for Gage's theory of teaching, thereby influencing teacher preparation curricula.

Statement of the Problem. Are pupil achievement and pupil satisfaction with the teacher related to the teacher evidenced behavior concerning frequency of and type of questions asked and frequency of and type of reinforcement provided? This is the main question. As a subordinate question, does individual pupil aptitude influence the effects of the teacher behavior?

Reinforcement. Jackson (1968, P. 22ff.) discusses the importance of a teacher's reinforcement of a pupil's knowledge in a concise manner:

> He is being praised, albeit indirectly, for knowing something, for having done what the teacher told him to do, for being a good listener, a cooperative group member, and so on. The teacher's compliment is intended to entice the student (and those who are listening) to engage in certain behaviors in the future, but not simply in the repeated exposure of the knowledge he has just displayed. (Jackson, 1968, p. 24)

Berliner (1969, p.5) states that one of the most obvious behaviors involved in competent teaching performance, regardless of subject matter, is the ability to reinforce student participation. The definitions used by Berliner in training novice teachers in the skill of reinforcement were used in this study.

Positive reinforcement will be classified in four categories:

(1) Positive verbal reinforcement--immediately following a pupil response the teacher uses words or phrases such as "good", "fine", "nice job".

(2) Positive qualified reinforcement--though a response is unacceptable, participation is reinforced by such remarks as "That's good, but...", "Right, but don't forget...", "You're on the right track".

(3) Postive post hoc reinforcement--the teacher recalls a previous positive contribution by a student or asks for repetition of a point made by a student.

(4) Non-verbal positive reinforcement

Negative reinforcement will be similarly classified in four categories:

(5) Negative verbal reinforcement--immediately following a pupil response the teacher uses words or phrases such as "That's wrong", "No", "That's not right".

(6) Negative qualified reinforcement--when a response is unacceptable participation is reinforced but the emphasis is on the incorrectness by use of remarks such as "That's wrong, but...", "Wrong, you forgot...", "You started off wrong".

(7) Negative post hoc reinforcement--the teacher recalls a previous erroneous contribution by a student with such a remark as "What was wrong with John's statement?".

(8) Non-verbal negative reinforcement

The above eight categories were the basis for the definition of the independent variable, reinforcement.

Questioning Behavior. Elliott (1970) suggests that thinking, or manipulating symbols which represent experience, is one of the chief mechanisms of learning and development. Teacher questioning strategies are intended to promote the development of more complex pupil thinking. As Berliner (1969) points out, a "good" classroom question is one that prompts students to use ideas rather than just remember them. Questioning behavior then represents an important area in teacher behavior.

While use of the terms higher order and lower order questioning appear too general for accurate differentiation between good and poor teaching, more specific categories are extremely difficult to categorize without typed transcripts of lessons. The following categories have been combined from Parson's (1968) Teaching for Inquiry, Questioning Strategies and Berliner's (1969) discussion of teaching the skill of probing.

Rhetorical Questions--questions for which the teacher does not expect the pupil to respond, used to redirect or refocus the lesson, or for which the teacher does not allow an opportunity for the pupil to respond.

Information Questions--questions calling for facts.

Leading Questions--questions asked in such a manner that the teacher prompts the student or refers back to material that is known by the pupil.

Probing Questions of one of the following categories:

(1) Clarification. The teacher asks for more information or to supply more meaning.

(2) Increasing critical awareness. The teacher requires the pupil to justify his response rationally.

(3) Refocusing. Rather than proceeding deeper into an area with a pupil, the response cay call attention to other related areas.

(4) Redirection. This is a teacher behavior that involves other pupils in the interchange that is taking place. To a student other than the one who has just spoken, the teacher may say, "Can you add to that?", "What are your views on that?".

The above seven categories were modified during training of observers and the following categories were used to define the variable questioning.

(1) Rhetorical Question/Non-Related--questions for which the teacher does not expect nor want the pupil to respond, or for which the teacher does not allow an opportunity for the pupil to respond, even if there is a response.

(2) Lower Level--questions calling for facts, simple recall from past knowledge or from present class discussion. What, where, when observation within/without the class. No interpretation, class review of facts and terms.

(3) Higher Level--questions asked with a clue or questions which involve reasoning. New element is added. Students are required to compare, judge, evaluate, translate, imply, analyze, expand, or show a relationship of cause and effect.

(4) Probing Questions--these are follow-ups to a question already answered. When the teacher has not received the correct answer, he probes. He can start by repeating a question posed by a student. These involve:

(a) Clarification-The teacher asks for more information or to supply more meaning.

(b) Increasing critical awareness-The teacher requires the pupil to justify his response rationally.

(c) Refocusing-Rather than proceeding deeper into an area with a pupil, the response may call attention to another related area.

(d) Redirection-This is a teacher behavior that involves other pupils in the interchange that is taking place. To a student other than the one who has just spoken, the teacher may say, "Can you add to that?".

Achievement. Ebel (1967) states "only when the 'content' of education is conceived as a set of goals to be attained, rather than as a set of lessons to be studied or as a set of class activities to be carried out, is it educationally useful to seek content validity in a test". Achievement was measured within this study using a criterion referenced post test designed to sample the behaviors from previously provided specified objectives.

Pupil Satisfaction. Pupils were asked to complete a teacher rating sheet for each lesson immediately following the lesson. The rating sheet is brief, contains concrete items, and attempts to assess both their satisfaction with the lesson and their feeling about the teacher.

PROCEDURES

Sample. The sample consisted of 17 teachers in grades 5 and 6 who regularly teach science. A secondary sample for a portion of the study dealing with aptitude interaction consisted of all of the students in the classes taught by these teachers which numbered approximately 300 students.

Method. Each teacher was asked to teach a twenty-minute lesson based upon a specific behavioral objective. During the lesson the teacher was videotaped.

Following the lesson the investigator administered a short achievement test and a rating scale. Appendices A, B, and C contain the lesson, achievement test, and rating scale, respectively.

Mean achievement scores and ratings were calculated for each class to yield two scores on each teacher. The scores on both measures were trichotomized to yield nine cells defining high, medium and low teacher effects.

(Table 1 goes about here)

Each teacher's videotapes were then analyzed by a panel of observers to count the frequency of behaviors defined above, questioning and reinforcing. A student "t" test of significance was used to determine whether frequency of various teacher behaviors differ between the most effective and least effective teachers.

As a second step, high and low frequency teacher's individual student's achievement gains were plotted against an IQ aptitude measure to identify whether teacher's behavior interacts with aptitude.

Lesson. Mini-lessons published in Teaching Improvement Kit prepared by Jason Millman, John D. McNeil, W. James Popham and Eva Baker and published by Instructional Appraisal Services, 1972, were examined for possible use. A lesson on converging and diverging light rays was selected and modified. Following a pilot use of the lesson in two classes, a background sheet was prepared and final refinement of the lesson plan was completed and mimeographed. Appendix A contains the lesson.

Instrumentation. Achievement test. A five-item achievement test (see Appendix B) was included in Millman, et. al. (1972) and was used with the pilot test lessons. Reliability of the test was established on the two pilot classes as $r = 0.58$ (coefficient alpha, Lord and Novick, 1968) with a total of 33 students.

Because a pre-post test design was not utilized, a comparable group of 5th and 6th grade students who did not receive the lesson were administered the test to establish that the test measured what was taught in the lesson. Results of comparison between the no-lesson and lesson groups shown in Table 2, below, support use of the test as a criterion referenced measure.

(Table 2 goes about here)

Intercorrelation of the items on the achievement test are shown in Table 3, below. All correlations were significant at the 0.05 level.

(Table 3 goes about here)

Teacher Rating. A rating scale (see Appendix C) was prepared and tested on the pilot test classes. The scale, containing 12 items, yielded intercorrelations significant at $p < .05$ level for all intercorrelations except item 4 with items 2, 3, 6 and 10 and item 6 with item 7. See Table 4, below.

(Table 4 goes about here)

Reliability was calculated by randomly dividing the class in half (randomly deleting one member when the class contained an uneven number of children) and calculating a Pearson product moment correlation on the split half classes where the number of classes equaled 17, r = 0.96.

Collection of Data. Each class was videotaped while the lesson was being taught. A short time before the class was used to help both the students and the teacher to become accustomed to the equipment in the classroom.

The videotapes were then examined by a panel of three observers to count the frequency of behaviors specified, questioning and reinforcing. The panel spent considerable time training to recognize the various categories of behavior prior to viewing the tapes. Pilot tapes (teachers one and two) were used to train.

Reliability among the observers ranged from 0.9790 to 0.9998 with lowest agreement in the category of "Probing questions". A consultant was called in to aid in training the panel for recognizing questioning and as a result, the categories were modified from those originally planned.

RESULTS

Teachers were assigned to effects cells according to achievement and rating. When Teachers 1 and 2 were eliminated as pilot lessons and teacher 19 was omitted because of videotaping problems (camera did not record entire lesson, and lesson ran more than twice the 20-minute time period allotted) there were 17 teachers to be assigned to effects cells. Tables 5, 6 and 7 reflect the data used to assign teachers to high, medium and low effects cells on the two dimensions of rating and achievement. Cells 1, 2 and 4 represent "High Effects", cells 6, 8 and 9, "Low Effects".

(Tables 5, 6 and 7 go about here)

Results will be reported under three topics: questioning behavior, reinforcing behavior, and aptitude treatment interaction results.

Questioning Behavior. The total number of questions asked, and each type of question asked, by teachers in "High Effects" and "Low Effects" groups were compared. Because this is not an experimental design but a study seeking to generate hypotheses for further experimentation, it might be more fruitful to report the level of significance obtained rather than prestablish a significance level. No hypotheses were stated and technically no nulls are to be rejected. To the extent that a researcher is willing to risk a Type II error, he might wish to consider whether these findings at 0.10 and 0.15 levels of significance hold any promise with more statistical power than the given 6 degrees of freedom.

Table 8 reports the complete data for total number of questions asked by each teacher and compares the high and low effects groups. Because the high group's variance was so great and the degrees of freedom so small, the rather substantial difference between means yields significance at only the 0.15 level. Table 9, reflecting other categories of questioning behavior yield mixed but not entirely dissimilar results. Though not easily interpretable, it is

suggested that the substantially different variances between high and low groups offers some interesting considerations. All variances yield F ratios greater than 0.05 level. The low group consistently is homogeneous while the high group definitely is heterogeneous. An explanation which might be offered for this phenomena is the suspected non-linear relationship between the independent and dependent variables, particularly with respect to the high effects group. Examination of this hypothesis, however, would suggest that any relationship between the independent and dependent variable would yield a U-type curve or a dish. Quite the contrary result is observed in Figure 9 which reflects, if anything, a crescent or inverted U. Alternatively, it can only be suggested that the teaching strategies employed are more significant than the variable of questioning. Those teachers who produced high effects with questioning frequencies similar to the low effects teachers probably had a teaching strategy which included the planned use of questions. Conversely, those in the low effects group may not have had such a planned strategy.

(Tables 8 and 9 go about here)

The number of questions of each category, plotted against achievement and rating, are shown in figures 1 through 10. Pearson r, linear correlation coefficients are shown. In a few instances it would appear that the data were more likely curvilinear.

(Figures 1-10 go about here)

Table 10 reflects the linear relationship of each of three variables, Questions, Reinforcements and IQ, individually and collectively, for the 15 teachers for which there was complete data. As expected, the relationship is non-significant even when used in combination.

(Table 10 goes about here)

Reinforcing Behavior. Frequency of teacher evidenced reinforcing behavior was compared by total and by category between high effects and low effects groups (see Table 11 below). The most promising comparison was in the area of Positive Verbal reinforcement indicating that those teachers who provide frequent verbal reinforcement are likely to produce most satisfactory results. It appeared that the sum of positive reinforcement less the negative reinforcements might yield even stronger results. As may be seen from Table 12, this comparison yielded a t-value of 2.34, significant at $p < 0.10$.

(Tables 11 and 12 go about here)

Similar reasoning might be offered concerning reinforcing behavior as was offered under questioning behavior concerning variance of the high effects group vs. the low effects group. The topic of judicious use of reinforcement incorporated within the teacher's strategy is more likely an explanation of differences in accomplishment than frequency of reinforcement.

The number of reinforcements for each category were plotted against achievement to examine the relationship between these variables. Correlation coefficients are shown on figures 11 through 20.

(Figures 11-20 go about here)

Aptitude-Treatment Interaction. The investigation of learning performance as an interactive function of individual differences of the learners and alternative modes of instruction is generally referred to as Aptitude-Treatment Interaction (ATI)(Cohen, 1969). In this investigation, IQ, which was used as an aptitude measure, was unavailable for three of the groups (classes). By plotting achievement on the abscissa and IQ on the ordinate, a class may be represented by a regression line. Each class is identified with a teacher, therefore each line is referred to as Teacher 1 or Teacher 2 and is representative of the treatment, i.e., high frequency questioning teacher, low frequency reinforcing teacher, etc.

In examining interactions between high frequency and low frequency teachers, only a limited number of classes offer promise. Teacher 18, for example, (see figures 21-34, below) evidenced a high frequency of questioning and a high frequency of positive reinforcing behavior. Figure 35 below reflects the resultant interactions with low frequency teachers numbers 3, 9 and 10. It would appear that the more able students perform better with a low frequency of questions and low frequency of positive reinforcements.

(Figures 21-35 go about here)

One of the most dramatically high frequency behavior teachers, number 20, evidences no interaction with low frequency questioning and positive reinforcing teachers, but demonstrates considerable interaction with teachers 8 and 11 who evidenced low frequency of negative reinforcing behavior. Figure 36 indicates that less apt students achieve greater with high frequency of negative reinforcing behavior than more apt students.

(Figure 36 goes about here)

CONCLUSIONS

This study represents an attempt to generate hypotheses which might be fruitful for investigating experimentally in the area of teacher performance in the classroom. It was designed to classify high effects and low effects teachers by using a combination of pupil measures--achievement and satisfaction. Particular performances studied are questioning and reinforcing behavior of the teachers. Not being an experimental study, there was no specific hypotheses to test and no pre-established probability level cut-off. In addition to generating hypotheses about behavior of high group effects and low group effects teachers, the study also seeks to identify effects on individual students through the examination of the behavior as it interacts with individual pupil aptitude.

Questioning. Lower level questions appeared to distinguish least between high and low effects teachers. Perhaps surprisingly, non-related or rhetorical questions were significant at the $p < 0.15$ level which may support a general conclusion that structuring or teaching strategy was a confounding variable. This appears to be the most parimonious explanation of striking differences in the homogeneity of the two groups. The low effects group consistently reflected a low variance whereas the high effects group reflected a high degree of heterogeneity or large variance. Probing questions seemed less significant than higher level questioning.

Reinforcing. Positive verbal reinforcements by the teacher appear to be a fruitful area for research. In fact, positive reinforcing behavior reflects significance at $p < 0.10$ level, a more significant behavior than any other behavior examined. Again, the large variance of the high effects group suggests reinforcing used strategically is most promising.

Aptitude-Treatment Interaction (ATI). On the basis of only a limited number of cases, a tentative area to explore would be the interaction of questioning and positive reinforcing with aptitude. There is some evidence that more able students perform better with a low frequency of questions and low frequency of positive reinforcement. Conversely, the evidence tends to favor a higher frequency of negative reinforcing behavior for less able students.

Implications for Further Study. Several factors need to be considered if future studies of this nature are planned. First is collection of data on a broader range of teachers. Due to the geographical area in which the data were collected, many of the teachers were graduates of the same, or similar teacher training institutions. It is suggested, but not demonstrable, that exposure to similar methods teachers may have caused a similarity of behaviors. This may also be partially accounted for in that this geographic region tends to be fairly homogeneous in its educational expectations. Only two of the 17 teachers evidenced very high frequency of behaviors studied, most a fairly low frequency. There needs to be a broader spectrum of frequencies for valuable research.

Secondly, there needs to be an examination of the teaching strategies employed and comparisons of teachers utilizing similar strategies. In order to account for the large variance in the high effects group, it may be necessary to reexamine the videotapes for several such considerations.

A third factor is the instrumentation. Though of adequate validity and reliability group use, a more sensitive achievement test is needed to obtain individual data and might pick up finer differences across classes.

Fourthly is the need for more sophisticated multivariate analysis. An addendum to this report will be prepared to examine non-linear relationships between the variables under study and if possible, a canonical analysis using both achievement and rating as dependent variables.

Lastly, it is suggested that greater power is needed to test any such hypotheses. A study of considerably larger scope would appear to be in order considering more teachers, more behaviors and possibly such added controls as multiple lessons, retention across time, and generalization across teachers.

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LESSON: LIGHT RAYS

I. Instructional Objective:

Given a diagram containing parallel light rays, air, and lenses, the student will indicate whether the light rays will converge or diverge by circling the correct term.

II. Materials:

Glass lenses (Light)

Charts

Test + pencils

III. Development

a. Introduction - Light vs. Dark

b. Everything either (1) gives or (2) reflects light

c. Light rays travel at different speeds

1. density mediums - air, low density medium
glass, higher density medium

2. rays bend as they hit an object

d. Using charts and lenses explain

1. converge - bring together - con

2. diverge - spread apart - di

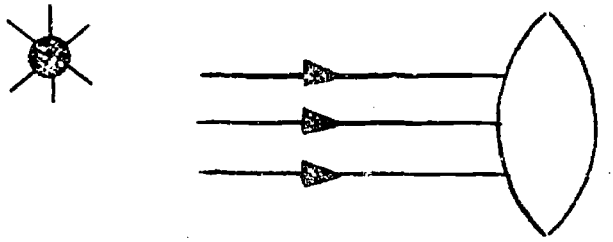
e. Test - Read directions aloud - time, 15 minutes

IV. Time: 30 minutes

V. Evaluation

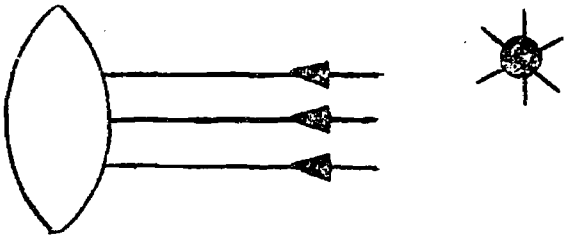
TEST: LIGHT RAYS NAME_____

For each diagram decide if the light rays will converge or diverge. If you think the light rays will converge, put a circle around the word CONVERGE. If you think the light rays will diverge, put a circle around DIVERGE.

1. 

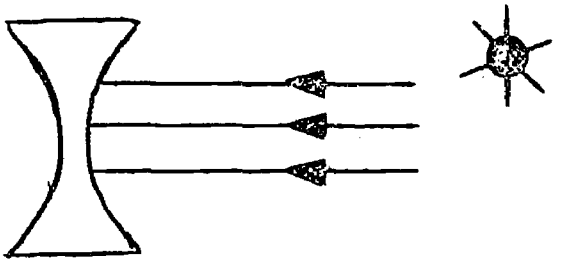
CONVERGE

DIVERGE

2. 

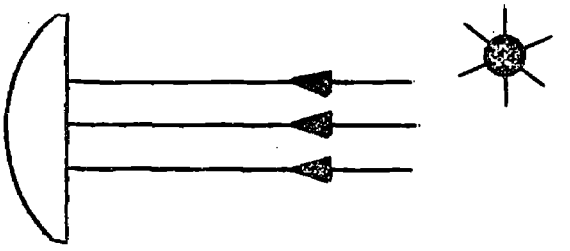
CONVERGE

DIVERGE

3. 

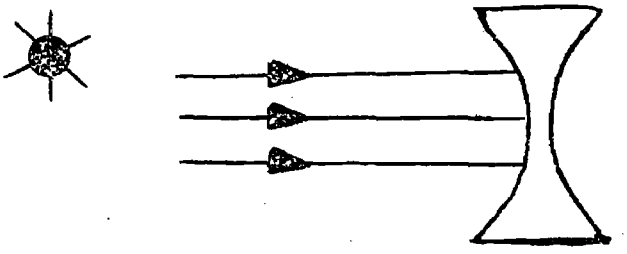
CONVERGE

DIVERGE

4. 

CONVERGE

DIVERGE

5. 

CONVERGE

DIVERGE

TEACHER'S BEHAVIOR INVENTORY

Name of Teacher _____ School _____ Date _____

Directions

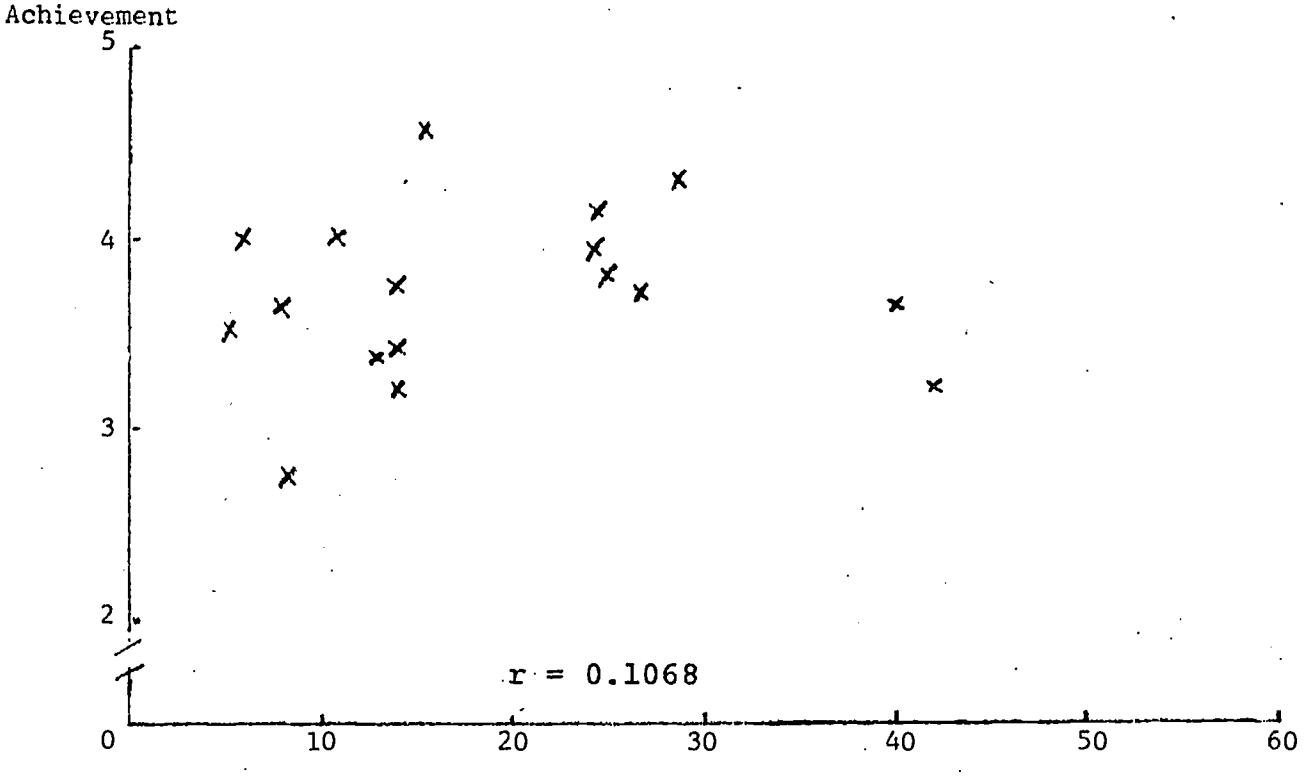
Listed below are statements which tell how some teachers act. We would like you to mark how well each statement describes the way your teacher acts.

Read each statement. Opposite the statement, circle the word that best describes your teacher. If you do not understand the directions, please raise your hand and we will help you.

Mark an answer for each statement.

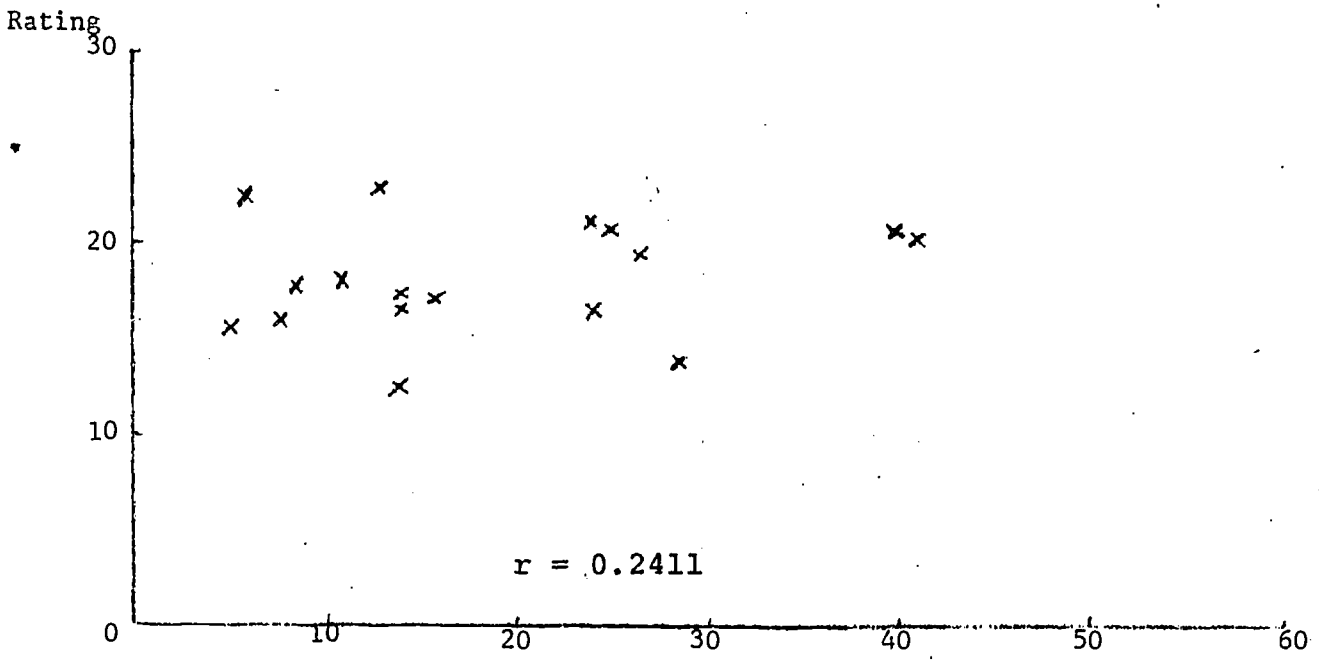
My teacher:

1.	gives directions that are clear and easy to understand.	Yes	Sometimes	No
2.	expects too much of us.	Yes	Sometimes	No
3.	makes class work exciting.	Yes	Sometimes	No
4.	uses words which we are able to understand.	Yes	Sometimes	No
5.	is a happy teacher.	Yes	Sometimes	No
6.	praises us when we do a good job.	Yes	Sometimes	No
7.	shames and embarrasses some students.	Yes	Sometimes	No
8.	understands us.	Yes	Sometimes	No
9.	spends time helping each of us with his or her special problem.	Yes	Sometimes	No
10.	tries to find things that we are "good at" rather than "poor at".	Yes	Sometimes	No
11.	causes us to be afraid to ask questions and to answer questions.	Yes	Sometimes	No
12.	is friendly to each of us in the class.	Yes	Sometimes	No



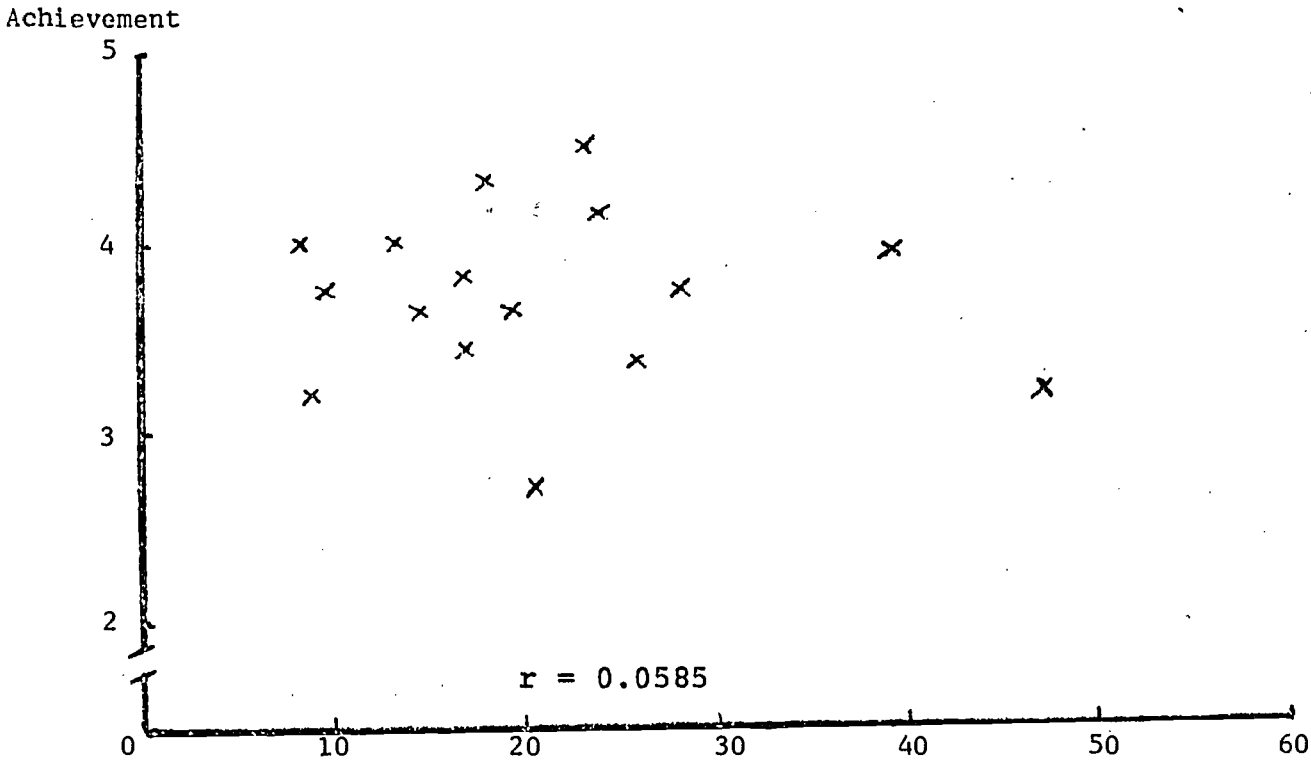
RHETORICAL QUESTION/NON-RELATED

FIGURE 1



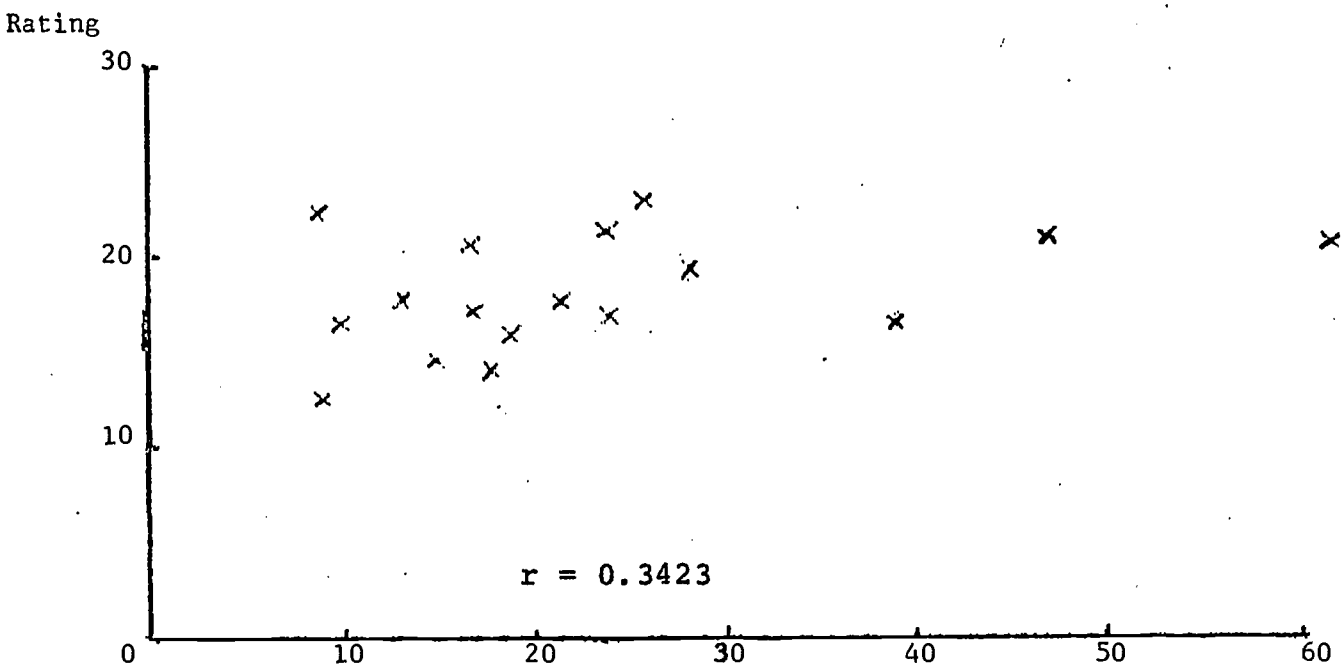
RHETORICAL QUESTION/NON-RELATED

FIGURE 2



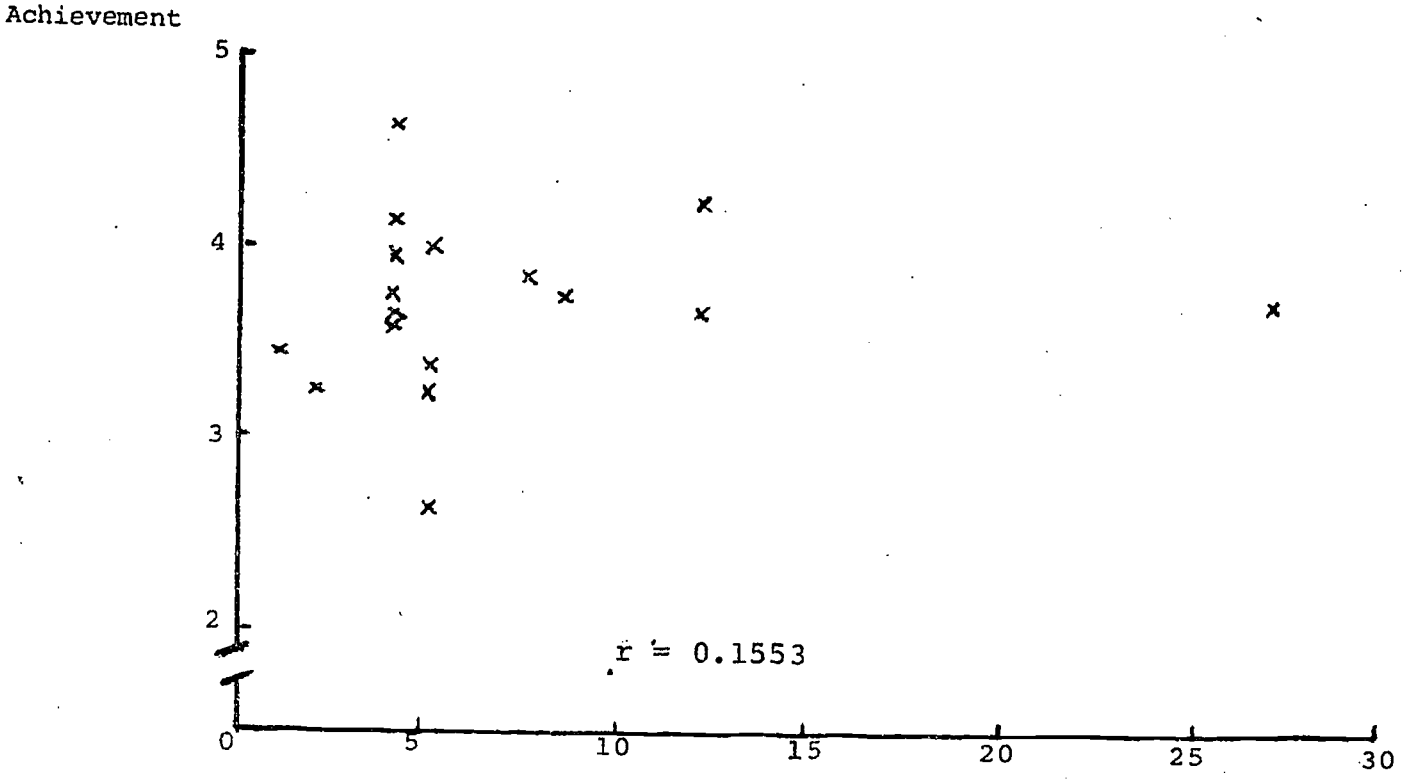
LOWER LEVEL QUESTIONS

FIGURE 3



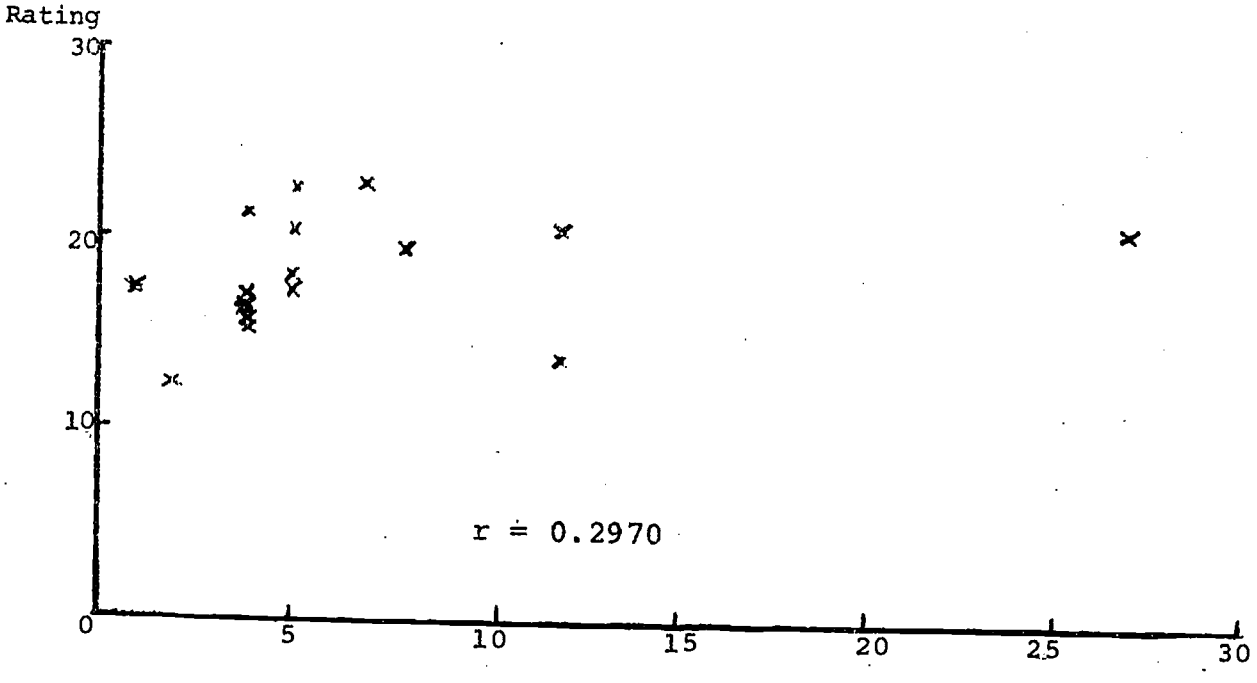
LOWER LEVEL QUESTIONS

FIGURE 4



HIGHER LEVEL QUESTIONS

FIGURE 5



HIGHER LEVEL QUESTIONS

FIGURE 6

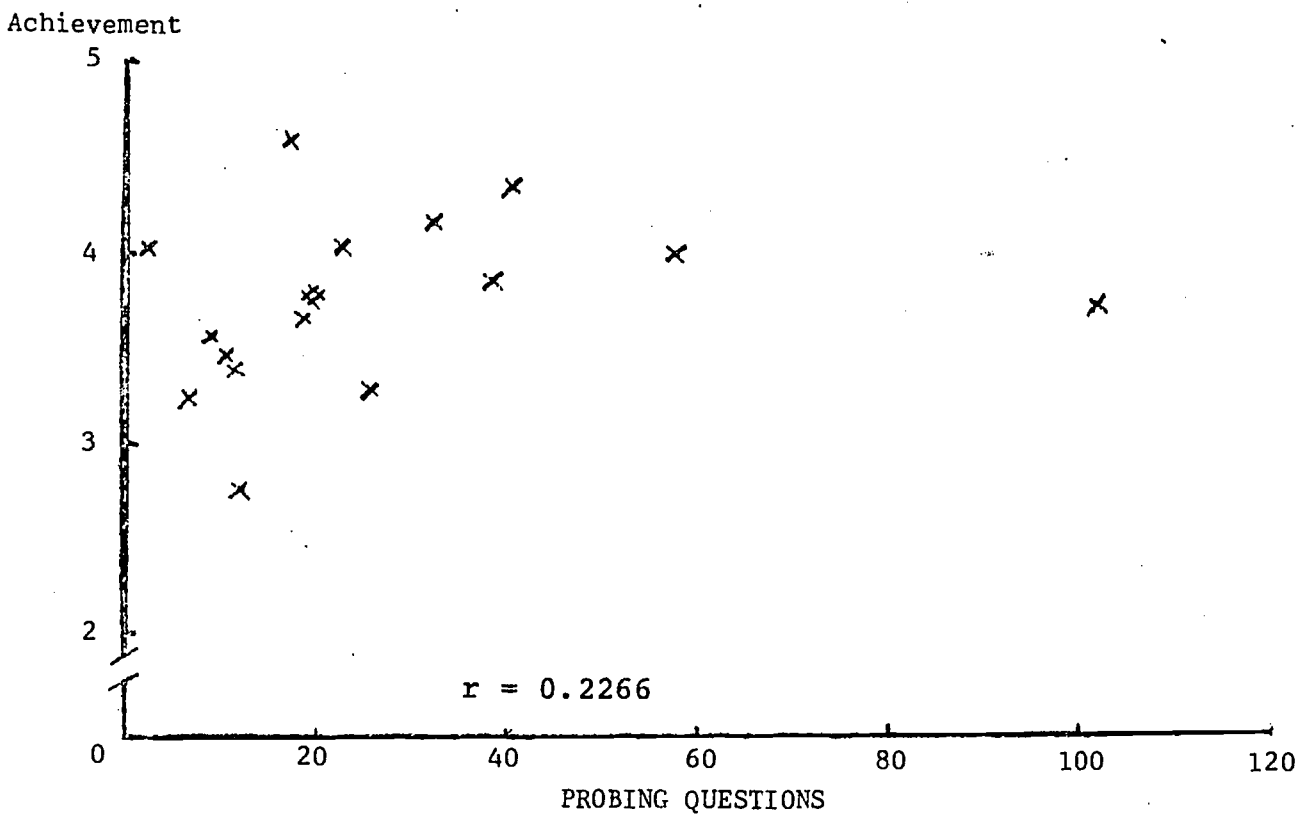


FIGURE 7

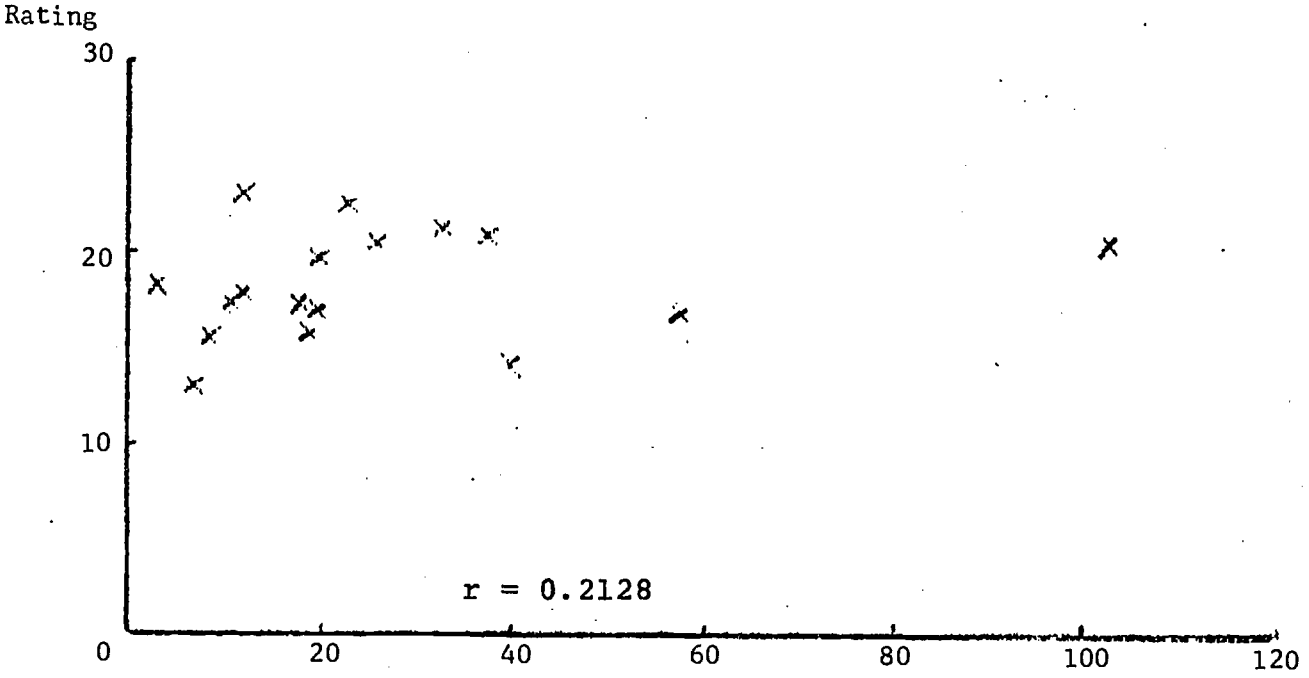


FIGURE 8

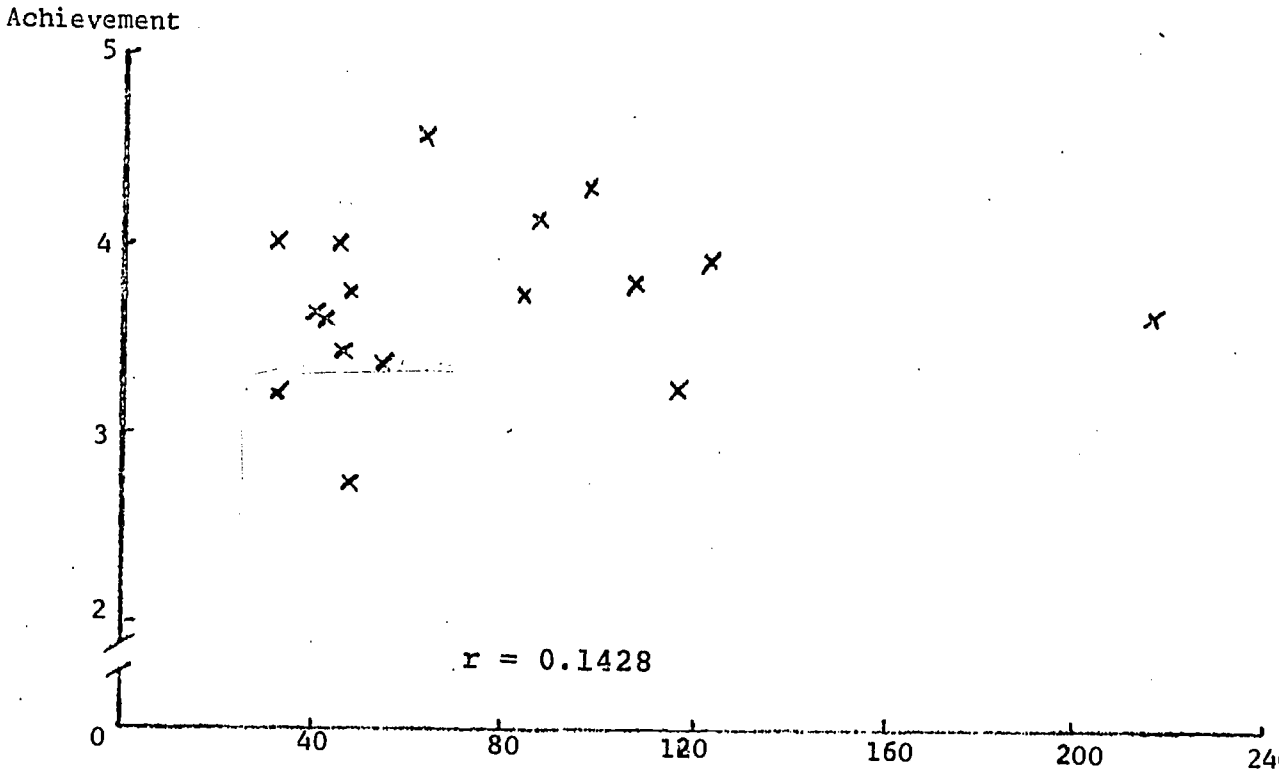


FIGURE 9

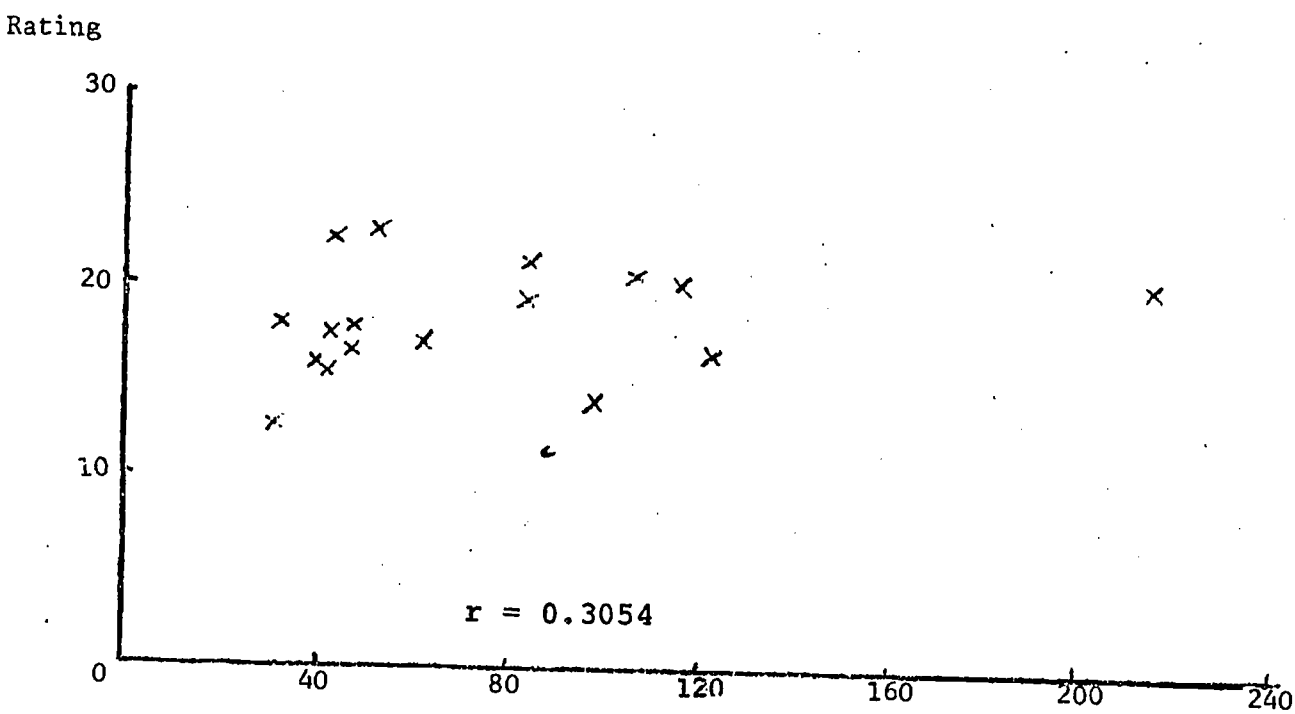
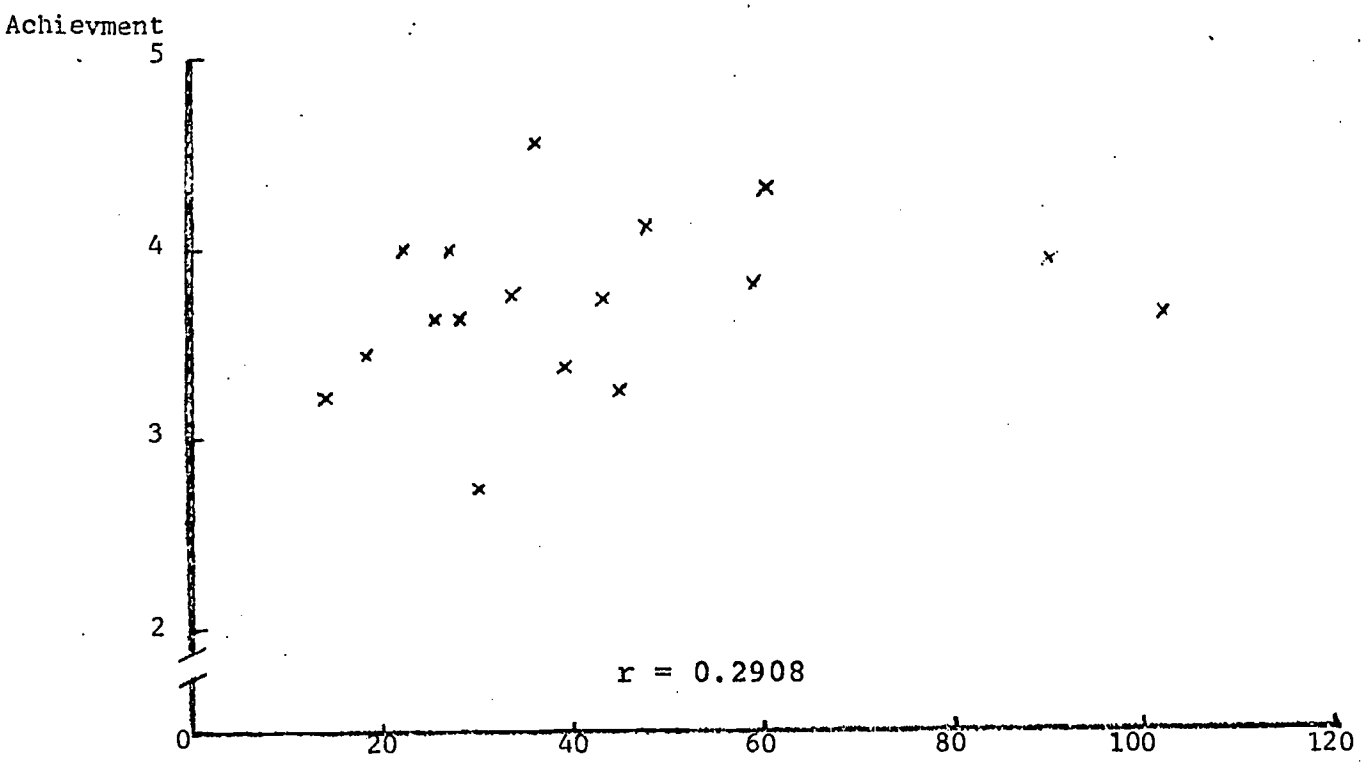
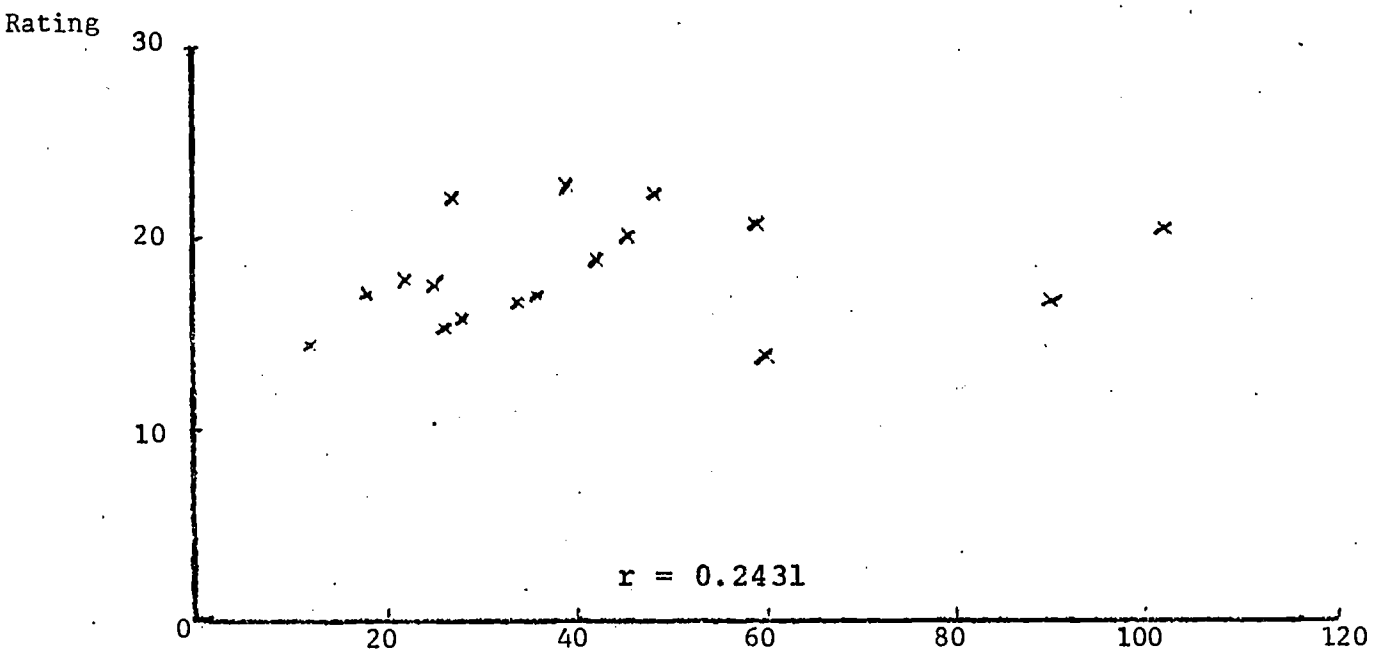


FIGURE 10



POSITIVE VERBAL REINFORCEMENT

FIGURE 11



POSITIVE VERBAL REINFORCEMENT

FIGURE 12

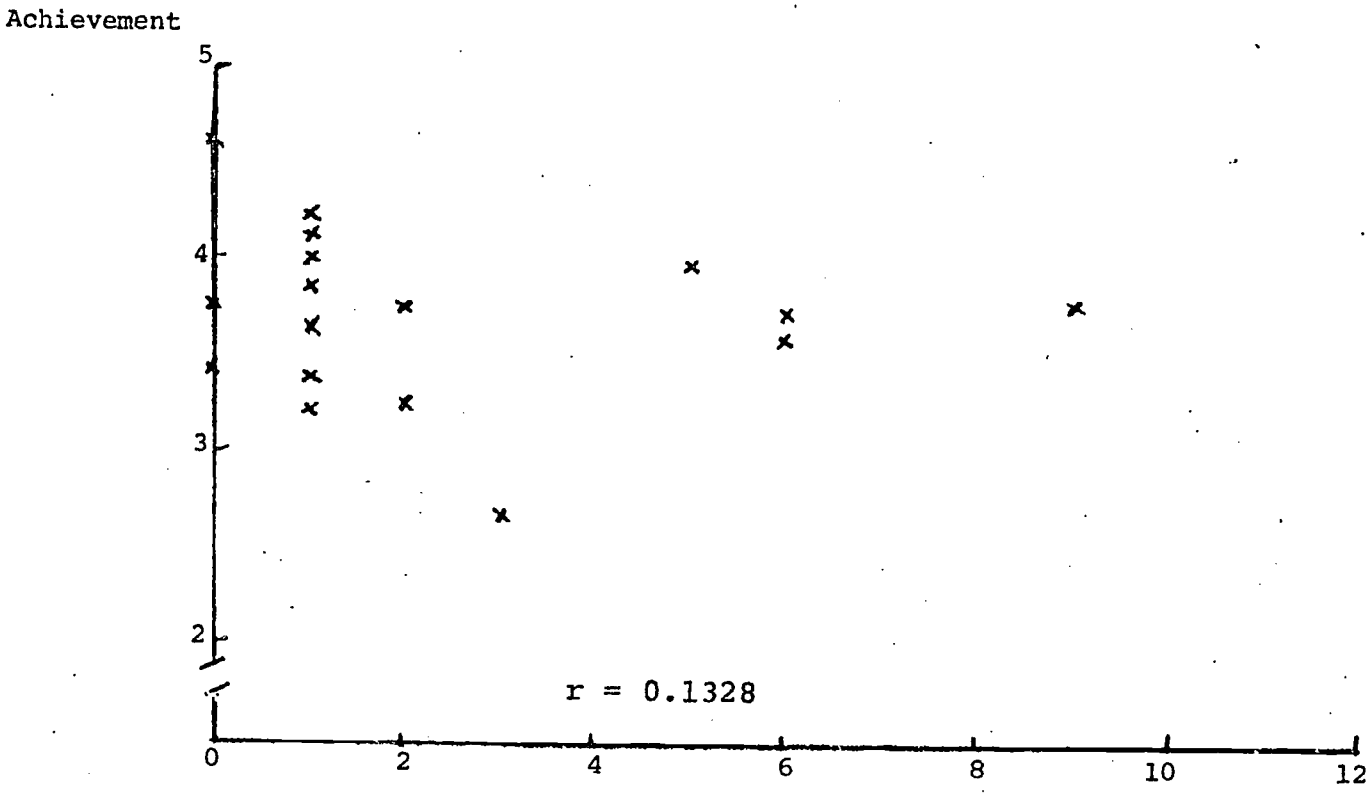


FIGURE 13

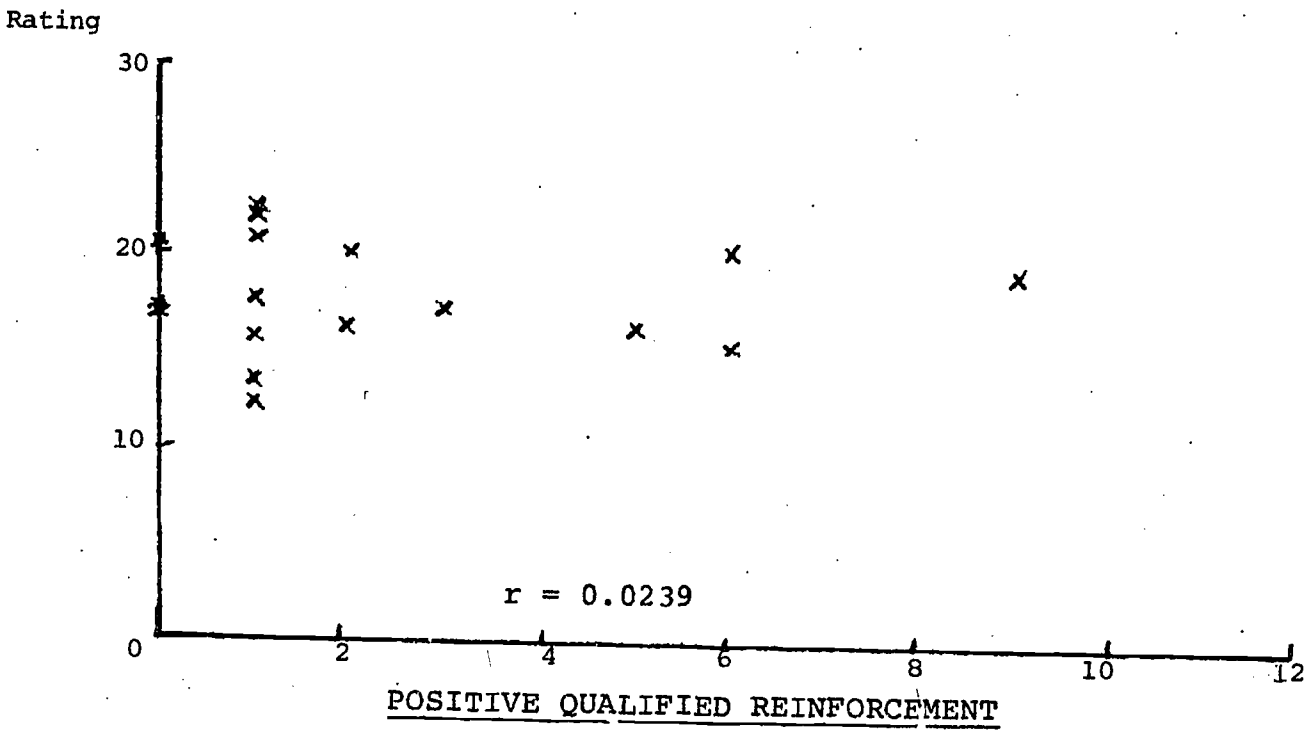
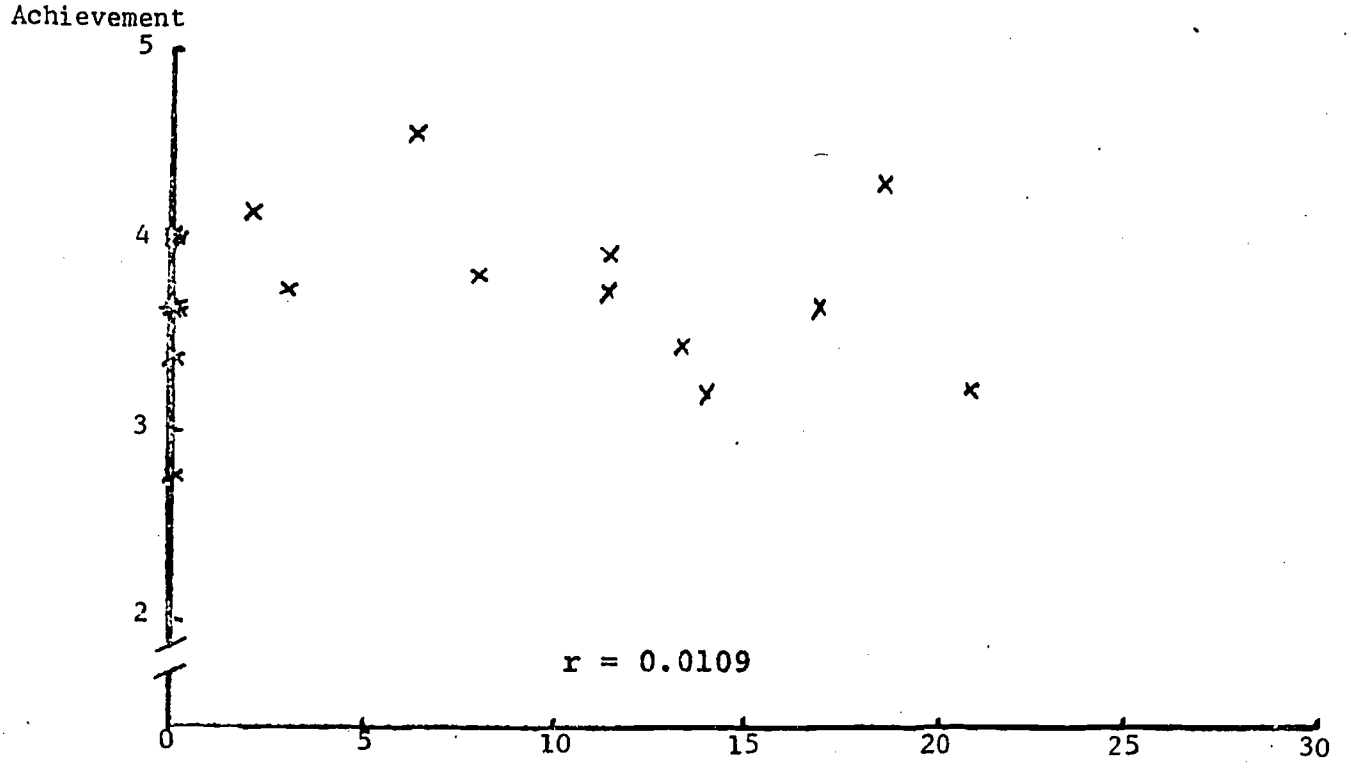
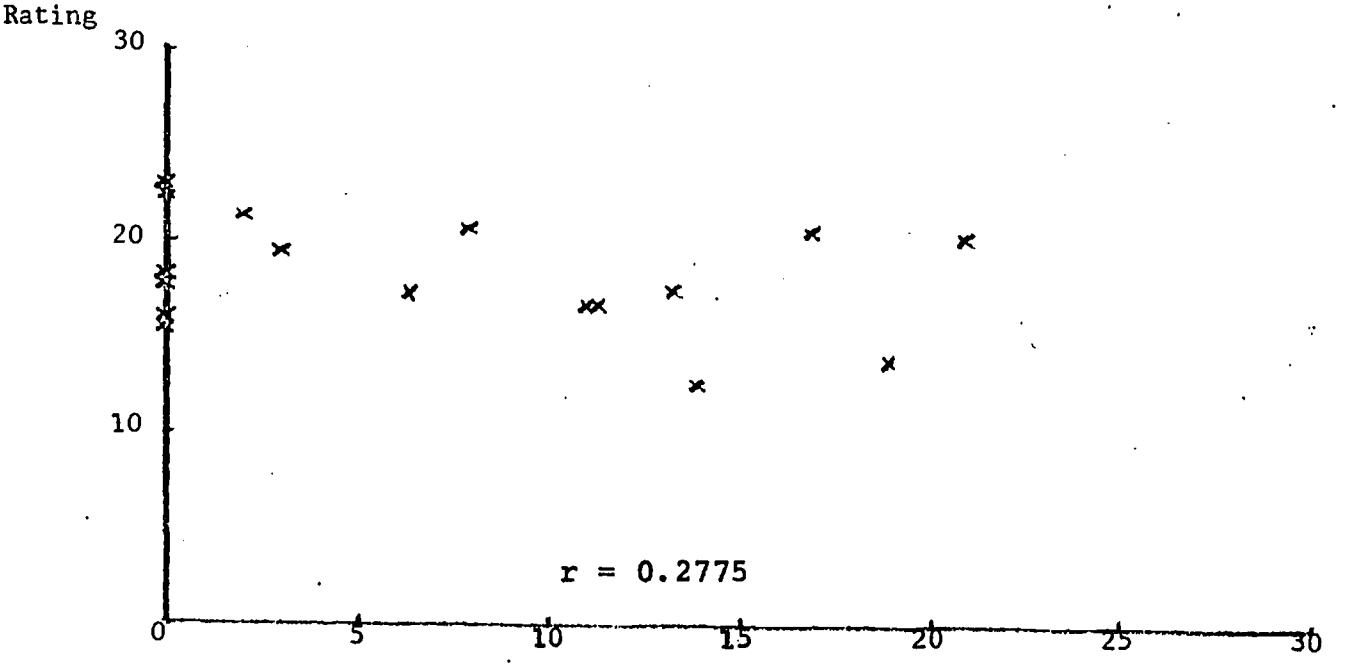


FIGURE 14



NEGATIVE VERBAL REINFORCEMENT

FIGURE 15



NEGATIVE VERBAL REINFORCEMENT

FIGURE 16

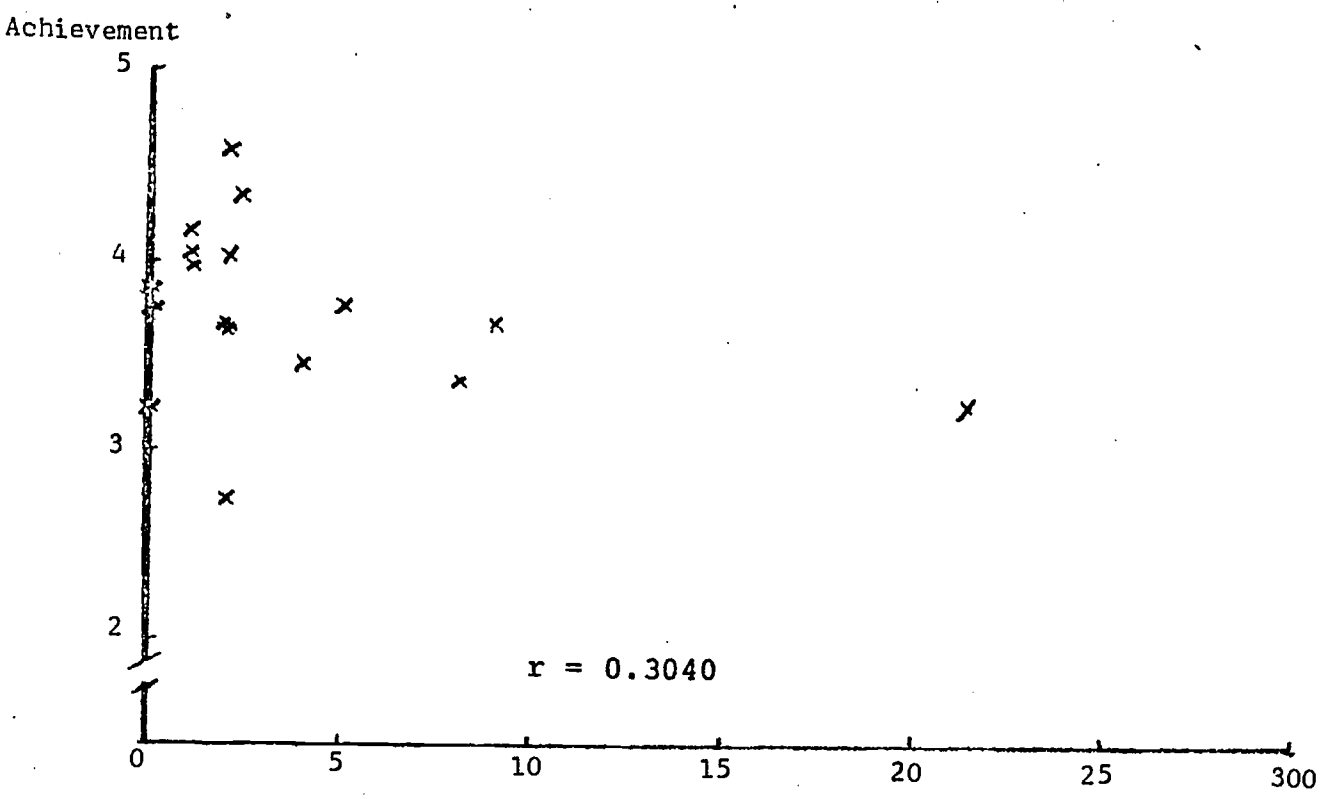


FIGURE 17

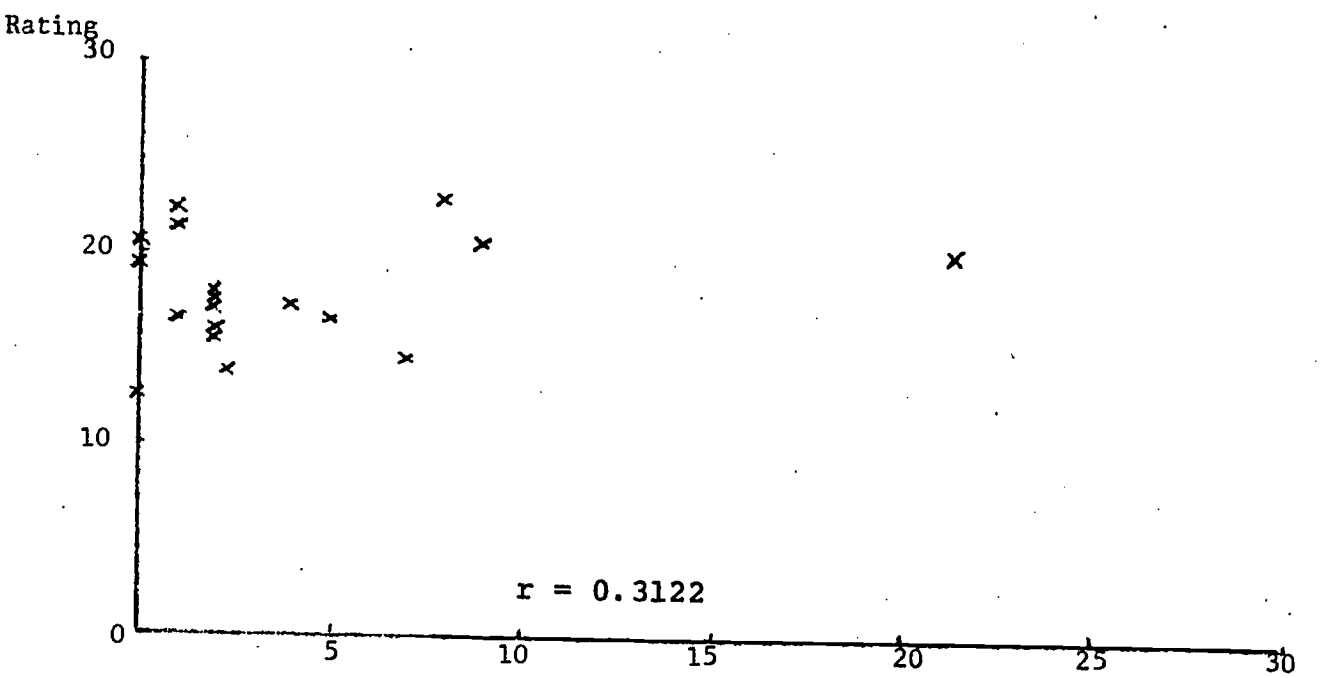


FIGURE 18

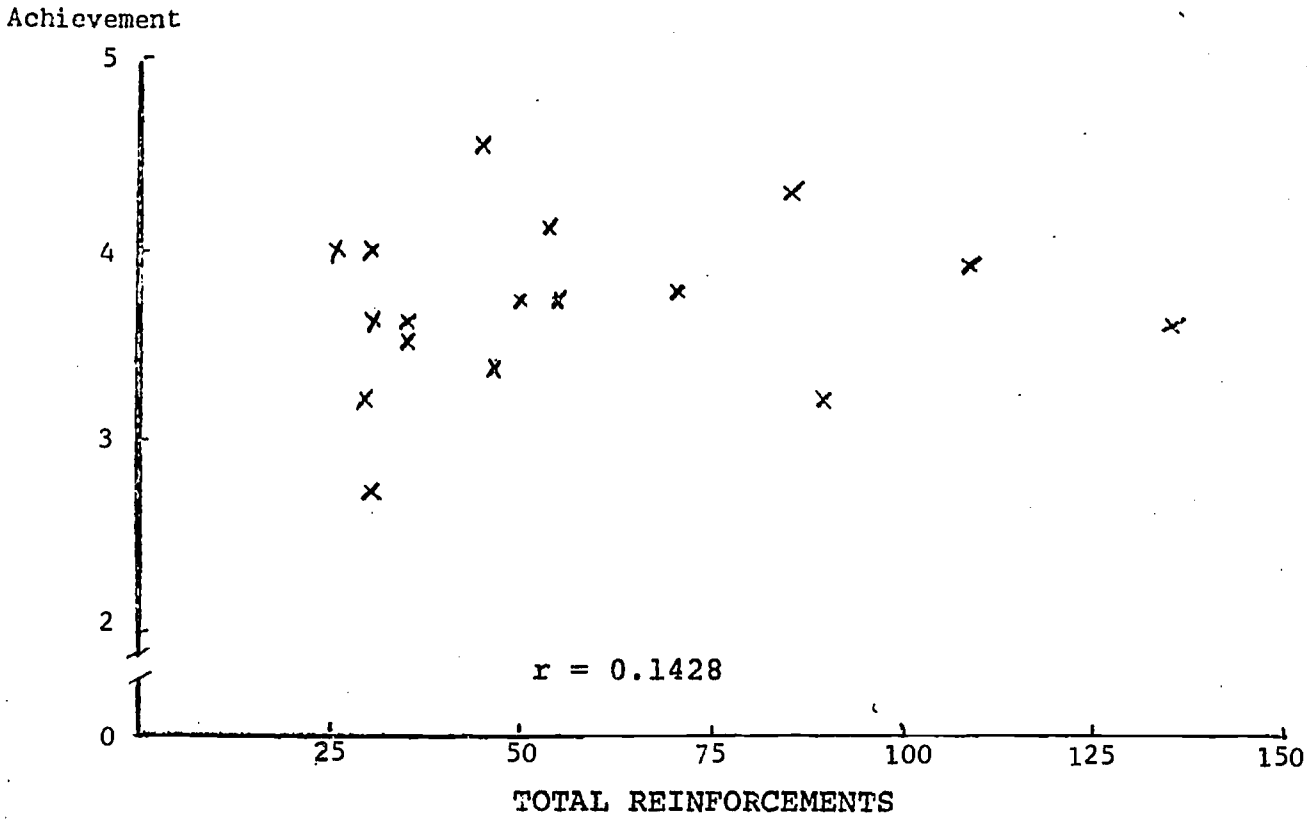


FIGURE 19

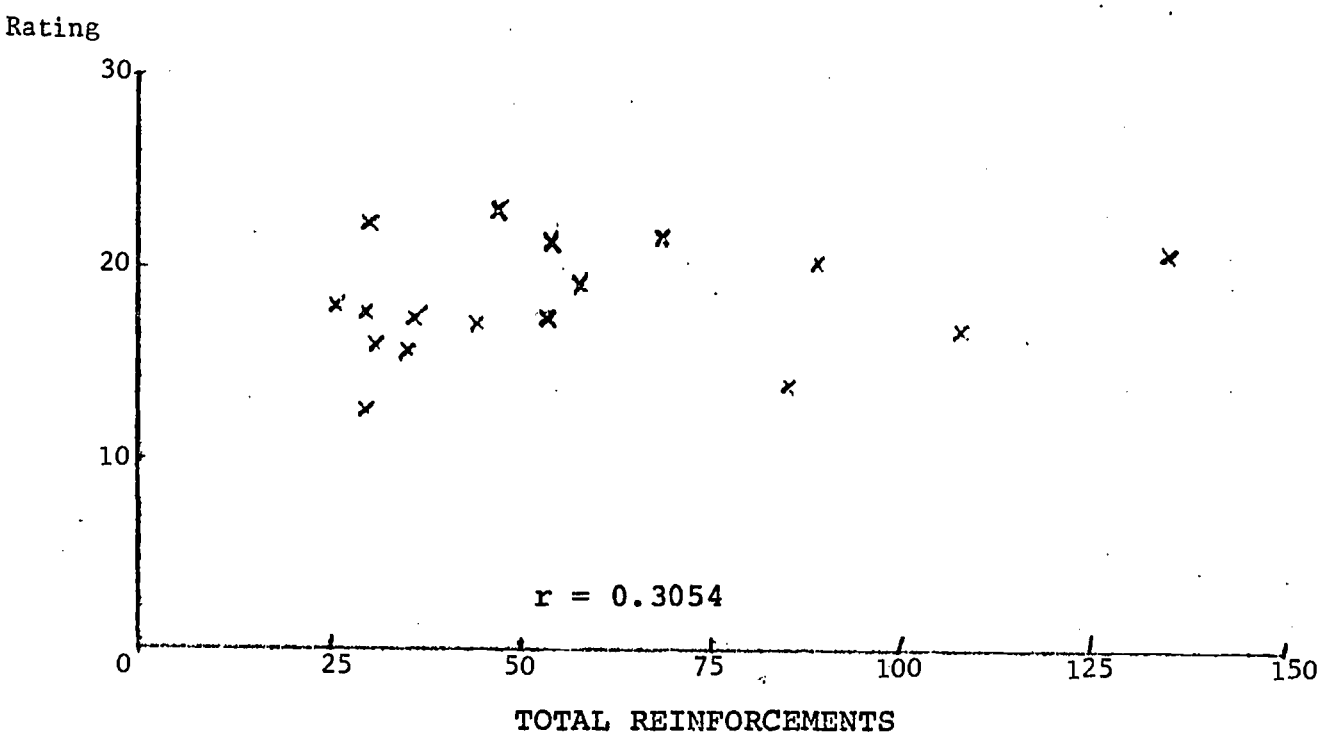


FIGURE 20

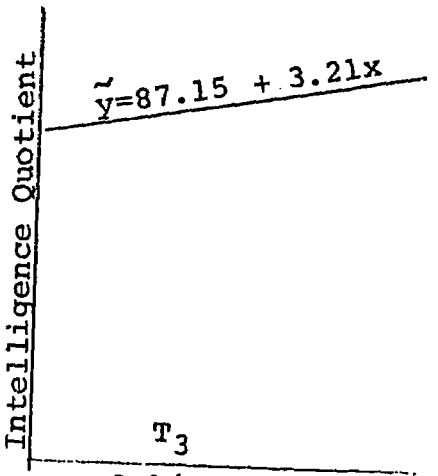


Figure 21

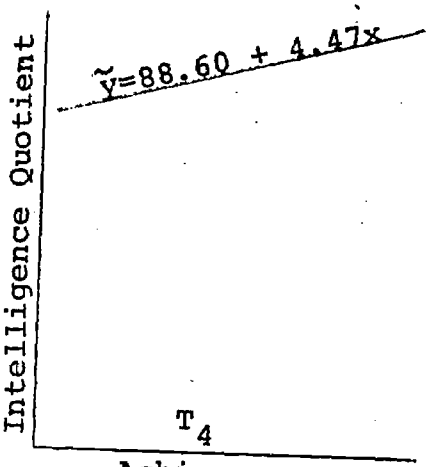


Figure 22

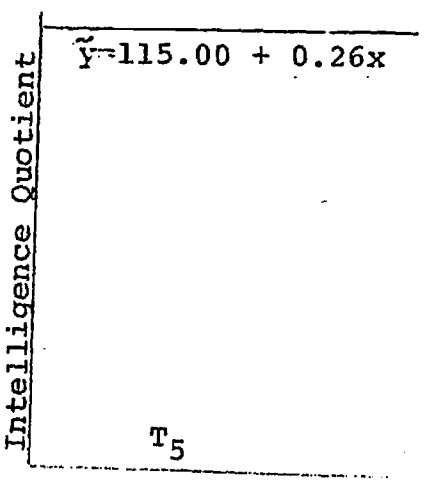


Figure 23

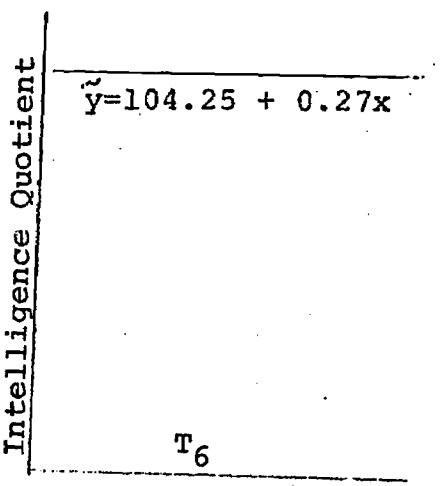


Figure 24

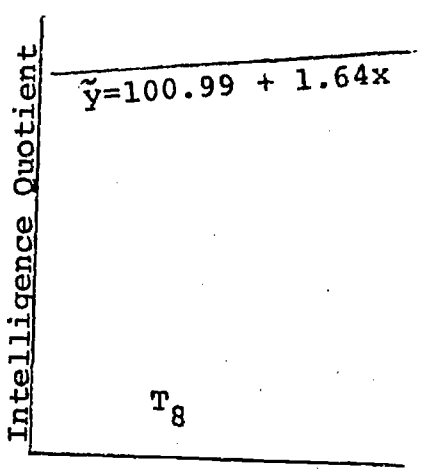


Figure 25

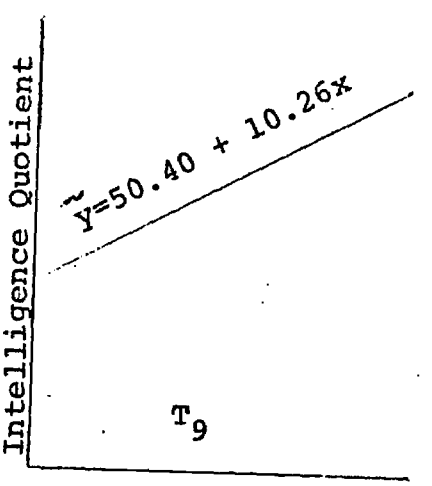


Figure 26

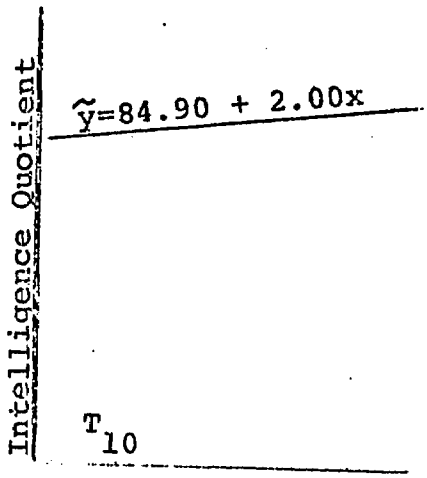


Figure 27

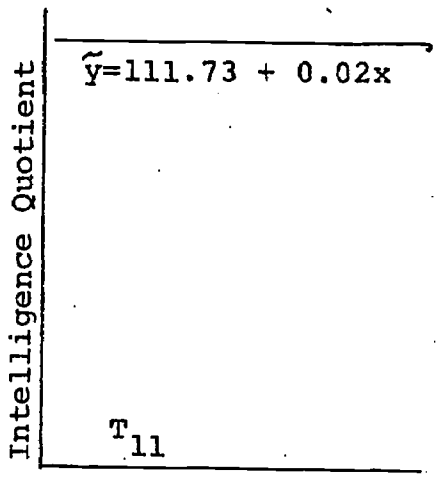


Figure 28

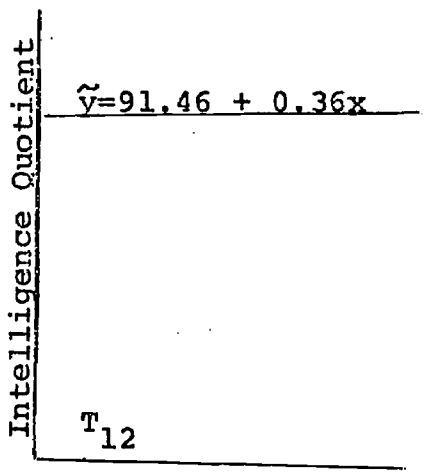


Figure 29

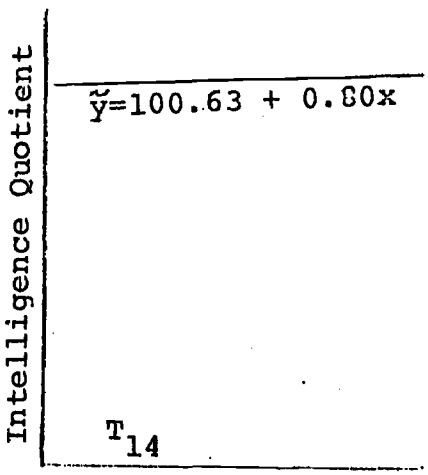


Figure 30

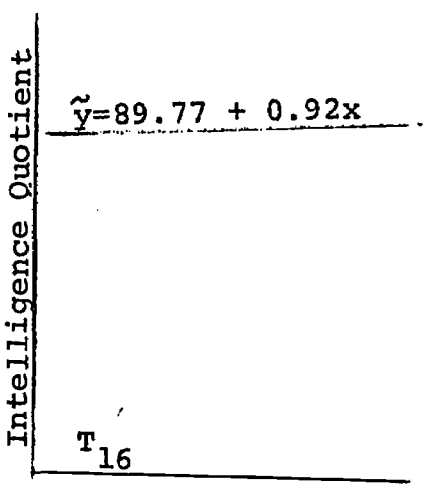


Figure 31

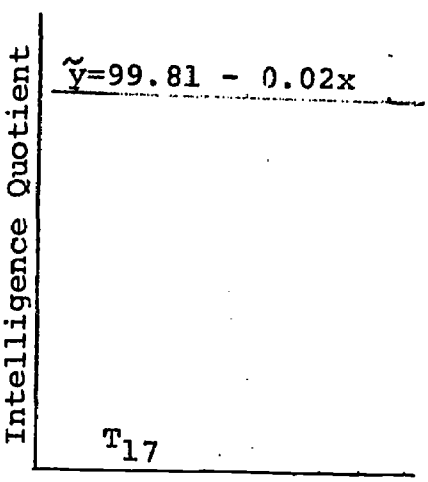


Figure 32

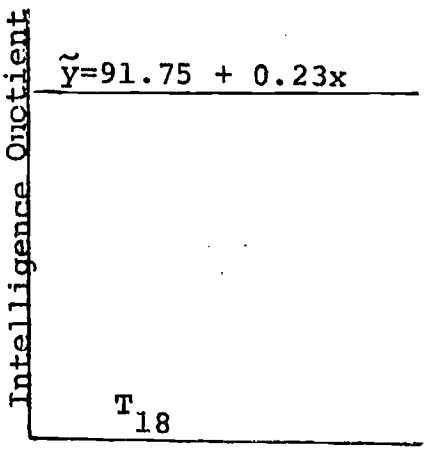


Figure 33

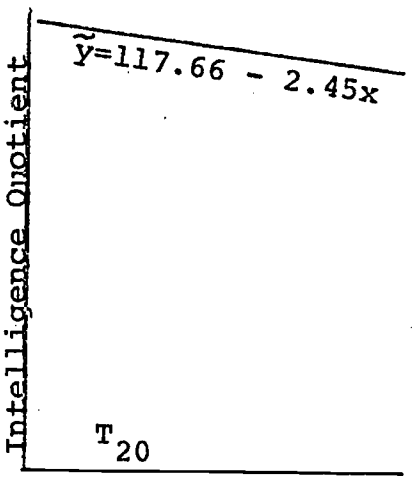
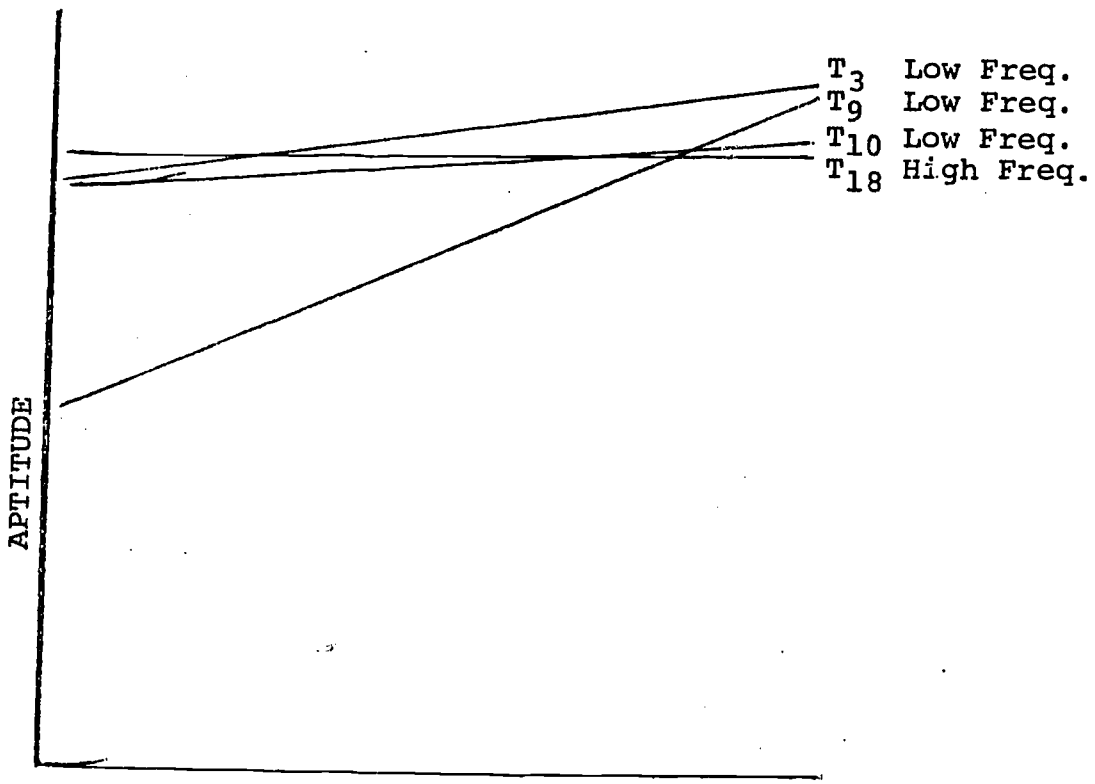
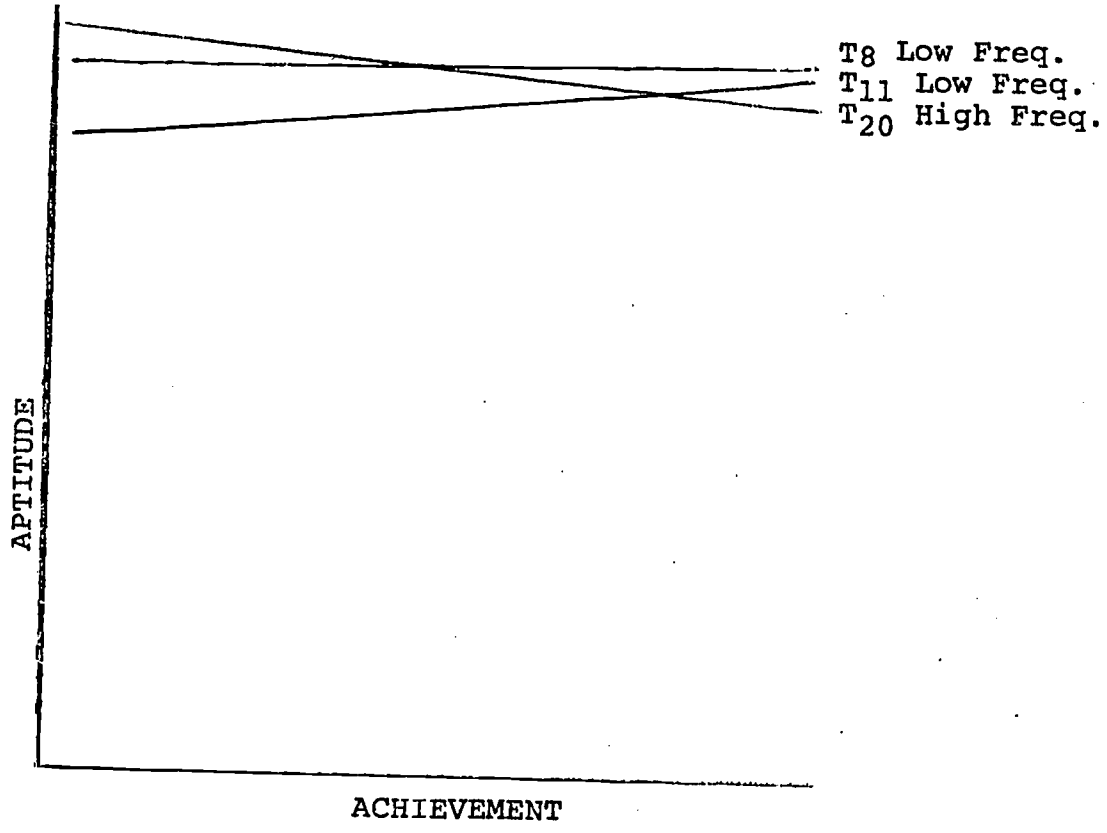


Figure 34



High and Low Frequency Teachers
Questioning and Positive Reinforcing Behavior

Figure 35



High and Low Frequency Teachers
Negative Reinforcing Behavior

Figure 36

TABLE 1

DEFINITION OF TEACHING EFFECTS

Criteria	High Rating	Average Rating	Low Rating
High Achievement	1	1	3
Average Achievement	1	3	2
Low Achievement	3	2	2

Notes: 1 = High effects
2 = Low effects
3 = Medium effects

TABLE 2

COMPARISON OF GROUPS RECEIVING LESSON
AND NOT RECEIVING LESSON

	Control No Lesson	Total Sample	Pilot Sample	
Number	90	303	33	
Mean	2.67	3.74	3.24	
Variance	1.60	2.40	2.12	
Reliability	0.33	0.77	0.58	
t		6.68		$p < .001$
t		2.13		$p < .05$

TABLE 3

INTERCORRELATION OF ITEMS ON ACHIEVEMENT TEST
(N = 303)

Item	1	2	3	4	5	Sum
1	1.0000					
2	0.2160	1.0000				
3	0.5052	0.5752	1.0000			
4	0.2934	0.2602	0.4045	1.0000		
5	0.4271	0.4807	0.4268	0.5042	1.0000	
Sum	0.6361	0.7105	0.7937	0.6997	0.7864	1.0000

TABLE 4

INTERCORRELATION OF ITEMS ON RATING SCALE
(N = 300)

Item	1	2	3	4	5	6	7	8	9	10	11	12	Sum
1	1.0000												
2	0.1715	1.0000											
3	0.2741	0.2962	1.0000										
4	0.2683	0.0927*	0.1158*	1.0000									
5	0.2160	0.2403	0.4286	0.1734	1.0000								
6	0.2183	0.1804	0.3472	0.1440*	0.2048	1.0000							
7	0.3198	0.3183	0.2925	0.2254	0.2750	0.1481*	1.0000						
8	0.3053	0.3407	0.3043	0.2044	0.2777	0.2483	0.3478	1.0000					
9	0.3153	0.2007	0.2859	0.2069	0.3379	0.29[illegible]	0.2759	0.2788	1.0000				
10	0.1944	0.2067	0.2943	0.1256*	0.2709	0.3265	0.1849	0.2221	0.2499	1.0000			
11	0.3575	0.2087	0.2489	0.2521	0.1902	0.1984	0.3588	0.2774	0.1951	0.1708	1.0000		
12	0.3854	0.3159	0.4433	0.2973	0.3980	0.3452	0.4289	0.4509	0.4331	0.2824	0.4430	1.0000	
Sum	0.5569	0.5316	0.6319	0.4381	0.5734	0.5305	0.6243	0.6136	0.5800	0.5287	0.5519	0.7480	1.0000

*Not significant at $p < .05$

TABLE 5

ACHIEVEMENT BY TEACHER

Teacher	Mean	S.D.	Number of Students	Rank Order by Mean
3	2.64	1.60	14	17
4	3.76	1.68	17	7
5	4.13	1.73	15	3
6	3.58	1.31	12	12
7	4.00	1.49	20	4
8	3.42	1.41	24	13
9	4.63	0.76	19	1
10	3.87	1.32	23	6
11	3.21	2.07	19	16
12	3.75	1.69	16	8
13	3.74	1.54	23	9
14	4.26	0.81	27	2
15	3.95	1.47	20	5
16	3.38	1.94	24	14
17	3.62	1.68	8	11
18	3.22	1.72	9	15
20	3.69	1.60	13	10
Total	3.74	1.55	303	-

TABLE 6

RATING BY TEACHER

Teacher	Mean	S.D.	Number of Students	Rank Order by Mean
3	17.64	4.09	14	9
4	20.69	4.56	16	4
5	21.12	5.10	16	3
6	15.54	2.14	13	15
7	18.00	2.79	20	8
8	17.21	4.24	24	10
9	17.05	2.72	19	11
10	22.22	5.23	23	2
11	12.53	0.84	19	17
12	16.69	1.40	16	12
13	19.46	4.31	22	7
14	13.96	1.78	26	16
15	16.68	2.89	19	13
16	22.83	4.51	24	1
17	16.00	1.16	7	14
18	20.11	3.72	9	6
20	20.54	3.78	13	5
Total	18.16	4.59	300	-

TABLE 7

ASSIGNMENT OF TEACHER TO EFFECTS CELL

ACHIEVEMENT	RATING								
	High			Medium			Low		
	T#	Ach.Sc.	Rating	T#	Ach.Sc.	Rating	T#	Ach.Sc.	Rating
High	5	4.13	21.12	7	4.00	18.00	14	4.26	13.96
	10	3.87	22.22	9	4.63	17.05	15	3.95	16.68
Medium	4	3.76	20.69	13	3.74	19.46	6	3.58	15.54
	20	3.69	20.54				12	3.75	16.69
							17	3.62	16.00
Low	16	3.38	22.83	3	2.64	17.64	11	3.21	12.53
	18	3.22	20.11	8	3.42	17.21			

TABLE 8

NUMBER OF QUESTIONS BY EFFECTS CELL

Achievement	Rating: High T#	High Quest.	Medium T#	Medium Quest.	Low T#	Low Quest.
High	5	85	7	32	14	98
	10	45	9	62	15	123
Medium	4	107	13	86	6	43
	20	218			12	47
					17	40
Low	16	55	3	47	11	33
	18	118	8	45		

	Cell 1, 2 & 4 (High Effects)	Cell 6, 8 & 9 (Low Effects)
Mean Number Questions	91.50	42.50
Variance	4571.50	28.70
N	6	6
t	1.77	$p < 0.15$

TABLE 9

COMPARISON OF TYPE OF QUESTION BY
HIGH AND LOW EFFECTS

Type of Question	High Effects		Low Effects		Difference		
	Mean	S.D.	Mean	S.D.	Mean	t	Significance Level p <
Rhetorical or Non-related	20.33	12.11	10.67	3.88	9.66	1.86	0.15
Lower Order	24.83	19.15	15.33	4.93	9.50	1.18	0.30
Higher Order	9.83	8.93	3.33	1.51	6.50	1.76	0.15
Probing	38.50	35.26	13.17	4.79	23.33	1.61	0.20
Total Questions	91.50	67.62	42.50	5.35	49.00	1.77	0.15

TABLE 10

CORRELATION OF ACHIEVEMENT AND RATINGS
WITH OTHER VARIABLES
(N = 15 Teachers)

Independent and Control Variables	Dependent Variables	
	Achievement	Rating
Number of Reinforcements	- 0.1374	0.0764
Number of Questions	0.2406	0.4144
IQ	- 0.2143	0.1093
Multiple R	0.3594	0.6379

TABLE 11

NUMBER OF REINFORCEMENTS BY EFFECTS CELL

Achievement	Rating					
	High		Medium		Low	
	T#	Reinf.	T#	Reinf.	T#	Reinf.
High	5	53	7	26	14	85
	10	30	9	44	15	108
Medium	4	69	13	55	6	35
	20	135			12	52
					17	31
Low	16	49	3	30	11	29
	18	89	8	36		

	Cell 1, 2 & 4 (High Effects)	Cell 6, 8 & 9 (Low Effects)
Mean	59.50	35.50
Variance	1612.83	73.10
N	6	6
t	1.67	$p < 0.20$

TABLE 12

COMPARISON OF TYPES OF REINFORCEMENT BY HIGH AND LOW EFFECTS

Type of Reinforcement	High Effects		Low Effects		Difference		
	Mean	S.D.	Mean	S.D.	Mean	t	Significance Level p <
Postive Verbal	49.00	29.30	24.17	7.17	24.83	2.02	0.10
Postive Qualified	1.50	2.26	2.17	2.13	-0.67	-0.52	-
Negative Verbal	4.50	6.86	6.33	7.00	-1.83	-0.45	-
Negative Qualified	2.50	3.27	2.50	1.76	0.00	-	-
Total	59.50	40.16	35.50	8.55	24.00	1.67	0.20
Total Positive minus Total Negative	42.50	22.64	17.50	13.18	25.00	2.34	0.10