

AN ABSTRACT OF THE THESIS OF

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This investigation was designed to determine whether or not the nonverbal behaviors of junior high and secondary school science students could be systematically analyzed. It was further designed to determine what relationship exists between the nonverbal behaviors of students and their attitude. The hypotheses investigated were as follows:

H₁: A valid and reliable instrument for the systematic observation of junior high school and/or secondary school student nonverbal behavior can be developed.

H₂: A significant positive relationship exists between the measured nonverbal behaviors exhibited by high school and/or junior high school students and their attitude toward their teacher and/or their class.

The first phase of the study involved pilot work. Ten video tapes were made of junior high and secondary school students in typical lecture-discussion activity. Student behaviors were recorded in handwritten descriptions, and these descriptions together with results reported in the professional literature were compiled into an instrument designed to systematically quantify student nonverbal behavior.

After the instrument had been completed the researcher administered a questionnaire to 181 students to determine their attitude toward their teachers and courses. From the population of 181 students a sample giving an extreme positive response and a sample giving an extreme negative response to the questionnaire were drawn. From the samples 54 20-minute video tapes were made -- 27 from the positive sample and 27 from the negative sample. The behaviors were then quantified using the instrument designed for that purpose. The behaviors as related to attitude were then analyzed using discriminant function analysis.

The Findings

Hypothesis One was accepted based on the implicit characteristics of the instrument, the nature of its development, and the method of encoding behaviors. The method of development provided a comprehensive catalogue of behaviors based on a sound theoretical framework. The behaviors were actually signs rather than categories which

contributed to precise definitions of each cue and virtually eliminated the need for observer inference when the behaviors were coded. The number of choices an observer was forced to choose among was small, which further contributed to coding accuracy. Finally, time sampling with a short time interval was used which prevented the "loss" of an appreciable number of behaviors, and generally high coefficients of inter-observer agreement were obtained, which contributed to the instruments objectivity. These factors argue cogently for the instrument's validity and reliability. Thus, Hypothesis One was accepted based on the arguments cited.

Hypothesis Two was completely accepted in all cases. Two different data measures were analyzed for the entire sample with both measures showing highly significant relationships ($p < .005$ for most cases) between attitude and nonverbal behaviors. In addition a selected subsample was analyzed as a check against a possible bias in the sampling procedure. The results of the final analysis strongly supported the results obtained from the total sample.

In sum the following variables were found to be significantly related to positive attitude toward the teacher. (1) Gaze direction toward teacher, (2) Taking notes, (3) Smiles, (4) Interactions with teacher, and (5) Frequency of raising hand. Positive attitude was found to be weakly related to (6) Forward lean, and (7) Object manipulation. Negative attitude was found to be related to the following

variables. (1) Head on hands (or fist) with hands on desk, (2) Eyes closed, (3) Frequency of yawns, (4) Frequency of negative head shakes, and (5) Frequency of turning head to greater than 90° from immediate. A weak relationship was found between negative attitude and (6) Supporting head, (7) Self manipulation for girls, and (8) Head down for boys. In each of the cases cited above a weak relationship does not imply statistical insignificance. All variables were significant at .05 and most were significant well beyond .005.

The results of the study support findings reported in the professional literature by Hall, Mehrabian, and Rosenfeld.

A COMPARISON OF STUDENT AFFECT AND
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A COMPARISON OF STUDENT AFFECT AND KINESIC BEHAVIORS

I. INTRODUCTION

They seemed almost, with staring on one another, to tear the cases of their eyes; there was speech in the dumbness, language in their very gestures; they looked as they had heard the world destroyed.

--Shakespeare, Winters Tale

The above quote relates to a form of communication held only in tacit awareness by most professional educators. Teaching is acknowledged to be a process of communication, and teaching is assumed to be a positive force in student learning -- the most fundamental objective in education. Victoria (1970) has stated, "The process of education is a communication process, not only in that sense of transmitting knowledge but more particularly as it relates to interpersonal communication behaviors " (p. 4). Communicators most continually make judgements during the actual process of communication as to how successfully they are communicating. In face-to-face communication settings the communicator has information feeding back to him from the audience while he is communicating. In a two-person setting immediate feedback is often possible. Even in small group situations at least occasional feedback is possible, but in general, as the audience becomes larger the communicator must base judgements of communication success on less and less immediate verbal feedback.

Similarly, teachers as communicators must continually make judgments as to how successfully they are communicating. Jecker, Maccoby, and Breitrose (1964) have stated

... while as a teacher is addressing a sizeable class of students, verbal feedback is likely to be severely limited, and the teacher is largely dependent upon non-verbal information from students, such as facial expressions and other bodily movements, when judging the effects of his communications. (p. 393)

It is the teacher who must be most fundamentally concerned with assessing indicators which have communicative properties, because it is he who is in nearly continual contact with students, and it is he who is the most salient influence in the students' total learning environment. However, Jecker, Maccoby, and Breitrose have stated, "Clearly visual feedback cues to live communicators in the one-to-many-to-one situation, e. g., the ordinary classroom, are not accurately interpreted. Yet verbal cues from students are usually either largely or totally absent in such situations" (p. 397). They have further said, "Since greatly increased verbal feedback is not feasible under normal classroom conditions, any method for substantially improving teacher accuracy in the interpretation of nonverbal feedback cues would be of value" (p. 397). The above statements are certainly not surprising since virtually no data beyond individual teacher intuition exist in the area of student nonverbal behavior. This component of the total classroom structure has been virtually uninvestigated. It

follows that teachers will have a difficult time determining whether they are communicating by assessment of student nonverbal behavior if they have no knowledge of typical student nonverbal behavior and/or if it is absent.

The previous statement together with the lack of any appreciable empirical data with reference to student nonverbal behaviors suggests a need for a natural history type investigation in the area. Jacobson (1970) has said of research in science education in general:

If fields of research pass through stages of evolution, there would be general agreement that education is at an early stage of development. One of the early stages in most fields of science is the natural history stage in which a great deal of effort is expended on the description of phenomena. These descriptive studies make possible the development of classificatory systems and eventually postulations which can serve as a basis for hypothetico-deductive studies. (p. 221)

He has also said:

A disturbingly large number of science education studies have reports of no significant differences. . . . To design an experiment in which one variable among many influential factors is manipulated over a period of a year or less, to collect data using one of the few instruments available, and to expect significant differences to occur is unrealistic and possibly undesirable. The effect of the one variable manipulated over 75 hours or less in a classroom setting where there may be many more potent influences at work is miniscule when contrasted to the bank of experiences that even young children have had in the past. (p. 219)

The citations suggest a possible need for a reorientation in the research emphasis in science education. It does not seem reasonable

to expend considerable time, effort, and money in an attempt to change the behavior of students or teachers if no accurate record of typical behavior, which can be used as a reference frame, exists.

The cited work of Jecker, Maccoby, and Breitrose considered the teachers' ability to assess student comprehension, and hence, lies in the cognitive domain. It has been found further (Raymond, 1971) that teachers do not accurately interpret students' attitude toward them as a person or toward the class the teacher is teaching. This all means that the teacher is relatively uncertain as to whether or not communication is actually taking place.

Previous studies have considered student behaviors unimportant, too difficult to measure, beyond the scope of the particular study, or isomorphic to teacher behaviors. The picture of the classroom environment is incomplete without information concerning student behaviors, and until a complete picture is obtained, it will be difficult to make valid inferences about the total learning environment. Inasmuch as the entire area of student behavior and particularly nonverbal behavior shows an extreme paucity of educational information, a definite need for substantial research in this area exists.

The Problem

As has been pointed out in the previous section, a definite lack of data exists in the educational body of knowledge with respect to the

components that make up the classroom environment. There is a particular shortage of empirical data that relates to the behavior of students, and of primary importance is the kinesic or nonverbal component of student behavior. The nonverbal channel is of primary importance because it is through this channel that the teacher receives most of the student feedback. At a time in science education and education in general when students' attitude toward their teachers and courses is receiving considerable emphasis, the ability of a teacher to evaluate nonverbal feedback becomes very important, and the teachers must have some information to work with in order to assess the feedback. Thus, the lack of data with respect to student nonverbal or kinesic behavior constitutes a problem for science educators.

The approach to the solution of the problem is twofold. The researcher initially attempts the development of an instrument that will allow the systematic observation of kinesic behaviors in students of junior and senior high school age. Kinesics has been defined as the "science of body behavioral communication." "... Communication is a term used to describe the structured dynamic processes relating to the interconnectedness of living systems" (Birdwhistell, 1969, p. 379). Further, Birdwhistell in the same paper said, "Research with visible body motion is convincing us that this behavior is as ordered and coded as is audible phonation" (p. 380). Scheflen (1968) stated in critically reviewing Birdwhistell's work, "Not only is

language structured in a hierarchy of levels, but Birdwhistell (1952, 1959, 1967) has shown an analogous morphology for kinesic or bodily movement actions" (p. 46). Scheflen (1964) has also said:

Although there are many who still believe that nonlexical communicative behaviors -- such as postures -- are individual, unique, expressions which occur in an infinite variety of forms, our research leads us to quite another view: Such behaviors occur in characteristic, standard configurations, whose common recognizability is the basis of their value in communication. That those behaviors are regular, uniform entities within a culture tremendously simplifies both research into human interactions and the practical understanding of them. (p. 316)

The work of the investigators cited suggests that kinesic behaviors would be amenable to investigation in a real situation, e. g., the classroom.

Hence, the study's first general hypothesis logically follows:

Kinesic behavior can be systematically observed and categorized.

The cited work of Scheflen and Birdwhistell and the latest writing by Birdwhistell (Kinesics and Context, 1970) indicate that the general hypothesis can be accepted. This leads to the first specific hypothesis:

H₁: A valid and reliable instrument for the systematic observation of junior high school and/or secondary school student nonverbal behavior can be developed.

The criterion used to determine whether or not the hypothesis can be accepted is whether or not the instrument to be devised meets the requirements of a valid and reliable observation instrument. The researcher demonstrates the validity and reliability of the instrument

by results such as sufficiently high coefficients of interobserver agreement, lack of inference, and precise definitions.

At this natural history stage of investigation it would be inappropriate to evaluate student or teacher behaviors, and hence, no judgments of this type are made. The integrity and anonymity of the students and teachers are preserved.

The second phase of the study attempts to systematically measure the kinesic behavior of a selected group of students and relate these observed behaviors to predetermined attitudes of the students toward their teacher. The attitudes of the students can be determined by an adaptation of the "semantic differential scale" (Osgood, Suci, and Tannenbaum, 1957). This technique has been used by Mehrabian for much of his research, and he used this method for the determination of attitudes in the examples of his work cited in Chapter Two.

Hence, the second general and second specific hypothesis respectively follow:

A significant positive relationship exists between kinesic expression and positive, or negative affectivity.

H₂: A significant positive relationship exists between the measured nonverbal behaviors exhibited by high school and/or junior high school students and their attitude toward their teacher and/or their class.

The criterion used to determine whether or not the hypothesis can be accepted is the statistical analysis of the obtained data and the appropriate interpretation of the results.

Thus, the purposes of this study are as follows:

1. To develop a reliable observation instrument which will allow systematic observation and quantification of student nonverbal behavior in the classroom context.
2. To determine the relationship between manifested student non-verbal behaviors and the attitude that students have toward their teachers and/or their classes.

Assumptions

The following assumptions are inherent in this study:

1. All body movement and expression have meaning within a specific context.
2. Student nonverbal behaviors are not random and are amenable to study.
3. Behavior representative of a subject's attitude is exhibited in spite of efforts to conceal the behavior due to some outside force.
4. Attitudes are not subject to capricious change.

Definition of Terms

1. An addressee is a person toward whom a verbal or nonverbal message is directed in any interaction. If A and B are talking, and A says something to B, B is then the addressee. Receiver

is also used as a synonym for addressee.

2. A channel is any one of several modes of communicating some message. For example, a person speaking would be utilizing both a verbal and vocal channel where the spoken words would be verbal, and the intonation would be vocal. A grimace would be an example of the use of a kinesic channel.
3. • A category refers to a class or division into which specific behaviors are classified. Categories are mutually exclusive.
4. A sign denotes a specific act or incident of behavior, e. g. , a particular gesture.
5. • A category system is defined as follows: "...a set of categories into one and only one of which every behavior of a certain type can be classified" (Medley and Mitzel, 1963, p. 298).
6. Systematic observation refers to the first-hand quantification of student behavior using a device such as a category system or a sign system or combination of both.
7. • A communicator is an individual involved in an interaction. A communicator is thus involved in sending and receiving verbal and nonverbal messages.
8. • Nonverbal behavior is that segment of behavior other than the use of oral language. It includes anything done which could be construed as communicating some meaning.

9. • Coefficient of inter-observer agreement refers to the agreement between scores based on observations made by different observers at the same time.
10. • An observation instrument is a measuring device which can be used to record and quantify behavior such that techniques like statistical analysis can be later employed.
11. Inconsistent communication denotes a multichanneled message from a communicator in which the message in one channel contradicts the message sent in a different channel. An example would be a verbal castigation while the communicator is smiling and exuding warmth.
12. • Classroom environment refers to the totality of influences to which an individual is subjected. It includes teacher and student verbal and nonverbal behavior, the physical setting of the room and any other outside influences which could have a significant effect on the total structure.
13. • An encoder is merely a communicator sending a message. The code could be something such as a learned verbal language and the encoding is done when the communicator forms the appropriate verbalizations, or the code could be a culturally developed set of body signals.
14. Encoding experiment refers to an experiment in which the experimental subject is asked to send a message related to his

attitude to a real or imagined addressee.

15. Decoding experiment refers to an experiment in which the experimental subject is asked to infer the encoder's attitude from the message sent by the encoder.
16. • The word coding is used two different ways in the present study. When a person makes a statement, he is coding his message in the form of sound language symbols. Similarly, when an individual manifests conscious or unconscious nonverbal behaviors, he is encoding the message in the form of nonverbal symbols (discursive or nondiscursive).

The word coding* is also used to describe the process a researcher undergoes to quantify a behavioral pattern. For example, a particular behavior, when observed, will be recorded on a tally sheet by means of an arbitrary symbol necessarily meaningful only to the researcher. The context of the writing should make the meaning clear, but the asterisk is included to ensure lucidity.

17. • Immediacy denotes the directness of orientation of one communicator relative to another. Maximum immediacy is obtained when the plane bilaterally bisecting the body of the encoder passes through the geometric center of the addressee.
18. • Reliability is defined as inter-observer agreement, which is calculated using the Scott formula for inter-observer agreement.

The coefficient of inter-observer agreement (π) is a ratio expressing the extent to which the observer's agreement exceeds chance compared to the extent to which perfect agreement exceeds chance.

Importance of the Problem

The need for a study of this nature was partially discussed in the introductory remarks, but the following reasons warrant reiteration.

The amount of data that exists in the educational body of knowledge that relates to the nonverbal communication channel is severely limited. Educators do not have a clear picture of the complex communication and interaction process that goes on in the classroom. This type of data could be used as an empirical contribution which could eventually lead to conceptual schemes explaining classroom communication. It does not seem reasonable to design studies which purport to improve the teacher's communication abilities until a clear picture of the communication process exists.

Evans (1968) found that 38.9% of all the behaviors that selected biology teachers exhibited in observed classes was nonverbal, and that the nonverbal behavior proved to be the majority. Hall (1959) has stated, "In addition to what we say with our verbal language we are constantly communicating our real feelings in our silent language -- the language of behavior" (p. 15). Galloway (1967) has said

While we may properly be interested in what the teacher says, does, and feels in the classroom, the more profound pedagogical problem is how the teacher says what he has to say, how he behaves, and how he expresses feelings about self and content. How the teacher communicated his perceptions, motivations, and feelings can be identified with vocal tones, facial expressions, gestures, and action. Such expressions determine in a large measure how pupils perceive the teacher when he is either talking or silent. (p. 5)

Similar statements could be made about the student. Galloway has also stated in the same publication cited above, "To check on the fidelity of verbal statements, persons read the meanings behind non-verbal expressions, for these expressions are heavily relied upon to reveal the authenticity, and genuineness of a message communicated by the sender. . . ." (p. 6).

The arguments suggest that effort should be directed toward the understanding of the very important channel of nonverbal communication.

Mehrabian and Weiner (1967) suggest that in cases of inconsistent communication the nonverbal channel will be the dominant one with the verbal channel becoming subordinate to the nonverbal. This means the nonverbal channel may be interpreted as being the most important for accurate communication. The previously cited work by Jecker, Maccoby, and Breitrose points out that nonverbal feedback cues in the classroom are not accurately interpreted, but at the same time verbal feedback is virtually absent. It has also been said in the same writing

that any method for improving teacher accuracy in interpreting non-verbal feedback would be valuable. A sensitization to the relationship between observable nonverbal behaviors and student attitude would be a positive effect in helping the teacher improve the accuracy of his perceptions of student feedback.

The previously cited work by Jacobson points out the need for more natural history and empirical type investigations until the educational body of knowledge is expanded.

Several trends run through much of the current research done in the area of nonverbal behavior. In nearly every case of encoding experiments the encoder was forced to role-play or had to encode the behavior as a result of his attitude toward an imagined addressee. For decoding experiments the experimental subjects inferred the attitude of some encoder toward them. In many cases the attitude was inferred from still photographs of line drawings. The situations were laboratory situations or laboratory-type situations in nearly every case.

This study would introduce a measure of "genuineness" not existing in the previous experiments by (1) gathering data in a natural setting, and (2) using the students -- having predetermined their attitude -- as encoders, thus eliminating role-playing and imagination as a necessity for encoding experiments.

In summary, the following point out why this study is important:

1. The area of student nonverbal behavior has been virtually uninvestigated.
2. The nonverbal channel may be the strongest indicator of attitude among the several channels of communication.
3. Teachers need feedback to assess the extent to which they are communicating with students, verbal feedback is scarce or nonexistent, and teachers don't accurately perceive nonverbal feedback.
4. A majority of the studies done in the area of nonverbal behavior has been done in clinical or laboratory situations as opposed to a "real world" setting.

Limitations of the Study

1. The study will be limited to the use of available and willing teachers and their classes, and their selection is subject to technical and logistic limitations.
2. The study is limited to the extent to which the adaptation of the "semantic differential scale" gives an accurate indication of the students' attitude.
3. The study is limited to the extent to which classes remain normal under the influence of a video camera in the classroom.

4. The study is limited to studying students in nine classes which were not selected using a random process.
5. The study is limited to the extent that the time sampling technique adequately measures student nonverbal behaviors.
6. The study is limited to the accuracy in measurement and interpretation that are afforded by the researcher's skill and perceptions.
7. The study is limited to the extent that the attitude as measured by the semantic differential scale remains constant throughout the data gathering process.

Delimitations of the Study

1. The study will be concerned only with nonverbal student classroom behaviors and their context.
2. No inference regarding teachers' or students' motives will be made.
3. No attempt to establish causality will be made.
4. No attempt will be made to modify behavior.
5. No attempt will be made to match students according to intelligence, grades, background, etc.
6. The study considers only the lecture-discussion phase of the teaching-learning situation.

Design of the Study

Some details of the study's design are carried out cooperatively with Joseph Kelly who, as part of his own research, is studying the nonverbal behavior of teachers. Cooperative effort took place in the inter-observer agreement phase of the instrument development and in the explication of details of the instrument. The study is conceived alone, the data is gathered alone, and the writing is accomplished singularly.

Initially, school principals in an area with reasonable proximity to Corvallis, Oregon, were contacted by letter, in which the nature of the research was explained, and the needs of the researcher were outlined. The schools were later contacted by telephone, and interviews were arranged for the researcher with the principals and science teachers in the schools. The interview process resulted in a pool of 18 science teachers who were willing to participate in the study.

A total of ten pilot recordings were made of various classes taught by the previously selected teachers. These recordings, each one class period in length, were made using an Ampex model 7500 video tape recorder, compatible camera, and one of three lenses -- 25 mm focal length, 35 mm focal length, or 55 mm focal length.

The pilot recordings were scanned repeatedly and various non-verbal behaviors exhibited by students were noted in handwritten descriptions. These handwritten descriptions, together with the results derived from the review of the literature, were developed into certain categories of nonverbal behavior. Categories from the literature were extracted and adopted in total, modified in keeping with results from the pilot recordings, or deleted. Additional categories were added to extend the completeness of the system with respect to the behaviors noted in the pilot recordings. The effort in this phase of the study resulted in a rough form of the instrument designed to quantify student nonverbal behavior.

The behavioral data were quantified using the time sampling technique with a five-second interval. At the sound of a number, which was pronounced by an audio recorder every five seconds, the researcher would place a symbol on a tally sheet, the symbol representing a particular behavior being manifested by the subject. The process was continued for all categories of the instrument resulting in a quantification of the general nonverbal behavioral manifestations of the student.

The process of coding and quantifying behavior was practiced by the researchers and various problems with interpretation and timing were discussed. The researchers then simultaneously encoded segments of the pilot recordings that had been randomly selected for

the purpose of this phase of the instrument development -- the inter-observer agreement phase. Cases of disagreement were discussed and slight modifications in the categories were made. These modifications resulted in the instrument in its final form (Appendix A). The researchers then independently coded the randomly selected segments and coefficients of inter-observer agreement were calculated using the Scott formula for inter-observer agreement (Scott, 1955). A total of ten five-minute segments were randomly selected and used for the purposes of inter-observer agreement.

The second phase of the study necessitated the identification of study objects. Teachers from the original pool of 18 were again contacted, and arrangements were made for having the researcher again go to the schools. All but one of the teachers selected for the data gathering phase of the study had previously been involved in the original pilot study phase of the work.

Classes from each teacher were selected, and the students were polled to determine their attitude toward their teacher. The class selection depended on time of day, size of room, similarity of objectives and course material to other classes participating in the study, and on any other factor that could prevent the introduction of confounding factors which could influence the behavior of students in the class relative to students in another class used in the study. The study requires one student in each class with a positive attitude toward the

teacher and a student in the same class with a negative attitude. Teacher variances obviously exist with respect to skill, rapport, etc., but this is not seen as a crucial factor by the researcher. The study is interested merely in the students' attitude toward the teacher, whatever his skills may be, and it also wants to measure the students' behavior and how it relates to the attitude, not what there is about the teacher that causes the attitude. Hence, the teacher variable, so critical in many studies, is not a confounding factor in this design. Care was taken to be certain as possible that the attitude is a genuine one. A method of accomplishing this could be to arrange a point scale, e.g., 3 2 1 0 -1 -2 -3, where the representation could be: 3-likes intensely, 2-likes moderately, 1-likes slightly, -1 -dislikes slightly, -2 -dislikes moderately, -3 -dislikes intensely. The above is an adaptation of the "semantic differential scale" used by Osgood, Suci, and Tannenbaum (1957). From the responses on the scale only students responding with 3, or -3 would be selected for observation. The following rationale is germane to the choice of polar responses. Some students who are approval seekers or achievement oriented may feel some compulsion to respond positively in spite of actually feeling negatively toward the teacher, even though the reason for polling would be explained as having no relation to their class work. However, the researcher feels the student is highly unlikely to represent his reaction by responding at the positive pole. Hence, the polar

responses should have a high probability of representing genuine attitude. The researcher also feels that once an attitudinal set has been formed (the set should be formed by the second semester of the school year) it is not subject to capricious change to an extreme extent such that the experimental results would be seriously confounded. The two students per class were seated in close enough proximity so that one camera could cover the two simultaneously.

The two students filmed were unaware that they were the select two. Each student was selected for convenience from the group having similar attitudes. Each group was videotaped repeatedly in normal classroom activity, giving several total hours of observation per attitude. The behaviors were quantified using the developed instrument, and repeated viewing of the tapes allowed the detection and categorization of patterns of behavior manifested by the students.

The behaviors could be measured in different ways. The measurements were made using time intervals which would allow detection and analysis of behaviors that are most prominent with respect to time. Further, behaviors were measured with respect to frequency. Eckman (1957) advocated the use of rate measures of frequency of occurrence as the basic methodological procedure most desirable for measuring nonverbal behavior. He supports his advocacy of the method by using Skinner's concept of probability of action. Skinner (1953) states that the probability of a behavior occurring is highest

for that behavior which has previously occurred most often. Hence, a frequency measure would give an indication of the dominant behavior. Actual length of time of duration of a behavior may not be as indicative of the dominant behavior as the number of times a behavior occurs, or the intensity with which the behavior is exhibited. Hence, the data would yield more meaningful results by the multiple classification procedure. The data were gathered using the classroom environment as a context referent.

Care was taken to avoid factors which may enter and confound results. For example, early Monday morning a student may behave differently than he does on Tuesday merely because it's the first period of a new week. Similarly, the day following a basketball game, the period immediately after lunch or periods Friday afternoon may show behavioral variances due to the mentioned effects rather than due to the attitude set. Hence, data gathering was avoided under these conditions. Therefore, data gathering was carried out on Tuesdays, Wednesdays, and Thursdays. A study with broader scope could consider differences such as the above mentioned ones, but it seems inappropriate when it hasn't been experimentally verified that differences due to the main effect -- attitude -- are detectable and categorizable. It logically follows that further research could probe questions relating to the above, depending on contingencies regarding the present study.

The design can be properly conceptualized as a correlational study which, of course, means that it is not an experiment as would be described by Campbell and Stanley (1963). It follows then that causality cannot be established between the teacher's behavior and the student's attitude, and the study will make no attempt to establish causality. The study is merely interested in detecting behavioral patterns and finding how they relate to attitude, if indeed they relate at all. What causes the student to feel the way he does is beyond the scope of the present study. The research is seen as empirical and falls into the natural history phase of research as described earlier in this writing.

The data are analyzed using discriminant analysis (Snedecor and Cochran, 1967; Morrison, 1967), which is a statistical technique designed to classify a subject into one of two populations. In the present study the populations would be the one of students having a positive attitude toward their teacher, and the other would be the one of students having a negative attitude toward their teacher. The discriminant analysis process resulted in a mathematical model expressing the relationship between attitude and discriminating nonverbal behaviors; these discriminating behaviors are the independent variables, and attitude is the dependent variable.

Organization of the Remainder of the Study

Chapter II is devoted to the background and related literature and is divided into three sections. Section One relates to communication and nonverbal behavior from an interdisciplinary approach. A discussion of nonverbal behavior in the field of professional education follows in Section Two. The final section is devoted to the work done in the area of research methodology appropriate to the present study.

Chapter III considers the design of the study. Selection of the pilot sample, pilot recordings, instrument development, method of quantifying behavioral data, validity and reliability, instrument description, identification of study subjects, gathering of behavioral data, and data analysis are all covered in detail in the chapter.

The data handling is dealt with in Chapter IV. It includes the presentation of data, a discussion of the hypotheses, and the results. A discussion of findings not directly related to the hypotheses is also included.

Chapter V is devoted to a summary of the study, conclusions, and recommendations for future research.

II. REVIEW OF RELATED LITERATURE

Chapter II is organized into three main sections which are as follows: Section One is devoted to a report of interdisciplinary approaches to the study of communication and nonverbal behavior; Section Two covers work done in the area of behavior delimited to the field of professional education; and Section Three gives a report of relevant work done in the area of research methodology.

Interdisciplinary Approaches to the Study of Nonverbal Behavior

The acknowledgement of teaching as a communicative process is inescapable, and the conception of nonverbal behavior as a form of communication is convincing. Thus, in order to achieve a measure of continuity and closure, a brief review of work done in the area of general communication as it is conceived and how nonverbal communication relates to it is appropriate. As quoted in Chapter One:

The process of education is a communication process not only in the sense of transmitting knowledge, but more particularly as it relates to interpersonal communication behaviors. The cognizance of this fact is interpreted to be the primary reason for the increase in research in the area of affective teacher communication behavior. (Victoria, 1970, p. 4)

Communication has been defined by Birdwhistell (1968), "as a process to which all participants in an interaction constantly contribute by messages of various, overlapping lengths along one or more

channels whose elements are culturally patterned" (p. 24). Central to Birdwhistell's theory of communication is the conception of communication existing as a multichanneled system, all of which contribute an integral part to the totality of the communication process. He, in the same writing cited above, has said:

... supported by an increasing body of evidence indicating the ultimate inseparability of linguistics and kinesics in communicative systems, it makes manifest the inadequacy of any theory of communication based on monochannel message transmission. (p. 28)

In the same writing he has said:

I am convinced that neither language nor communication can be either studied or understood so long as we assume that either subsumes the other. A monochannel analysis of communication must ignore or deny too much evidence to gain support unless the definition of communication is limited to the wholly aware, completely purposive transmission of commonly held, explicit, and demotative verbal information between interactants. (p. 29)

Birdwhistell (1967) in developing his communication theory has said, "Communication is a multichanneled system emergent from, and regulative of, the influenceable multisensory activity of living systems" (p. 380). Thus, for Birdwhistell the spoken language and other means of communication become infracommunicational systems. These systems interdependently merge with each other utilizing the symbolic codes of the respective channels ultimately becoming operationally communicative. This emphasis on communication as a

multichanneled process means it is difficult to assess the relative importance of the spoken language in communication until more is known about the total communication process itself. Birdwhistell (1967) again states, "All infracommunicational channels are equally important to the whole of which they are dependent subsystems" (p. 380).

Birdwhistell also argues that communication is a continuous interactive process composed of discontinuous behavioral segments. When silence occurs the communication continues in one or more of the other existing communication channels, an important one being the gestural or body motion channel. Birdwhistell (1967) states, "research with visible body motion is convincing us that this behavior is as ordered and coded as is audible phonation" (p. 380).

Schefflen (1968) in a critical review and commentary of literature in the area of communication outlines the following channels as being those through which information is conveyed.

Language modalities

- VOCAL Linguistic
 - Lexical
 - Stress, pitch and junctures
- Paralinguistic
 - Nonlanguage sounds
 - Vocal modifiers

Nonlanguage modalities

KINESIC & POSTURAL, including voluntary and involuntary mediation behavior, facial expression, tonus, positioning and so on
 TACTILE
 ODORIFIC
 TERRITORIAL OR PROXEMIC
 ARTIFACTUAL, including dress, cosmetic usage, props, decor, use of space and so on (p. 52)

Scheflen (1964, 1968) conceives of communication behavior as existing in "programs" within a general cultural and subcultural context. Communication takes place when the "programs" are performed. This means that a behavioral process proceeds in a predictable manner once the "program" is understood. The "program" concept assumes that behavior appears in standard units in any culture because the members learn to perform so as to shape their behavior into molds so that it is mutually recognizable and predictable, and Scheflen (1968) has stated, "communication depends upon a common behavioral morphology of shared meaning" (p. 47).

He has further stated in the same writing, "people behave in coded, patterned ways and others perceive and comprehend these patterns" (p. 47), and he has finally stated in support of Birdwhistell, "Not only is language structured in a hierarchy of levels, but Birdwhistell . . . has shown an analogous morphology for kinesic or bodily movement actions" (p. 46). In summary, Scheflen (1964) defines communication as, "All behaviors by which a group forms, sustains,

mediates, corrects, and integrates its relationships" (p. 318).

Galloway (1962) in a literature review describes communication models as described by communication theorists (Shannon and Weaver, 1949; Ruesch and Bateson, 1951; Osgood and Sebeck, 1954). Common to these models is the conception of the communication process requiring four ingredients: (1) Sender or encoder, (2) Message, (3) Channel, (4) Receiver or decoder. The sender of the message, which could be an intention, emotion, need or merely information, codes the message in the form of symbols which is transmitted along the communication channel and subsequently decoded, or put back into recognizable form, by the receiver. When the receiver responds the cycle begins anew. (Birdwhistell would argue that this procedure is in operation continuously and is not a stopping and restarting cyclic process.)

Communication occurs when there is agreement regarding the symbols of a language. A message then amounts to coding the content into words. The semantic word meanings comprise the code, the words themselves being symbols which are composed of a subset of symbols -- the letters of an alphabet. The symbolism is not limited to verbal language, and it is suggested that nonverbal language tends to become symbolized and hence, an instrument of communication. (Birdwhistell and Scheflen emphasize the symbolic structure of the nonverbal channel of communication, but the present study is

concerned primarily with determining the referents of the behavioral manifestations more in keeping with work done by Mehrabian. Expressive gestures are communicative and, whether symbolic or non-symbolic, are capable of interpretation. The present study is aimed at this interpretation.)

To understand an individual's nonverbal behavior requires a knowledge of the symbols in which the behavior is enacted. No definitions of the nonverbal symbols exist partly because a person's nonverbal codes and signs are partially unique, private, and esoteric. Thus human behavior is partially symbolic and nonsymbolic. Nonsymbolic actions in the nonverbal realm are linked particularly to the communication of feelings and attitudes. Further, nonverbal expressions are used to check the fidelity of a verbal communicative act, and thus are used to obtain a better picture of the self one proposes to be.

Blumer (1936) suggests that it may be virtually impossible to identify the cues to which a person is responding in an interaction. He asserts that interaction on a nonsymbolic level operates in a way different from that relegated to the symbolic level. The nonsymbolic is distinguished by spontaneity and immediate response to some action. Further, the individual is usually unaware of this unconscious response. Blumer states:

Nonsymbolic interaction is constituted... by expressive behavior, i. e., a release of feeling and tension, to be distinguished as different from indication of intellectual intention, which properly comes at the symbolic level. (p. 516)

Thus expressive gestures form the channels for disclosure of feeling. Blumer asserts further, "It is this nonsymbolic interaction which seems to form the setting for the formation of the feelings which are intrinsic to and basic to social attitudes" (p. 523).

Victoria in his review cites work done by Langer in Langer's theory of symbolic processes. The theory deals with the nature of symbolic processes, and Langer differentiates between discursive symbols, which correlate names or concepts with things, and nondiscursive symbols, which depend on an individual's personal perceptions and hence, is related to the expression of feeling. Discursive symbolizing has an identifiable syntax and order while nondiscursive symbols do not. Thus nondiscursive symbols are related to what Blumer would call nonsymbolic. Victoria has said:

There is evidence that nondiscursive language is different from but related to discursive language. It would seem that emotional or feeling expression can be investigated with the aim of discovering the general principles of "qualitative intelligence" accounted for by nondiscursive symbolization. (p. 6)

Further, gestural behavior has been considered either learned (Birdwhistell, et al.) or instinctive (Darwin, et al.). Learned gesture can be considered discursive symbolization and instinctive gesture

can be considered nondiscursive. As such nondiscursive symbolization in the form of gestures can deal with themes that are emotional in nature. A discussion of learned and instinctive gestural behavior follows in the next section.

As Galloway points out in his review the communication process is much more complex than what it appears to be in the simple model described earlier. People verbally communicate by arranging words in a sequential pattern which becomes a "statement." A "statement" becomes a communicated message when it has been decoded by another person whose interpretation has been based on prior agreement, i. e. , they must have a common social meaning upon which persons agree. Thus, communication is successful when sender and receiver agree on what interpretation should be put on the message. The complexity arises when the encoder transmits along more than one channel simultaneously. Semanticists may agree precisely on the meaning of a spoken word or statement, but a subtle overtone, a mere reflection, a slight gesture, a subtle facial expression, or a seemingly insignificant postural attitude can distort the entire meaning of the spoken word. Thus, human communication is rarely perfect.

Further, communication is often carried on beyond the purely cognitive level. Galloway (1962) has said:

Although an exchange of ideas may be almost purely at the cognitive level, communication between two persons always carries a freightage of manifold

meanings; for indeed information, ideas, emotion, attitudes, and feelings are communicated. Perhaps a failure to be aware of the many affective implications of ordinary speech constantly remains a grave handicap. . . . for truly understanding the impact of one's communication on others. (p. 20)

Communication is further increased in complexity due to the uniqueness of the communicator. His spoken language is determined by both his hereditary capabilities and his past experiences. Murphy (1947) maintains that an individual's uniqueness is expressed particularly in the nonverbal when using words, i. e. , the individual's uniqueness is made manifest through bodily as well as verbal behavior.

Galloway (1962) sums his review by saying:

. . . human communication consists of individuals in conversation, discussion, or in other forms of social intercourse. Each individual and each conversation or discussion is unique; different people react to signs in different ways, depending upon their own past experience and upon the situation at the time. It is such variation, such differences, which give rise to the principle problems in communication itself and in the study of communication. (p. 22)

Nonverbal Communication

Katz (1964) in considering the nonverbal component of communication behaviors outlines three aspects of nonverbal communication which all overlap strongly but differ in emphasis. These ways of viewing nonverbal behavior are as follows: (1) Nonverbal behavior as an extended intra- and/or interindividual communication process

with feedback an integral part, (2) Nonverbal behavior as an intra-individual etiology, (3) Nonverbal behavior as a cue to interpersonal judgements.

Birdwhistell with his view of body language as an intracommunication system would be a proponent of the point of view conceiving of nonverbal behavior as a communication in the sense of a language process. Birdwhistell defined the term kinesics as, "the systematic study of those patterned and learned aspects of body motion which can be demonstrated to have communication value" (Katz, 1964, p. 15). He has also spoken of kinesics simply as, "...the science of body behavioral communication" (Birdwhistell, 1967, p. 379). As quoted earlier in this writing Birdwhistell has said, "Research with visible body motion is convincing us that this behavior is as ordered as is audible phonation" and says further in the same paragraph, "like language intracommunicational body motion is a structured system that varies from society to society and must be learned by the membership of the society if it is to interact successfully" (Birdwhistell, 1967, p. 380).

Schefflen supports Birdwhistell's view of nonverbal behavior being one channel in the total communication process, e. g., in page 27-28 of this writing his channels are outlined. As quoted previously he also says in support of Birdwhistell, "not only is language structured in a hierarchy of levels but Birdwhistell has shown an analogous

morphology for kinesic or bodily movement actions" (Scheflen, 1968 p.46). Of the role nonverbal behaviors play Scheflen (1968) says, "...many kinesic behaviors act with verbal language and appear to reduce ambiguities of speech; some kinesic actions are clearly metacommunicational. In general there is considerable redundancy of channels" (p. 52). Scheflen calls metacommunication communication about communication, or communication which clarifies the nature of the original communication in an interactive process.

Hall (1963a) also supports Birdwhistell's view that nonverbal behavior is culturally patterned, learned and is systematic and has said in his writing concerning Proxemics, "...man, like other vertebrates, moves with the framework of highly patterned spacial systems" (p. 426), and has also said in the same writing, "the study of space... is a bio-basic, culturally modified, system of behavior" (p. 441). Further, "a great many spacial acts are so highly patterned and so automatic that they function almost totally out of awareness, and therefore are not subject to the kind of control and distortion that conscious words are" (p. 441). Hall (1963b) defines Proxemics as, "the study of how man unconsciously structures microspace" (p. 422). Hall (1963b) views Proxemics as a communicational channel in keeping with Scheflen's conception outlined earlier in this writing when he says "In Proxemics one is dealing with phenomena akin to tone of voice, or even stress and pitch in the English language" (p. 428). Hall

argues that while Proxemic behavior is not language, it parallels language. He uses Hockett's (1958) principle features.

Katz criticizes Birdwhistell's view of body language as being too narrow when Birdwhistell restricts the behaviors to learned etiology. There is considerable evidence that suggests that unlearned or innate stimuli may cause behaviors as well.

Krout (1954b) develops the conception of what he calls autistic gestures. These reflex-like forms of behavior possess a definite adaptive aspect in that they drain off impulses and hence reduce tension. Thus, autistic gestures are forms of self communication. Hence, if one would desire to place a label on Krout's point of view, its emphasis would fit Katz' classification of nonverbal behavior as an intra-individual etiology. Krout argues that autistic gestures are not capricious, and thus, once the symbols are understood, they become communicative. Further, he argues that they stem from some sort of conflict and, hence, are emotionally charged. As stated before, he argues that they are unwitting or nonconscious. They arise, according to Krout, when an individual inhibits his direct response to an external situation, he responds to internal stimulation explicitly, and the autistic gestures occur.

Darwin (1899) has argued that the primary expressive actions of man and lower animals are innate or inherited and are not at all governed by learning or imitation. From cross-cultural studies he

has found that gestures such as shrugging the shoulders or raising the arms with open hands are conventional signs of impotence. On the other hand, behaviors such as kissing and the nodding or shaking of the head are not innate. Darwin argues that only a few of the expressive movements are learned consciously by individuals, and the greater number and all those of importance are innate or inherited and are not dependent on the will of the individual. Darwin also argues for the conception of involuntary responses to some emotional stimuli as being innate and not learned. For instance, blushing in anger or embarrassment is innate, involuntary and not culturally unique.

Other writers (Deutsch, 1947; Allport and Vernon, 1933) argue that behavioral manifestations exist which are an unconscious effort to cope with a situation, or these behaviors may be a manifestation of an unconscious emotion or feeling.

In sum, the people cited above agree with Birdwhistell et al., that gestures, i. e., broadly, those manifestations of body movement that are observable, are communicative in nature, but they disagree with Birdwhistell when he argues that the behavior is strictly a learned behavior and culturally defined. Further, Katz in his review cites arguments asserting that the analogy between kinesics and linguistics is not as strong as Birdwhistell claims.

The arguments cited in this writing are not intended to imply that cultural differences do not exist for cultural differences in expressive behavior are obvious. Victoria (1970) cites Labarre in stating, "a great deal of speculative nonsense has been indulged in by the older instinctivist theories and much of what they uncritically attributed to innate inherited responses can now be clearly seen to be culturally learned responses" (p. 9). Evidence obviously exists that supports both positions. Thus, the only realistic view would include all behavioral forms; learned and innate, cultural and cross-cultural, unconscious and overt.

Ruesch and Kees (1956) elaborate a comprehensive theory of communication in which no distinction between intentional and unintentional expressions is made. According to their theory every action form -- verbal or nonverbal -- has a communicative function. Further, they maintain that sources of communicative skills mean little except to the extent that they relate to the receiver's accurate perceptions. Thus, the receiver is the key link in the communication process according to their theory. Ruesch and Kees feel that the meta-communicative acts are primarily codified nonverbally. Hence, the nonverbal channel is the dominant one in that it is this channel that relates to or clarifies the communication process itself.

Their theory can be summed in the following quote:

Communication does not refer to verbal, explicit, and intentional transmission of messages alone. The concept of communication would include all those processes by which people influence one another. . . This definition is based upon the premise that all actions and events have communicative aspects, as soon as they are perceived by a human being. (pp. 5-6)

Eckman (1957) doesn't argue or discuss the nature of the communication process in all its glory but simply assumes that nonverbal behavior has significant communicative value. He asserts that an organism tends to communicate by means of and reacts to nonverbal cues regardless of whether or not the individual manifesting the behavior or the person perceiving the behavior are able to report the use of the nonverbal channel. Eckman's view may be summed as follows:

Nonverbal behavior may be conceived as supplying two types of information which may or may not correspond to verbal behavior. It may have a specific direct meaning. This type of nonverbal behavior may emphasize, contradict, aid in the interpretation of, or have little relation to a verbal statement. Nonverbal behavior may also have a more general significance providing information about such variables as activity level, and the accumulation and discharge of tension or anxiety during a specific time period. (p. 142)

An additional dimension that must be considered when attempting to conceptualize communication and its nonverbal subset is that of the subliminal nonverbal channels. The process that takes place in these channels might properly be called "unconsciously felt perceptions."

An individual experiences feelings, emotions, thoughts, attitudes and reactions towards others and in reference to others, but often he is not able to articulate these feelings. He even may not have any understanding of the feelings, but the feelings, attitudes, and emotions are real, nevertheless. Galloway (1962) argues that these feelings are transmitted nonverbally and has said, "...the signals of subliminal motion and impulses are transmitted silently through nonverbal modes of communication" (p. 24).

Katz outlines an aspect of nonverbal behavior that has received considerable research and theoretical emphasis. This aspect considers body language primarily as a cue to interpersonal judgements.

Mehrabian(1969a) views nonverbal behavior as a communication process and makes theoretical and experimental attempts to determine the referents of the behavior. His thesis is that the referents of nonverbal behavior can be characterized in a three dimensional framework: potency, status, or social control; activity or responsiveness; and evaluation or the degree of liking, preference or extent of positive attitude.

One of the earliest attempts to isolate nonverbal referents was made by Darwin (1899). He related the behaviors to emotions, and as previously cited in this writing felt that the causes of the behavior were often instinctive. Eckman and Friesen (1967) state the nonverbal behavior has been related to nearly every aspect of the human

condition ranging from personality to social class and so on, but say further, "Most popular for the theoretician to assume or explain and for the experimenter to test has been the contention that emotions are expressed through nonverbal behavior" (p. 711).

Tagiuri (1968) in his work on person perception reviews the work done in the area of expression and recognition of emotions and refers to psychologists who have worked in the area. Much of the work through the 1930's deals with the problem of emotion, whether or not it is easily recognized, and how it relates to personality.

Victoria (1970) in his review cites work done by Crichley and Wolff both of whom assert that gestures can be of an emotional nature, particularly at certain developmental stages in an organism.

Mehrabian (1969a) in his review cites early work done which attempted to identify specific moods and feelings, e. g., anger, fear, happiness, etc., as referents of specific nonverbal behaviors. He in the same publication refers to alternate attempts to conceptualize the referents of nonverbal communication. This attempt conceived of the referents in terms of a multidimensional framework. These attempts were refined by Schlosberg (1954) who suggested that:

... facial movements, for instance, could be characterized within the three-dimensional framework of pleasantness-unpleasantness, sleep-tension, and attention-rejection. Thus, anger would be characterized with a slight degree of rejection and high degrees of tension and unpleasantness.

This scheme, then, made possible a parsimonious characterization of the major referents of nonverbal behavior. (Mehrabian, 1969a, p. 203)

Mehrabian (1969b) cites further support for the notion that the non-verbal referents can be characterized in a small number of dimensions. From the research cited in his review together with his own work comes the citation of the major referential factors cited above. (Those factors being evaluation, social control, and activity.)

Mehrabian in a manner similar to Eckman's work previously cited doesn't consider the communication process per se when he outlines his conceptualizations. He asserts that nonverbal behaviors communicate, which is actually a considered assumption, and then suggests that the behaviors are communicating with reference to the dimensions cited above. Even if the extremely complex nature of the communication process is not totally understood, a researcher can investigate the referents of a system of behaviors if the assumption that the behaviors do indeed communicate is reasonable.

Eckman (1965b) in a review of work done in the area of non-verbal behavior states that the behavior has been related to mood, to the quality of an interpersonal relationship, and to the communication of attitude. Eckman (1965a) with reference to attitude asserts that nonverbal behavior can be shown to be an accurate communicator of attitude and says further that nonverbal behavior alone may sensitively track moment-to-moment changes in affect. Victoria states

that postural-gestural behavior gives an accurate indication of a person's inner attitudinal and emotional state.

Considerable work has been done in relating specific postural-gestural manifestations to attitude. Allport and Vernon (1933) in an early effort studied the relation of postural and gestural styles to personality characteristics. James (1932) found that body posture gave general clues to attitude, and he found more specifically that a communicator leaning forward communicated a relatively more positive attitude compared to a communicator leaning backward.

Mehrabian (1969a, 1969b, 1970) reviews the relevant work related to the referents of nonverbal behavior and the work related to specific behavioral manifestations and how they may communicate attitude. Mehrabian reports that immediacy or proxemic measures relate primarily to the attitude of the communicator toward his addressee. He reports that for a communicator with positive attitude toward his addressee the communicator will in general exhibit greater degrees of touching, leaning forward toward the addressee, eye contact with the addressee, and the body orientation of the communicator will be more directly toward the addressee, and the communicator will position himself at a smaller distance from his addressee. In cases where distances are fixed the communicator can increase his perceptual availability to the addressee by the increasing degrees of orientation, eye contact, and forward lean. Hence, the groupings are

made on a conceptual as well as experimental basis. Thus, as Mehrabian summarizes he states that general immediacy, i. e., the directness of orientation, is positively correlated with attitude. However, if the communicator is in a state of tension the relationship is reversed. With respect to proxemic factors Mehrabian draws from Hall (1963a, 1966).

Also related to attitude is a set of activity variables which correlate positively with affect. The indexes are as follows: high rates of gesticulation, less halting speech quality, more pleasant facial expressions, and frequent positive head nods.

Mehrabian in the same works cited previously reports a second set of variables which relate primarily to status. These variables are arm asymmetry, sideways lean, leg asymmetry, neck relaxation, and reclining angle -- the converse of forward lean. It has been found that these variables which relate to status are a measure of postural relaxation, and the greater the communicator's status relative to his addressee, the greater his relaxation. For the above variables greater degrees of each respective variable are taken to be a sign of greater relaxation.

In sum, Mehrabian reports that greater immediacy is positively related to attitude, and the movement and verbalization cues of gesticulation rates, positive head nods, positive facial expressions, longer communication, higher speech rates and lower rates of speech

disturbance all relate positively with attitude. Status is communicated by relaxation cues cited above as well as increased rocking and gesticulation rates and lower rates of trunk turning. High rates of leg movement and self manipulation also relate to status according to Mehrabian.

Interesting work has been done which attempts an analysis of the relative magnitude of the effect on a perceiver of the various communication channels. Victoria (1970) reports in reference to a speaker that nonverbal gestural behaviors are an important aspect of effective speech communication. Further, he states that these gestures may supplant and reinforce audible symbols or, "...they often supercede words when there is a discrepancy between the words and actions of the speaker" (p. 10).

Galloway (1962) states in reviewing the work of Ruesch and

Kees:

Throughout their book one notes that Ruesch and Kees place a profound importance on the superiority of nonverbal behavior as being a more accurate representation of the true person or self; that is, nonverbal communication is more constant with the real feelings and thoughts of the person. (p. 27)

Mehrabian and Weiner (1967) report that in the case of communication where the content component of the message is inconsistent with the tonal component, "...the tonal component makes a disproportionately greater contribution to the interpretation of the

message than does the content component" (p. 113).

Mehrabian and Ferris (1967) in integrating their work with the Mehrabian and Weiner study above state, "It is suggested that the combined effect of simultaneous verbal, vocal and facial attitude communications is a weighted sum of their independent effects with the coefficients of .07, .38, and .55, respectively" (p. 252). This suggests that the facial channel is nearly one and a half times as weighty as the vocal channel in terms of its effect, is more than seven times as weighty as the verbal channel, and the vocal channel is more than five times as weighty as the verbal channel.

Studies in Nonverbal Behavior in Professional Education

Studies in the area of nonverbal behavior in the field of professional education are few in number, and an extreme paucity exists in the number related to student nonverbal behavior.

Galloway (1962) constructed seven categories for the observation of teacher nonverbal behavior in his doctoral research. Galloway's approach was deductive in that he constructed categories, and then on the basis of inference from the teacher's facial expression, actions, and vocal language, observers placed the behaviors into the previously developed categories. Three of these categories were a priori designated as inhibiting to communication, one was considered neither inhibiting nor encouraging, and three were considered encouraging to

communication. Galloway's results proved inconclusive, and in fact the observers themselves couldn't agree as to the proper classification of the manifested behaviors on the part of the teachers.

Victoria reports work done by Lail in which the Flanders interaction-analysis system was combined with Galloway's nonverbal categories in an observation instrument that could be used for the purposes of teacher evaluation. Victoria cites Lail as stating that the utilization of combined verbal and nonverbal systems of observation caused significant changes in student-teacher behavior in the areas of praise, response to and acceptance of pupils, and in gaining sensitivity to pupil interest. Victoria cites Neil further in his review in saying, "For the teacher to become fully embodied in teaching and the pupil to become fully embodied in learning they both need to be aware of the extent to which both can inspire, and be inspired, through body mobilization" (p. 17). However, as in the previous citations, the specific body action analysis related to the teacher as opposed to the pupils and also related to deductively developed categories.

Victoria conducted an investigation of the manifested nonverbal behavior of student-teachers in art. He developed seven categories of nonverbal behavior and seven categories of terms descriptive of affective qualities. He further compared the behavior of the student-teachers to reflected qualities within task-setting, demonstration, and evaluation constructs. His theoretical

frame was built on Birdwhistell's conceptions in that he was attempting an ultimate behavioral typology as opposed to the referents of non-verbal behavior.

Evans and Balzer (1962) developed a system for the observation of biology teacher behavior. Specific behaviors were captured on video tape, studied, recorded, and compiled in categories. The study further compared the behaviors manifested by the teachers to measured personality characteristics. In terms of the measured behaviors themselves Evans (1969) reported that 38.94 percent of the total behavior manifested was nonverbal, according to the way the behaviors were defined. Further, the nonverbal behavior was the majority of the behavior types manifested according to Evans. The comparisons between the behaviors manifested and the personality types were inconclusive.

Jecker, Maccoby, and Breitrose (1964) in one of the few studies directly related to student nonverbal behavior analyzed the ability of teachers to assess cognitive feedback from students. They stated as cited in Chapter I:

...while a teacher is addressing a sizeable class of students, verbal feedback is likely to be severely limited, and the teacher is largely dependent upon nonverbal information from students... when judging the effects of his communications. (p. 393)

They hypothesized that when teacher judgements of student comprehension were based on nonverbal cues from students, misperceptions were more apt to occur than if the judgements were based on verbal

cues. Tests were developed to obtain measures of student comprehension, and the understanding as perceived by the teachers from student feedback was compared to the results obtained from the tests.

The researchers found clear results that supported their hypothesis; i. e., visual feedback cues are not accurately interpreted. Further, teachers with more classroom experience didn't interpret visual cues with any significantly greater accuracy. They concluded their work by stating, "since greatly increased verbal feedback is not feasible under normal classroom conditions, any method for substantially improving nonverbal feedback cues would be of value" (p. 397). Weick (1968) in reviewing their work argues that even though observers were directed to use nonverbal cues to detect cognitive rather than affective information the observers may have actually been using affective reactions such as interest or boredom in the judgement of comprehension. This would support the contention that research into the areas of nonverbal behavior compared to affective aspects is necessary.

However, with respect to Weick's remarks Jecker, Maccoby, and Breitrose (1965) report that with only eight hours of training they were able to significantly improve the ability of teachers to detect comprehension from nonverbal cues. Again the teachers were detecting cognitive nonverbal feedback from students. Little work has been done which is concerned with the analysis of affective nonverbal

feedback from students.

Nonverbal behavioral ramifications for teaching can be partially summed in the following:

... implications of paralinguistics and kinesics, for... teaching... are enormous. The speaker is free to choose his message. He is not free to choose the code of his message -- this is strictly imposed by the language... The speaker is, however, free to color his message in certain ways, and these ways are predominantly paralinguistic and kinesic.
(Victoria, 1970, p. 19)

Further, Hendrix has stated:

One phase of teaching looming large in things revealed to date is the enormous role played by nonverbal communication between teacher and students. Current research in paralinguistics -- especially that involving kinesics -- is revealing ways to identify and classify the nonverbal behavior which human beings learn to interpret each other; it is thus that we produce the complicated stream of communication sometimes accompanying, sometimes independent of, words.
(p. 467)

Considerable work has been done in the area of student-teacher interaction and in the area of teacher behavior -- mostly verbal behavior. The studies usually make the tacit assumption that verbal behavior adequately samples the total behavior manifested by the subject. This assumption appears questionable, and the entire area of teacher and pupil nonverbal behavior looks rich and worthwhile for research problems in professional education. Comprehensive reviews of the work done in these areas as well as work done in the development of category systems for systematic observation have been done

by Medley and Mitzel (1963) and Evans (1968).

Systematic Observation of Nonverbal Behavior

Interdisciplinary Approaches to the Categorization of Nonverbal Behavior

A significant contribution to the categorization of nonverbal behavior was accomplished by Eckman and Friesen (1969). They developed five categories of facial and body behavior distinguished by usage origin and coding. The five behavioral categories are as shown in Figure 1, and are listed as follows: Emblems, Illustrators, Regulators, Affect Displays, and Adaptors. For example, using Figure 1 as a guide, Emblems might be the making of a fist to denote anger. It is intended to communicate the feeling and substitutes for a verbal description of the anger. Emblems are learned which makes them unique to a specific culture. The coding refers to the body symbols that an individual manifests in order to communicate the emblematic meaning. Similar interpretations can be made of the remaining categories, all of which are discussed in detail by Eckman and Friesen.

	EMBLEMS	ILLUSTRATORS	REGULATORS
USAGE:	Most frequent when verbal channel blocked.	May vary with enthusiasm or excitement.	Vary with partially defined roles, orientation of interaction.
external conditions	high agreement about verbal definition	directly tied to speech, illustrate message content, or rhythmically accent or trace ideas	maintain and regulate back-and-forth conversational flow, not tied to specifics of speech.
relation to words	usually as aware as choice of words	within awareness, not as explicit as emblems	periphery of awareness
awareness	usually intended to communicate	intentional to help communicate, not as deliberate as emblems	over-learned habits that are almost involuntary
intention to communicate	visual attention and direct comment	visual attention and some direct comment or response	other interactant very responsive to, but rarely directly comments on
receiver feedback	more shared than idiosyncratic, typically communicative, informative and interactive	more shared than idiosyncratic	more shared than idiosyncratic
type of meaning	some arbitrarily; some iconic (pictorial, kinetic, spatial) usually not intrinsic	Batons and ideographs	arbitrary, iconic or intrinsic
CODING	culture specific learning	socially learned by imitation	learned but we have not specified when
ORIGINS	can be based on affect display, or adaptors	Kinetographs can include an adaptor	all other categories can serve as regulators
OVERLAP			

Figure 1. Nonverbal behavioral categories.

	AFFECT DISPLAYS	ADAPTORS
USAGE:		
external conditions	Culture, social class and family define affects appropriate for certain settings	Self adaptors inhibited by conversations, but still prevalent.
relation to words	can repeat, augment, contradict or be unrelated to verbal affective statement.	can be triggered by verbal behavior in present situation which is associated with conditions when adaptive habit first learned
awareness	often highly aware of affect once displayed, but can occur without any awareness	typically not aware of adaptors, although tend to conceal and inhibit
intention to communicate	often not intended to communicate but can be	rarely intended to communicate
receiver feedback	greater receiver attention	other interactant rarely comments on, and politeness implies lack of attention to
type of meaning	both shared and idiosyncratic	both shared and idiosyncratic
CODING	Some intrinsic, may be iconic as result of display rules	Intrinsic/kinetic or tend to be iconic when fragmented by time
ORIGINS	Relationship between facial musculature and affect and some of the evokers neurophysiologically programmed	Habits first learned to deal with sensation, excretion, ingestion, grooming, affect
OVERLAP		

Figure 1. Categories of nonverbal behavior. (Cont.)
(Eckman and Friesen, 1969, p. 94-95)

Krout (1954b) in his previously cited work in the area of autistic gestures developed a description of autistic manual gestures as shown in the following list:

1. Relaxed palm in lap
 - 1-a upturned palm in lap
 - 1-b in-turned palm in lap
2. Index or small finger between fingers
 - 2-a index finger between fingers
 - 2-b small finger between fingers
3. Thumb between two fingers
4. Finger enclosed by other hand
5. Two fingers enclosed by other hand
6. Three fingers enclosed by other hand
7. Four fingers in palm enclosed by other hand
 - 7-a four fingers in palm
 - 7-b four fingers enclosed by other hand
8. Cupped hand in cupped palm
 - 8-a reversed cupped hand enclosed by hand
 - 8-b cupped hand in cupped palm of other hand
9. Hand covering another, with fingers showing
 - 9-a one hand over another, showing one or two phalanges of covered hand
 - 9-b one hand covering another, showing entire finger set
10. One hand over another with fingers bent
11. One hand over another with no fingers showing
12. Open hand dangling between legs
13. Fingers interlaced
14. Folded fingers forming circle
15. Fist gestures
 - 15-a resting fist (on flat surface)
 - 15-b enveloped fist (covered by hand)
 - 15-c supporting fist (against face)
 - 15-d checked fist (held at wrist)
16. Folded hands joined at fingertips
17. Finger at lips
18. Hands in back
19. Crossed wrists
20. Hand to nose
21. Hand to ear
22. Hand to eye
23. Hand to chin
24. Hand to neck (p. 100)

The above list was accompanied by a series of photographs illustrating each of the gestures. His results were derived from studying issues of a Chicago newspaper covering a ten year period. Pictures of individuals obviously manifesting autistic gestures were studied and evaluated by a team of judges with the results shown in the above list. Krout further developed a list of attitudes using the same source, and the list of attitudes were related to the gestures. The attitudes were perceived inferences on the part of the judges and their validity may be questionable.

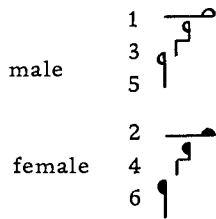
Matchotka (1965) developed using line drawings a systematic classification of spacial and position variables. He studied the variables body access or denial, gaze immediacy, nudity or clothed, body protrusions or pointing, facial expressions, and bowed or raised head. He used conceptions built on the work of Hall and Mehrabian for his theoretical base. He had subjects react to drawings showing various postures in reference to bipolar dimensions such as natural-unnatural and yielding-unyielding, etc.

Birdwhistell (1954, 1970) developed complex systematic coding techniques that were used to describe the tonal inflections in speech and techniques that coded nonverbal markers. Birdwhistell's notational system divides the body into eight major sections and notes that the system is designed primarily for a static subject. He further acknowledges that the classification system is arbitrary but asserts its

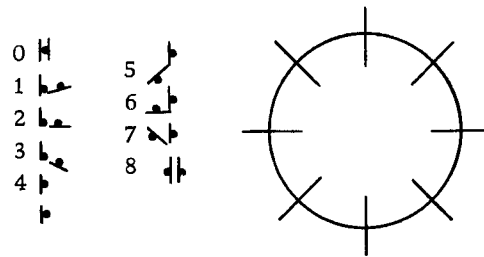
usefulness for the groups he has studied to date. The descriptions of the regions and the particular cues are accompanied by symbols to be used in coding*. The body sections are (1) total head, (2) face, (3) trunk, (4) shoulder, arm, and wrist, (5) hand and finger activity, (6) hip, leg, and ankle, (7) foot activity and walking, and (8) neck. A complete development of the classification system together with symbols can be found in Appendix I of Birdwhistell's Kinesics and Context. The system as developed for the face is shown in Figure 2.

Hall (1963a) developed a system for coding and categorizing proxemic behavior in individuals. Hall asserts that proxemic behavior can be developed as a function of eight different "dimensions" which are as follows: (1) postural-sex identifiers, (2) sociofugal -- orientation, (3) kinesthetic factors, (4) touch code, (5) retinal combinations, (6) thermal code, (7) olfaction code, and (8) voice loudness scale. The complete classification system is shown in Figure 3, and iconic, syllabic, and simple number codings are included. Some brief examples will explain the system. Under postural-sex identifiers a numerical coding of 54 would denote a standing male addressing a sitting female. For orientation of bodies an 0 would denote two subjects directly facing each other while a 2 would note that the subjects were oriented at right angles with respect to each other. Using kinesthetic factors a 12 would show subject 2 touching subject 1 with a forearm, elbow, or knee, while a 103 would denote subject 1 just outside subject

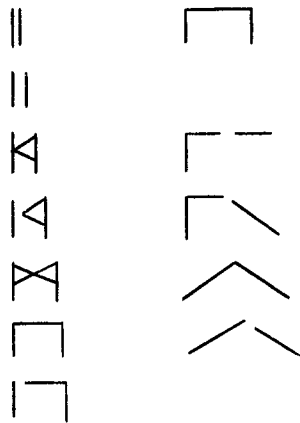
(1) Postural--sex identifier



(2) Orientation of bodies (SFP axis)



(3) Kinesthetic factors



(4) Touch code

caressing & holding	0
feeling or caressing	1
prolonged holding	2
holding or pressing against	3
spot touching	4
accidental brushing	5
no contact	6

(5) Retinal combinations (Visual code)

foveal	f	1
macular (clear)	m	2
peripheral	p	3
no contact	mc	8

(6) Thermal code

contact heat	thc	1
radiant heat	thr	2
probable heat	th	3
no heat	∅h	8

(7) Olfaction code

differentiated body odors detectable	do	1
undifferentiated body odors detectable	ubo	2
breath detectable	br	3
olfaction probably present	oo	4
olfaction not present	∅	8

(8) Voice loudness scale

silence	si	0
very soft	vs	1
soft	s	2
normal	n	3
normal ⁺	n ⁺	4
loud	l	5
very loud	vl	6

Figure 3. System for the notation of proxemic behavior. (Hall, 1963a, p. 1020)

2's arm's reach. The remaining categories are self-explanatory from the figure. The total system when used is designed to give a complete picture of the subjects' proxemic behavior.

Mehrabian (1969a, 1970) developed measures for the classification of cues related to the referential factors of evaluation, social control, and activity. Mehrabian's measures resulted from his review of the professional literature in the field as well as his own research and are outlined as follows:

- I. Immediacy Cues
 - A. Touching
 - B. Distance
 - a. Straight-ahead distance
 - b. Lateral distance
 - C. Forward Lean
 - D. Eye Contact
 - E. Orientation
- II. Relaxation Cues
 - A. Arm Position Asymmetry
 - a. Symmetrical
 - b. Slight asymmetry
 - c. Moderate asymmetry
 - d. Extreme asymmetry
 - B. Sideways Lean
 - C. Leg Position Asymmetry
 - a. Symmetrical with insteps touching
 - b. Symmetrical with insteps not touching
 - c. Asymmetrical with both feet flat on the floor
 - d. Asymmetrical with one or both feet not on the floor
 - D. Hand Relaxation
 - a. Very tense
 - b. Moderately tense
 - c. Relaxed

- E. Neck Relaxation
 - a. Head unsupported and line of vision ten degrees or more above the horizontal
 - b. Head unsupported and line of vision within ten degrees of the horizontal
 - c. Head supported or hanging so line of vision is ten degrees or more below the horizontal
- F. Reclining Angle
- III. Movements
 - A. Trunk swivel movements
 - B. Rocking movements
 - C. Head-nodding movements
 - D. Gesticulation
 - E. Self-manipulation
 - F. Leg movement
 - G. Foot movement
- IV. Facial Expressions
 - A. Facial Pleasantness
 - B. Facial Activity
- V. Verbalization
 - A. Communication length
 - B. Speech rate
 - C. Halting quality of speech
 - D. Speech error rate
 - E. Speech volume
 - F. Intonation

Mehrabian notes in summarizing that attitude or evaluation is the primary referent of the immediacy cues, social control is communicated by the relaxation cues, and responsiveness is related to the activity cues. There is some overlap, of course, and Mehrabian notes that the cues are unique to North American communicators.

Educational Approaches to the Categorization of Nonverbal Behavior

Galloway (1962) as previously cited in this writing deductively developed seven categories of teacher nonverbal behavior. On the

basis of inference from the teacher's facial expression, actions and vocal language, the behavior was coded into the categories. Galloway had three categories of encouraging behavior which were enthusiastic support, helping, and receptivity. He also had three categories of inhibiting teacher behavior which were inattentive, unresponsive, and disapproval. His seventh category was that which contained behaviors believed to be neutral. The observers while looking through a one-way screen attempted to place themselves in the role of the pupil and inferred the meaning of the communication and put a tally in the appropriate category. The behaviors were tallied in columns to preserve the behavioral sequence but were not timed in any way. Galloway's results proved to be inconclusive, but he reported optimism for similar future research.

Victoria (1970) developed a category system for observing student-teachers' nonverbal behavior as they taught art. Victoria developed the categories of eye contact, facial motion, head motion, body posture, arm hand finger motion, directed arm hand finger motion, and body motion in his observation instrument. Further, he used judges to rate each of the categories on a seven point scale as to qualitative affect. The affective qualities were: (1) Enthusiastic, (2) Receptive-Helpful, (3) Clarifying-Directive, (4) Neutral, (5) Avoidance-Insecurity, (6) Inattentive, and (7) Disapproval. The judges rated the behaviors on a supportive-unsupportive continuum

with Enthusiastic considered most supportive and Disapproval considered least supportive. Victoria's approach was similar to Galloway's in that the development of the characteristics on the supportive-unsupportive continuum was deductive, and the coding was based on the inference of the judges.

Victoria concluded that a student-teacher's nonverbal behavior is classifiable as to type and kind. He further found that judges could adequately agree as to the affective quality of the teachers in the teaching-learning situation. However, in both Galloway's and Victoria's work no conclusive results were obtained from the use of students themselves. The categories, affective qualities and categorizations were all made deductively and from an adult's point of view and perspective. Further work with student responses is necessary before conclusive results can be obtained.

Evans and Balzer (1968) developed a system to categorize the behavior of biology teachers. The categories (Evans, 1968, p. 217) developed using an inductive method were: (1) Management, (2) Control, (3) Release, (4) Goal Setting, (5) Content Development (teacher or student centered), (6) Affectivity (positive and negative), and (7) Undecided. The category system together with definitions and a glossary of behaviors comprised the instrument for quantifying the behavior. The observer when using the instrument coded the behavior into one of four columns to note the predominant channel in which the

behavior was being manifested. These channels were verbal, non-verbal, congruent (verbal and nonverbal), and contradictory (verbal and nonverbal). The behaviors were noted on a second by second basis, and the predominant behavior per ten second interval was noted. As reported earlier in this writing inconclusive results were obtained when behavior was related to personality in Evans' study.

Medley and Mitzel (1963) in an extensive review of research report efforts to measure teacher effectiveness and classroom climate by systematic observation. Medley and Mitzel report some early attempts to measure pupil participation. Horn (1914) merely noted on a seating chart when a student participated or requested participation. Puckett elaborated Horn's system by developing symbols to more precisely define the interactive and participation patterns of pupils.

Little professional literature in the field of education has been reviewed to date by this writer that attempts to measure and quantify postural and gestural behavior of students in teaching-learning situations. Thus few instruments for the categorization of student non-verbal behavior have come to the researcher's awareness.

Summary

The related literature and research reviewed in the chapter were separated into three sections. Section one considered conception of

communication and the role that nonverbal behavior plays in the communication process. The work of Birdwhistell, Scheflen, Hall, Krout, Eckman, and Mehrabian was discussed in some detail.

Section two dealt with research in professional education related to nonverbal behavior. Emphasis was placed on work done by Galloway; Victoria; Evans and Balzer; and Jecker, Maccoby, and Breitrose.

Work done in the area of systematic observation of nonverbal behavior was cited in Section three. The research and conceptions of Eckman and Friesen, Krout, Birdwhistell, Hall, and Mehrabian received primary emphasis in the section and references were made to work done by Galloway, Evans and Balzer, Victoria, and Medley and Mitzel.

III. DESIGN OF THE STUDY

The present chapter is divided into sections which are as follows:

- (1) Overview of problem and design, (2) Selection of pilot sample,
- (3) Pilot recordings, (4) Instrument development, (5) Method of quantifying behavioral data, (6) Validity and reliability of the instrument,
- (7) Instrument description, (8) Identification of experimental subjects,
- (9) Gathering of behavioral data, (10) Data analysis, and (11) Summary.

Overview of Problem and Design

As stated in Chapter I the lack of data with respect to student non-verbal behavior constitutes a problem for science educators, particularly at a time when educators are concerned with student attitude. The nonverbal channel is of importance because it is primarily through this channel that the teacher receives feedback which he can use to assess student attitude.

The researcher has thus formulated the following hypotheses which relate to the problem.

- H1: A valid and reliable instrument for the systematic observation of junior high school and/or secondary school student nonverbal behavior can be developed.
- H2: A significant relationship exists between the measured nonverbal behaviors exhibited by high school and/or junior high school

students and their attitude toward their teacher and/or their class.

The design can be properly conceived of as a form of correlational study. A population of junior high school and secondary school students was selected and two samples were drawn from the population. The sample selection was determined by response to an instrument used to determine student attitude. After the samples had been determined the design dictated that the nonverbal behavior of the subjects in the samples be compared to their attitude. This comparison was accomplished by systematically measuring the behavior of the subjects using an instrument devised for that purpose by the researcher as an integral part of the study described in this writing. The instrument was developed from results derived from a survey of the professional literature combined with empirical results taken from a pilot study of random subjects. The results were then analyzed using a statistical technique which used correlations as an integral part of the analysis.

The study as the design is conceived uses systematic observation as a fundamental technique. This is a basic observation method which Weick (1968) defines as, "the selection, provocation, recording, and encoding of that set of behaviors and settings concerning organisms

'in situ' which is consistent with empirical aims" (p. 360). Weick further explains his definition as follows: He includes the word selection to note that editing of behaviors is done before, during, and after an observation. He asserts that edit free observations are impossible. Provocation refers to the fact that observers make subtle changes in the observation setting. (He discusses the observer as an individual as opposed to an inanimate object, such as a camera, which is used in this study.) Recording is the means used to obtain a record of events which can be subjected to analysis at a later time-video taping in the present study. Encoding involves the simplification and quantification of the record through ratings, duration measures, or frequency counts. "In situ" notes that the method is typically used in a situation with which the subject is familiar.

Medley and Mitzel (1963) describe an observational technique as one in which an observer records relevant aspects of classroom behaviors as they occur. They describe the measurement process as proceeding in two steps: (1) A record of a sample of the behaviors to be measured, and (2) a quantification of the record. The first step can be accomplished with reasonable efficiency by the use of video tape recordings. The second step is usually accomplished by the use of an observation instrument which can be either a category system or sign system or a combination of the two.

Category systems and sign systems differ as to the type of items that make up the measuring instrument. A sign system is composed of several items which are specific behaviors such as smiles, blinks, points, etc. A category system is composed of items into which specific behaviors are placed but do not by the description of the item denote specific behaviors. An example could be Warmth into which individual smiles, positive head nods, positive verbal reinforcement, etc., all would be classified. Category systems are supposed to be exhaustive of all behaviors and all categories are supposed to be mutually exclusive, while these requirements do not exist for sign systems. A category may require an extensive definition, but a sign should nearly define itself. A sign should have three characteristics as described by Medley and Mitzel: (1) Present tense, (2) Positive occurrence, and (3) Singular number.

Weick discusses other desirable features for an observation instrument. An instrument with these characteristics would have a small number of categories, each category would be precisely defined, and necessary inference would be kept to a minimum. These characteristics enhance objectivity and makes the instrument more reliable. Further, as Weick states, "category systems should permit immediate judgements and discourage the use of context. Time sampling may serve this purpose" (p. 423). Length of the sample interval should be as short as is workable to increase reliability and prevent the loss of

behaviors. Finally, short intervals, minimum inference, precise definitions and acceptable coefficients of reliability lend to the entire system giving results that researchers can be confident are valid.

A detailed description of each of the steps described above and how the present research relates to each follows in the remainder of this chapter.

Selection of Pilot Sample

Initial contact with schools was made by letter written by the researcher and signed by the major professor. The letter was sent to junior and senior high school principals in an area enclosed by a radius of approximately 40 miles from Corvallis, Oregon. It is requested that the researcher be allowed to contact science teachers in the respective schools regarding their willingness to participate in the study. The letter also stated that the researcher would contact the principals by telephone concerning the principals' permission and the teachers' reaction.

In a matter of a few days some of the contacted principals called the major professor and told of teachers in their schools expressing a desire to be involved in the study. The researcher then called the schools and arranged for interviews with these teachers. The researcher also called the remaining schools that had been initially contacted by letter and had interviews set up with the school principals.

The researcher then traveled to the schools at the appointed time and talked at some length with the science teachers who had expressed willingness to be involved in the study. The nature of the research, what it could potentially contribute to the educational body of knowledge, and what requirements would be made of the teacher and students were outlined in considerable detail. The interviews ended with all teachers expressing willingness to cooperate fully with the researcher. The researcher then arranged to call the teachers a number of days prior to his next visit. A total of 18 teachers were interviewed, and the researcher explained that a period of time would elapse before some of the teachers would be contacted a second time. Thus, the researcher had a pool of 18 teachers and their classes from which a sample could be drawn for pilot study and data gathering purposes.

Pilot Recordings

The equipment used for the gathering of pilot data and research data consisted of an Ampex model 7500 video tape recorder, collapsible cart for transporting the recorder, compatible camera, collapsible camera tripod, camera-recorder connecting cord, power cord, and extension cord. Thus, the entire equipment package was portable and was capable of being transported in a standard sized automobile. A lense adapter was obtained which would allow the fitting of lenses

made for Honeywell Pentax 35 mm cameras, and the researcher bought a 35 mm focal length Tauckamar lens. The lens together with the standard 55 mm lens from the researcher's personal Honeywell Pentax camera and the 25 mm focal length lens that was standard on the video camera afforded considerable versatility in production of image size and wide angle capability.

After reasonable familiarity with the equipment was obtained the actual gathering of the pilot recordings was begun. Teachers were contacted by telephone a few days prior to the day the researcher planned to go into the respective schools. The selection of the teachers as to respective order of class taping was arbitrary and was based primarily on convenience.

The equipment was taken to the school and moved into the teacher's room either before the beginning of the day's classes or during the teacher's preparation period, and it was prepared for operation at that time. Each classroom had an adjacent equipment room which was used for equipment and chemical storage, and this equipment room provided a convenient location for the recorder which allowed it to be operated outside the classroom. Hence, neither the recorder nor the researcher were observable by the students during the times that the recordings were being made, and at no time did the researcher enter the classroom during the recording period. The camera was mounted and either placed in the equipment room doorway

or behind the equipment room door if there was a window in the door through which the camera could be focused. In all cases the camera was set up so the students would be facing it. After the camera was initially adjusted and focused the researcher left it alone to avoid attracting the students' attention and disrupting normal classroom activity. The camera did not have remote control capability and was thus noiseless and motionless.

A total of ten pilot recordings were made, each a class period in length. The teacher had previously been encouraged to do no special preparation for the day's activity and was told that as natural a setting as possible was desired by the researcher.

The ten pilot tapes represented science classes in lecture-discussion activity from grades eight, nine, and ten. Four tapes were made of eighth grade science classes, three were made of ninth grade science classes, and three were made of tenth grade biology classes. Students in the classes had backgrounds ranging from rural, low socioeconomic environments to upper middle class high socioeconomic conditions. Hence, the students represented a reasonable range in socioeconomic background even though no metropolitan area, suburban, or inner-city students were represented.

Instrument Development

The technique used in the development of the instrument was a combination deductive-inductive process. The literature review resulted in several categories of nonverbal behaviors becoming manifest. However, the literature review was primarily done outside the field of professional education because of the paucity of educational literature in this area. Thus, an assumption of a one-to-one correspondence between a prominent behavior in a clinical situation and that same behavior in the classroom situation would have no foundation, and the need for the pilot study became apparent.

The pilot tapes were then studied in considerable detail, and behaviors manifested by the students were noted in brief handwritten descriptions. After all the pilot tapes had been studied and the behavioral descriptions made, the literature results were again consulted and used as a reference frame. Where applicable the described behaviors were fitted to the literature descriptions, and where application was not obvious, new categories were developed, and categories described in the literature were abandoned or revised. Some examples are given as follows:

1. The literature described a category called Forward-Lean which was described by the "number of degrees that a plane defined by a line from the communicator's shoulders to his hips is away

from the vertical plane" (Mehrabian, 1969a). No appreciable deviation from this description was observed in the pilot tapes, and hence, the category was adopted directly.

2. The literature also described a category called self-manipulation which is determined by "motion of a part of the body in contact with another -- either directly or mediated by an instrument" (Rosenfeld, 1966b). The pilot tapes revealed, however, that the category was not sufficiently broad to include all the manipulative activity manifested by students. Activities such as playing with a paper clip, rolled piece of notebook paper or pencil, or opening and closing notebooks and books, taking notes and tapping fingers on desks, etc., were common and the category was thus modified to include and allow for this behavioral variety.
3. A description of a category called leg--position asymmetry was revealed in the literature, but the classroom situation with the researcher's desire for inconspicuous camera location acting as a restraint resulted in the impossibility of recording the position of all students' legs, and hence, the category was abandoned.
4. Finally, no category was described in the literature that was closely related to what is described in the instrument as Interactions. This category was primarily a result of the study of

the pilot recordings.

The instrument was thus developed, and the technique had advantages over either a deductive or an inductive technique used alone. It is built on a sound theoretical reference frame and the work of prior researchers, but it doesn't make a prior decision as to what the relevant study factors are. These factors are revealed in the inductive development phase, which is the progression from the individual behaviors to the individual categories and finally to the appropriate place in the instrument per se. The complete instrument with category definitions is described in Appendix A.

Method of Quantifying Behavioral Data

For encoding and quantifying the behavioral data time-sampling technique was employed. Time sampling as defined by Arrington (1943) is:

... a method of observing the behavior of individuals or groups under the ordinary conditions of everyday life in which observations are made in a series of short time periods so distributed as to afford a representative sample of the behavior under observation. (p. 82)

It is thus a sampling technique, the validity of which is primarily a function of the number, length, and distribution of the separate observations or time samples. Arrington elaborates by stating that the validity also depends on the naturalness of the behavior observed, the

accuracy with which it was recorded, and the adequacy with which it was sampled, which related to the number, length, and distribution of the time samples. As Arrington conceives of the procedure it differs from the experimental method in that the recording and selecting of the behavior are subject to control, as opposed to an experiment, where the situation in which the observations are made are controlled.

The technique developed out of studies dealing primarily with the normal patterns of social behavior and language in the young child.

Arrington's review shows the technique used in a variety of ways. The variety of applications of the method demonstrates that the procedure has wide applicability and is very appropriate for work in behavioral research. The application of this technique for the present study is described as follows:

An audio tape was prepared by having the researcher read a stopwatch, and at every five second interval vocally pronounce a number into the audio-recorder microphone. This process was continued for ten minutes, thus preparing a tape that when played back would pronounce numbers sequentially from 1 to 120.

The audio tape was then played and recorded onto the audio track of the video tape using the video-recorder microphone as an input. For video recordings of longer than ten minutes the audio recording was simply rewound and played into the video recording beginning the second 120-interval sequence. The video tape thus was divided into

five-second intervals using the above technique. Some experimentation was done with a ten-second interval, but it was found that too many behaviors were being lost in the interval, i. e., the student would shift from behavior A to behavior B and back to behavior A during the ten seconds, and consecutive codings would record only behavior A. Behavior B was thus lost. An interval shorter than five seconds proved unwieldy, and hence, the five-second interval was adopted.

When behavioral data were to be quantified, the recorder was connected to a monitor and set in operation. At the beginning of the sound of each number, a code symbol representing the behavior manifested by the student was placed in the blank opposite the number on a data sheet prepared for this purpose. A data sheet is shown in Appendix B.

The video tape was then played through to completion, and one category was analyzed by coding* the observed behaviors in that category at the beginning of each five-second interval. The video tape was then rewound and replayed while a second category was analyzed. The process was continued until all the categories in the instrument had been analyzed. This technique was employed for each experimental subject.

The details of the data gathering are presented in a later section of this chapter.

Validity and Reliability

An integral part of the development of any observation instrument is the establishment of satisfactory levels of validity and reliability. The instrument developed as part of the research project has characteristics that lend to high validity. Inasmuch as the behaviors to be measured are actually signs in most cases, the definition of the sign is very precise, and necessary inference on the part of the observer is virtually eliminated. Also, the necessity of the establishment of context was reduced, because the captured behaviors were delimited to those manifested by students in the teaching-learning situation. Further, the context for different subjects in the same class remained constant, because the subjects' behaviors were videotaped simultaneously. Also, with respect to Arrington's assertions cited earlier, the behaviors were natural, postural-gestural manifestations that appear to be typical of the subjects observed, which some researchers argue are subconscious manifestations in the first place.

Arrington outlines factors affecting observation accuracy, and thus, relate to validity. These factors are the amount of behavior observed, the degree of precision with which the observed behavior is defined, and the simplicity or complexity of the coding method. The present study adequately satisfies the stated requirements for accuracy inasmuch as the behaviors to be coded* are actually signs,

and thus are precisely defined. The number of decisions a researcher must make while coding* is small due to the small number of signs in each behavioral division, and thus coding* is simple. The length of each time sample is five seconds, and each coded* segment is 20 minutes, which affords a sizeable sample of behaviors.

One final factor relating to validity must be considered. This factor is that of having a camera in the classroom.

As Arrington outlines the total research procedure she notes that the major deterrents to the widespread use of observational methods are (a) the fact that people know they are being observed and are likely to consciously or unconsciously adapt their behavior to this knowledge, and (b) the limited range of life situations in which individuals can be observed over a sufficiently extended period and under sufficiently comparable conditions to insure an adequate sampling of their normal behavior. With respect to the first problem, Arrington reports that extensive observation of young children showed that observer-consciousness at this age was negligible. For older people it is usually necessary for the observer either to secure rapport with the subjects or to conceal from them the fact that they are being observed. Other factors that can affect observer-consciousness are familiarity with observers in general, previous experience in being observed, and the type of situation in which the individual is being observed. Arrington states further:

As to the type of situation in which systematic observation is feasible, we know that . . . work periods in . . . the public schools and periods of undirected activity are particularly favorable. . . , and that certain types of social behavior can be satisfactorily observed in the ordinary school classroom. (p. 90)

She states in general that the basic requirements for a satisfactory observation situation are that the situation should be one with which the subjects are familiar, the situation should remain uniform from day to day and the personnel of the groups should remain constant.

The requirements outlined by Arrington are adequately met by the present study. The classroom content (pupils) remains constant, the students are obviously familiar with classroom situations, and the classroom activity is relatively uniform. Further, as previously mentioned, the context for pairs of subjects remains the same inasmuch as behaviors for each pair are captured by the camera simultaneously.

Masling and Stern (1969) studied the effects of an observer in the school classroom and found no conclusive results. They hypothesized that if observations were conducted in time periods A, B, and C, where time period A was first, time period B came later, and period C last, observer effects, if present, should cause behavioral patterns in A to correlate less strongly with patterns in C than the correlation between behavioral patterns in B and C. No such correlation was found, leaving the results inconclusive. They could only

state that observer effects were not significant or that the effects were too complex to be detected under the conditions of the study.

Weick (1968) in a review of observational techniques states that most observers argue that subjects in familiar habitats soon forget they are being watched or, if they do not, the observer will notice their concern. In reference to studies done where interference has been assessed, Weick reports, "the typical finding is that interference is not extensive, and when it occurs, its effects are usually localized in the period when observation begins" (p. 371).

Weick also outlines procedures for coping with interference. He discusses total concealment, partial concealment and nonconcealment. Total concealment has ethical problems. With partial concealment the investigation does not conceal the fact that observations are being made but does conceal who and what is being observed. The research described here utilizes partial concealment in that the subjects knew they were being videotaped, but the exact purpose of the videotaping was not explained by the researcher. With nonconcealment the observer indicated his purpose to the subjects in advance and then tries to remain inconspicuous while recording their actions. Finally, Weick states, an investigator can cope with interference by recording behaviors not under the conscious control of the subject. In the review of related literature, work has been cited that asserts the behavioral manifestations as a result of an attitudinal set are largely out of the

subjects' conscious control. Thus, the subjects observed in this study fit the description as outlined by Weick.

Medley and Mitzel (1963) state in reference to interference by observers, "To know how teachers and pupils behave while they are under observation seems better than to know nothing at all about how teachers and pupils behave" (p. 248).

A final comment with respect to the above discussion is in order. The above citations relate to the presence of a live observer in the classroom. The research described here used only an inanimate camera inconspicuously placed in a classroom corner. It is felt that an inanimate object making no noise is soon forgotten by students involved in classroom activity. Thus, the researcher feels a strong argument can be made for the validity of both the instrument and the results of the study within its limitations.

Inter-observer Agreement

With respect to reliability in the use of systematic observation in general and time sampling in particular, Arrington states that, "the accepted criterion of reliability of observations... is agreement of independent observers of the same events..." (p. 110). The procedure used to establish a satisfactory level of reliability is described in the paragraphs that follow.

The researcher using a stopwatch determined a graphical relationship between units on the video tape recorder counter and time. Thus, knowing the number of units and the timed length of each tape, it was a convenient matter to divide the tape into segments with the location of the segment being determined by merely reading the counter. The ten pilot recordings were then divided into five-minute segments, and each segment was numbered. A total of 58 five-minute segments were numbered using the above procedure. A random numbers table was then consulted and ten numbers were selected from the total of 58. The ten segments were then re-recorded onto a separate tape which was used for inter-observer agreement. The researcher worked cooperatively on the inter-observer agreement phase of the study with Joseph Kelly, who as part of his own research developed an instrument similar to the one described in this writing, Kelly's instrument being designed to measure the nonverbal behavior of teachers. The researchers then studied pilot recordings in detail and discussed the behavioral manifestations. These discussions resulted in further modification of some of the categories. For example, the researcher initially had differentiated in a category between the student turning his head 45° to the left and 45° to the right. This was modified and the result was the notation of the head being turned without regard to direction.

After reaching a mutually satisfactory level of familiarity with the instrument as it existed a researcher connected the audio microphone to the recorder, and voiced numbered 60 five-second intervals on each five-minute segment. The researchers then practiced coding behaviors on the first two five-minute segments according to the time sampling technique previously described. When satisfactory agreement was not obtained, the tape was rewound and replayed through the numbered intervals where agreement had not been reached. The points of disagreement were discussed, and the tape was replayed as often as desired to thoroughly study the total behavioral ramifications. The discussions resulted in further slight modifications of some categories. For example, the literature discusses the category Forward-Lean, as was previously mentioned in this chapter. The author notes and records 10⁰ shifts in forward and backward inclination. It was found in the practice runs that the researchers were not able to discriminate to the author's described degree of precision and achieve high agreement. Hence, the category was broadened to include only three levels (cues) -- forward, erect, and back. The practice -- discussion -- modification process continued until satisfactory agreement was reached and the researchers were thoroughly familiar with the instrument. The slight modifications resulted in the instrument in its final form. The final form includes category definitions, and explanations for coding* the specific cues as well as keys to be used

as an aid for the coding* of idiosyncratic behaviors.

The searchers then coded the five-minute segments using the technique described earlier in this chapter and coefficients of inter-observer agreement were calculated using Scott's formula (Scott, 1955) for inter-observer agreement.

Arrington notes that observer agreement has been measured primarily by correlations of total scores obtained by observers in successive observation periods and by simple percentages of agreement. Both have weaknesses that are at least in part corrected by the Scott formula.

Scott has described the technique for improving the accuracy of content analysis, and his description is appropriate for the present study. A random sample of material to be coded is assigned for "check-coding." A second coder independently analyzes and codes the material, and a record of differences is kept as a basis for a report of overall coding reliability for the entire set of material.

A common reliability index as Scott describes it has been the simple percentage of agreement between the two coders compared to the total number of judgements. This, however, is biased in favor of dimensions with few categories, due to chance agreement. By chance alone better agreement would be expected on a two-category scale than on a five-category scale. Scott reports work done which attempts to take into account the number of categories, but he criticizes the

developed expression, because it is based on the unwarranted assumption for behavioral research that all categories have equal probability of use.

As Scott states, for certain data types some preferred indices are already available. The Pearson Product-moment correlation is appropriate for cases where the coding dimensions are composed of equal-interval scales. A rank-difference correlation is adequate when phenomena are ordered along a dimension of unknown intervals. The present study falls into neither of the above descriptions, and hence, the Scott formula was used.

Scott proposes his expression, which he claims accounts for both the number of categories and the frequency with which each is used. The coefficient is essentially a measure of the extent to which the observers exceed chance compared to the extent to which perfect agreement would exceed chance. The expression is

$$r = \frac{P_o - P_e}{I - P_e}$$

where P_o is the simple percentage of agreement and P_e is the agreement expected by chance alone.

$$P_e = \sum_{i=1}^k p_i^2$$

where k is the total number of categories and P_i is the proportion of the sample which falls in the i^{th} category.

Two comments are noteworthy regarding the inter-observer agreement in general and Scott's formula in particular. First, conceptually there was virtually no disagreement between the researchers regarding the various behaviors. The disagreements arose because of timing problems, i. e. , occasionally the subject would be in the process of shifting or would just begin to shift from behavior x to behavior y at the sound of the number on the tape, and the observers could interpret the process differently solely as a function of their individual perception of the sound of the number. The problem was discussed, and one ramification of the timing aspect was alleviated. It was agreed upon that in any case where the sound of the number the subject was involved in a behavioral change, the encoders would code the subject as manifesting the behavior he was "coming from" rather than "going to" or any other choice. This technique solved most of the timing problems, but as in any case where human perception is involved, it is impossible to maintain 100% agreement. Second, in the case of a category with a small number of levels the agreement expected by chance is quite high, and hence, any disagreement between the observers greatly reduced the value of the coefficient. In actuality the percentage of agreement between the observers was high, but the above described factor caused a reduction in the value of the coefficient in the categories with a small number of cues. As argued with respect to validity, the instrument by its design allows high agreement,

because the encoder has only to code the actual physically manifested behavior. No inference of subject intent, attitude, or context is required. It is believed that the generally high inter-observer agreement coefficient, together with the previously cited assertions regarding validity, argue strongly for the instrument's objectivity.

Description of the Instrument

The instrument consists of two parts: the catalogue of behaviors and the definitions and explanations of the respective variables (cues). The catalogue of behaviors consists of 13 categories which are split into two divisions. The first division consists of 12 categories of non-interactive variables, and the second division consists of one category of interactive variables. The Division I categories measure behaviors with respect to various anatomical parts and consist of the following: three categories with respect to the upper torso, which are (1) forward lean, (2) sideways lean, (3) body immediacy; four categories with respect to the head which are (4) head immediacy, (5) head orientation in a plane perpendicular to the floor which bisects the body through its bilateral symmetry plane, (6) head orientation in a plane perpendicular to the floor which bisects the body into a front and back portion, and (7) head movement; one category with respect to the face, which is (8) facial expression; one category with respect to the eyes, which is (9) gaze direction; three categories with respect to the arms and hands,

which are (10) arm symmetry, (11) manipulation, and (12) gestures. The thirteenth category is the Division II category -- Interactions.

The instrument in total consists of 48 variables which comprise the 13 categories. The 48 variables measure behaviors with respect to the subject as described in the following: (1) body -- 8 variables, (2) head -- 11 variables, (3) face -- 5 variables, (4) eyes -- 4 variables, and (5) arms and hands -- 17 variables. Thus the non-interactive categories are comprised of 45 variables and the interactive category consists of 3 variables.

A complete catalogue of behaviors together with the definitions and explanations of the cues is presented in Appendix A.

Identification of Subjects

The first phase of the process of gathering behavioral data consisted of isolating the experimental subjects. The device used for this purpose was a questionnaire (Appendix C), which polled the students' attitude toward their teachers and classes. The questionnaire is a modification of the "semantic differential" as described by Osgood, Suci, and Tannenbaum (1957) as first cited in Chapter I. The background and conceptualization of the "semantic differential" is outlined below.

Semantic differentiation as conceptualized by Osgood, Suci, and Tannenbaum is a device which uses linguistic encoding to determine the

this was related to intelligence differences. Further, they cited a study with schizophrenics which showed that the patients used the finely discriminative positions (2, 3, 5, and 6) significantly less frequently than did control groups.

The above conceptualization has been developed around the use of the technique to analyze the "meaning" of concepts. However, the technique has wide applicability, and as the authors have stated, "it is a very general way of getting at a certain type of information, a highly generalizable technique of measurement which must be adapted to the requirements of each research problem to which it is applied" (p. 76). As such it is appropriate for the measurement of attitude, specifically student attitude in the present study.

The actual process employed by the researcher for the identification of the subjects is developed as follows:

The researcher contacted the teachers who had previously agreed to participate in the study and arranged to visit the respective teachers' classes. All but one teacher had previously been involved in the pilot study phase of the project. At the appointed time the researcher went to the class and was introduced by the teacher. The researcher explained that he was in the class to take a poll and noted that this polling process was similar to polls that people heard of everyday. Whenever a student asked the purpose of the poll he was told that it was part of a research project at Oregon State University. The researcher

emphasized that the poll was in no way related to the student's performance in the class. The student was asked to give his honest response and to work independently. No further information of any kind was volunteered to the student.

Prior to administering the questionnaire the researcher identified the respective questionnaires by putting a small pencil mark in the first closed letter of consecutive words in the questionnaire heading. The questionnaires were handed out in a specific order, and even though randomly collected, all individual responses were identifiable as to number and location of the class. Each teacher as part of his normal pattern had students assigned to specific seats. Thus, individual responses were identified and associated with a specific subject.

No student names were solicited, and a class list was refused by the researcher with the explanation that anonymity of students was desired by the researcher. The teacher was not told who the specific subjects were but was given a tally of the students' responses. In general the responses to the teacher were favorable, and the essence of the entire questionnaire administering process tended to be a pleasant experience for researcher and teacher alike.

The researcher selected from the responses two students in each class. One showed a polar positive response, and the other showed a polar negative response to both the class and the teacher. These responses were checked against the potential subject's attitude

as perceived by his neighbor. All subjects' attitudes were verified by their neighbors' responses. The subjects were selected in a way that would allow both subjects to be recorded simultaneously, thus maintaining similar context for both subjects. In any case where two students showing polar responses didn't exist in a class, the class was not used for purposes of gathering behavioral data. The remaining classes comprised the sample from which the behavioral data was gathered.

Gathering of Behavioral Data

The final sample consisted of nine classes. The classes were each visited and videotaped four times over a period of three months. The first taping session was used as a conditioning session to allow time for students to develop indifference to a camera in the classroom. The final three sessions were used for purposes of gathering data. No data were gathered on Mondays or Fridays of any week, nor was any first or last period taped.

The taped segments were all 20 minutes in length. The number was determined because of the classes that had no more than 20 minutes of lecture-discussion activity. The technique thus resulted in nine classes times two subjects times three taping sessions per class giving a total of 54 independent 20-minute segments or a total of 1080 minutes of actual coded student behaviors.

Using the previously devised audio tape and the videotape recorder microphone, voice numbers were recorded onto the audio track of the video tape. The tapes were then viewed and coded using the same technique as had been previously used for the inter-observer agreement.

A 20-minute segment to be quantified was divided into 240 five-second intervals, and an entry was made on the data sheet for each of the five-second segments. Thus, a total of 240 entries were made for each category in each 20-minute segment. A subject's nonverbal behavior was totally quantified according to the instrument when the 240 entries had been made for each of the 13 categories. A total of 3120 entries were then made on the data sheets for each 20-minute segment. With the total of 54 20-minute segments the result was a total of 168,480 entries, each representing a particular behavior manifested by a subject.

Two different types of data were gathered. For Type A data the total number of five-second intervals in which each particular behavior was manifested was determined by merely tallying the various symbols shown on the data sheet. For Type B data the groups of symbols were counted and totaled. Thus, the pattern of behavior was analyzed as well as the total length of time each behavior was exhibited. An example is shown as follows: Suppose the following symbols representing behaviors exist on a data sheet: XYXXXZXXYYYYZZXXXYYZZ.

For Type A data the results would show 9 X's, 6 Y's, and 5 Z's. Type B data would show 4 X groups, 3 Y groups, and 3 Z groups. Type B data can be termed a type of frequency sampling procedure, and Type A data could be called a kind of duration sampling procedure.

Results from the questionnaires also revealed some general trends with respect to student attitude, and these results together with the "duration" and "frequency" results are given in Chapter IV.

Analysis of Data

The researcher in the process of planning the research design and data gathering techniques consulted with experts in statistics regarding problems such as sample size, context, the handling of Type A and Type B data and so forth. The researcher as a result of these conferences was assured that his sampling technique was satisfactory, and he settled on discriminant analysis as a technique for analyzing the raw data. The use of discriminant analysis proved efficacious in several ways. The issue of parametric versus nonparametric statistics doesn't exist with this technique. A stepwise computer program existed at the Oregon State University Computer Center, which allowed a model development showing the respective order of discriminating variables. The technique has the capacity to analyze a large number of independent variables with respect to a dependent variable, which was amenable to the type of data gathered in this study.

The stepwise program extant at the university had a capacity of 40 variables (independent). Discriminant analysis requires one more observation than the number of variables. Thus, 40 variables requires 41 observations, and the study's total of 54 observations allowed a comfortable margin for statistical handling of error.

The discriminant function is expressed as follows:

$$Y = (\bar{X}_1 - \bar{X}_2)' S^{-1} X$$

$(\bar{X}_1 - \bar{X}_2)'$ represents the vector of the mean differences of the two groups, S^{-1} is the inverse of the within-group covariance matrix, and X is the vector representing the independent variables. For example, suppose a discriminant function was desired for three variables which were measured on groups A and B. The sample means would be X_{A_1} , X_{A_2} , X_{A_3} , X_{B_1} , X_{B_2} , and X_{B_3} .

We would then have

$$(X_1 - X_2)' = [X_{A_1} - X_{B_1}, X_{A_2} - X_{B_2}, X_{A_3} - X_{B_3}]$$

and

$$Y = [X_{A_1} - X_{B_1}, X_{A_2} - X_{B_2}, X_{A_3} - X_{B_3}] \begin{bmatrix} V_{11} & V_{12} & V_{13} \\ V_{21} & V_{22} & V_{23} \\ V_{31} & V_{32} & V_{33} \end{bmatrix} \begin{bmatrix} X_1 \\ X_2 \\ X_3 \end{bmatrix}$$

where V_{ij} represents the covariance of variable i with variable j , and the rules for matrix multiplication apply.

Summary of Chapter III

The design of the study was considered in Chapter III. The conception and nature of the design was considered in the first section. The procedure used to collect the pilot sample was discussed, and in turn the use made of the data gathered from the pilot sample was considered. The method used to develop the instrument was reviewed and the instrument itself was described. The adaptation of the time sampling technique, which was the method used to quantify behavioral data was discussed and an evaluation of factors including objectivity as determined by inter-observer agreement which relate to the validity and reliability of the instrument was made. A description was given of how the experimental subjects were identified, and the method of gathering the behavioral data was also discussed in further detail. Finally, a section considering the method of analyzing the data was included.

IV. RESULTS OF THE STUDY

Chapter IV includes five parts which are as follows: (1) Introduction, together with a brief review of the purposes of and procedures used in the study, (2) Handling of the data, (3) Findings related to the study's hypotheses, (4) Findings not directly relating to the study's hypotheses, and (5) Summary.

Introduction

The purposes of the study are stated as follows: (1) To develop a reliable instrument for the direct and systematic observation of the nonverbal behavior manifested by students in the lecture-discussion phase of teaching-learning classroom activity, and (2) To determine the relationship between the nonverbal behaviors exhibited by the students and their attitudes toward their teachers and classes.

In order to meet the stated purposes, the study progressed through several stages. Initially, contact was made with teachers in an area with proximity to Corvallis, Oregon. The nature and purposes of the study were explained to the teachers and a pool of willing teachers was established.

Ten video tape recordings each one class period in length were made of ten different classes involved in lecture-discussion activity. These recordings were studied, and the behaviors manifested by the

students were recorded in handwritten notes. The recorded behavioral cues, together with material from the professional literature, were compiled and developed into categories of behavior which ultimately became the Seated-Subject (Student) Catalogue of Nonverbal Behavior.

Ten five-minute samples of behavior were drawn at random from the pilot recordings, and these samples were re-recorded onto one 50-minute videotape. The tape was divided into five-second intervals by means of a spoken number recorded onto the audio track of the video tape. Two observers then simultaneously coded* the behaviors observed on the video tapes and used the results to calculate coefficients of inter-observer agreement.

Upon completion of the instrument the researcher went again to classrooms and, using the videotape recorder, gathered 54 20-minute samples of behavior from subjects who were selected from results obtained with a questionnaire devised to determine the attitude of the students. All but one of the teachers' classes had previously been used in the pilot study phase of the research.

The behavioral data gathered were then coded using the instrument devised for that purpose, and the data were recorded onto data sheets (Appendix C). The results found on the data sheets were used for the analysis of the behavioral data.

Handling of Data

From the results obtained using the questionnaire 25 different subjects were identified. Of the 25 subjects, 15 were found to have a polar positive attitude, and 10 were found to have a polar negative attitude. The 25 subjects included 13 eighth graders, 10 ninth graders, and 2 tenth graders.

The subjects were video taped no less than two times and no more than five times. The variance in the numbers of recording sessions was caused by logistic problems such as student absences, canceled periods, assemblies, etc. In each case the first recording was discarded. The first recording session was used for the purpose of acclimatizing the subject to a video tape camera in the classroom. The taping sessions resulted in the 54 20-minute segments - 27 positive and 27 negative - which were subsequently used in the analysis.

From the total of 25, 18 subjects were selected for further analysis to check for any bias that could arise due to the uneven number of recordings for the total sample. The 18 had each been taped three times exactly, and the results were used as a check against the results for the entire sample. Each taping session simultaneously recorded a positive subject and a negative subject, which prevented contextual differences from becoming a biasing factor. The 20-minute sample was begun as soon as the routine activity at the beginning of the

class period was completed, and the normal teaching-learning activity was begun.

The 54 20-minute segments were divided into five-second intervals resulting in 240 five-second intervals per segment. Each of the 13 categories was coded in each of the 240 intervals, which means that a total of 3120 separate codings were made for each 20-minute segment, or it could be said that 3120 samples of behavior were taken in each segment. For the 54 segments then, each category was sampled a total of 12,960 times. For all 13 categories the total number of samples taken numbered 168,480, each of which represented a separate coding by the researcher.

The data were recorded and tallied on data sheets which were then kept as a master record of all the behavior. The data were tallied according to both "duration" and "frequency" measures. The method of tallying the data is illustrated by the following example: From Appendix A we see category 1 is Forward Lean with the three cues Forward, Erect, and Back. A data sheet could show the following pattern:

1. <u> f </u>	6. <u> f </u>	11. <u> b </u>	16. <u> f </u>
2. <u> f </u>	7. <u> f </u>	12. <u> b </u>	17. <u> e </u>
3. <u> f </u>	8. <u> f </u>	13. <u> e </u>	18. <u> e </u>
4. <u> e </u>	9. <u> e </u>	14. <u> e </u>	19. <u> e </u>
5. <u> e </u>	10. <u> e </u>	15. <u> e </u>	20. <u> e </u>

This process would be continued until the 240 intervals are completed. The "duration" measure shows a ratio of 7:11:2 for forward, erect, and back, respectively. The "frequency" measure shows a ratio of 3:4:1 or what would be 6:4:2. The two measures obviously give different results. The "frequency" measure is designed to provide data regarding what behavioral changes may indicate. For example, an analysis could be made of comparison in attitude between a subject who changes cues often and the attitude of a subject who seldom changes cues. "Duration" measures simply are designed to provide data regarding the total "time" a cue is manifested.

Finally, the data were punched on computer cards and stepwise discriminant analysis was used to determine the relationship between the manifested behaviors and the subjects' attitude. The computer program was available at the Oregon State University Computer Center. Discriminant analysis as a technique was arrived at as a result of the researcher's consultation with experts in the Statistics Department at Oregon State University. The technique was efficacious in several respects. The parametric versus nonparametric statistic is not an issue using the technique. The technique is designed to classify experimental subjects into one of two groups, which is precisely what the present study has as an implicit intent. The study wanted to develop a model which would classify subjects into either the group of students having a positive attitude or the group having a negative attitude. The

program was stepwise, which allowed a ranking of the variables (behavioral cues) in terms of their ability to classify subjects.

Findings Relating to the Study's Hypotheses

Hypothesis One

Hypothesis One - A valid and reliable instrument for the systematic observation of student nonverbal behavior can be developed - is supported by the following discussion of the method of developing the instrument, the implicit characteristics of the instrument, and the method of coding.*

Instrument Development. The instrument, which is composed of the catalogue of behaviors and the criteria for coding, was developed in a combination inductive-deductive manner. This method of development has advantages over either an inductive or a deductive approach alone in that it utilizes the best features of each technique.

For the present study the extensive body of professional literature relating to nonverbal behavior and the techniques for classifying behaviors were reviewed. Experts in the field developed categories of behaviors which they felt related to particular aspects and referents of nonverbal behavior in general. These studies were conducted primarily in group counseling, psychotherapy, or family therapy sessions, and hence could not be directly adopted for a classroom situation.

However, the conceptualizations of the professionals in the field - primarily psychology - provided the present study with a sound theoretical framework on which the project could be built.

Inasmuch as the assumption of a direct correspondence between behaviors exhibited in a psychotherapy session and those exhibited in a classroom context could not be made, the researcher inductively modified, extracted, deleted, and supplemented results obtained from the professional literature by the use of pilot study work. Behaviors manifested by students as captured on videotape were viewed and noted in handwritten descriptions. These descriptions provided a comprehensive record of the nonverbal behaviors exhibited by the students. The written record and the professional literature were then simultaneously studied, discussed, related, and conceptualized. From this process the 13 categories of behavior shown in Appendix A were developed. The catalogue of behaviors retained the strong conceptual framework used as a foundation. However, it provided an inductive element in that it progressed from a list of individual student behaviors to a related list of behavioral cues and finally to a series of behavioral categories which ultimately became the Catalogue of Behaviors.

The category Forward Lean was adopted from the literature and was one of the immediacy categories Mehrabian (1969a, 1969b, 1970) found to be related to attitude. The category was modified to include only the three cues Forward, Erect, and Back, which seemed more

appropriate to the classroom situation due to factors such as restriction by a desk and physiological differences in size which would select against valid differences in intensity of the forward or back cues.

Sideways Lean was adopted and modified to include only two cues - Sideways Lean and No Sideways Lean. Again the restrictions on the movement of a student probably prevented the varying degrees of lean reported in the literature. The pilot recordings showed little distinguishable difference in varying degrees of lean, and hence, the combined process is illustrated.

Orientation was considerably expanded and revised as a result of the pilot work. Orientation was first separated into body and head manifestations, and the head cues were divided into three different categories. Orientation in general was conceived as related to attitude in that the more direct orientation could be termed as more immediate, which again refers to the cues and conceptualizations outlined by Mehrabian. The three head categories allowed a more precise analysis of right-left, up-down, and tilted orientations by the subject and were a result of the inductive pilot work.

Further immediacy cues are noted in the literature, an important one being eye contact. This category was modified to become the more comprehensive Gaze Direction, which included not only eye contact with the teacher, but also observations of the teacher or his work without eye contact, and it included any other directions a subject

might be looking.

Facial Expression is a difficult category inasmuch as expressions are hard to evaluate with the retention of objectivity. Thus, the category was developed to include only obvious expressions which could be objectively interpreted. The professional work comments only briefly on the above point, but prominent researchers typically use the policy adopted for use in this study.

Activity cues are reported by workers in the field, and the review in conjunction with the pilot work resulted in three categories of movement which are as follows: (1) Head Movement, which merely included Positive Nod, Negative Shake, and No Head Movement, (2) Gestures, which includes only Gestures and No Gestures, and (3) Manipulation. The pilot work resulted in considerable expansion on what the literature reported as Self-Manipulation. Manipulations can be conceptualized as relating to activity cues as reported by Mehrabian or autistic gestures as reported by Krout. The interpretation of the cues for the present study are developed more comprehensively later in the present chapter. Manipulation was expanded to include Self, Object, Drumming, Taking Notes, and No Manipulation, all of which were evident in the pilot recordings.

Arm Symmetry was expanded to include ten behavioral cues with a notable example being Raised Hand, which has relevance primarily in a classroom situation as opposed to a psychotherapy session. The

category relates to relaxation cues as conceived by Mehrabian.

The final category provides a rather unsophisticated analysis of interactions between the subject and his peers or the subject and the teacher. It does relate conceptually to affect, but the cues are necessarily quite gross in order that objectivity remain high.

In summary it can be argued that the process of developing the instrument has retained the best of both the deductive and inductive approaches. The resultant categories derive from a list of individual behaviors, while at the same time they retain a strong theoretical framework to which the behaviors themselves and experimental results can be related. The complete instrument is shown in Appendix A.

Implicit Characteristics of the Instrument. The instrument is composed of two integral parts - the Catalogue of Behaviors, and the Criteria for Coding Behavioral Cues. The Criteria for Coding Behavioral Cues include precise definitions and explanations as well as keys to aid in objectively coding manifested behaviors. The precision with which the cues are defined as well as the nature of the cues themselves - primarily signs as defined by Medley and Mitzel - allow a virtually exact interpretation of behavior. This means that the observer is not required to infer a categorization of the particular cue, nor is he required to make a contextual analysis while coding* the behavior. Many studies make an a priori designation of particular behaviors, classifying a behavior as supportive or unsupportive or as restrictive or

unrestrictive, for example. These designations can never be more than inferential. The user of the present instrument makes no such designation, and in no way suggests the meaning, motivation, or effect of the behaviors being measured. These factors all contribute to greater objectivity when using the instrument.

The instrument is developed to quantify nonverbal behaviors in the classroom context. Behaviors in this context are natural exhibitions by a subject in a familiar environment. Further, it can be argued that many of the behaviors are subconscious manifestations, which means the instrument is designed to measure behaviors over which the subject may have no control. Both factors contribute to the instrument's validity in keeping with remarks made by Arrington (1943).

The way the instrument was developed contributed to its inherent comprehensiveness. The professional literature provided a rather complete review of behavioral cues and their referents, and the pilot work contributed to making the repertoire of behaviors complete and relevant for an educational setting. Again as noted by Arrington, comprehensiveness enhances the validity of an observational technique, and the development process for the present instrument contributed to it being comprehensive.

Finally, a factor that cogently argues for the instrument's objectivity and reliability is the high coefficients of inter-observer

agreement, The coefficients are provided in Table 1.

Table 1. Coefficients of inter-observer agreement.

Category	Description	
1	Forward Lean	.89
2	Sideways Lean	.99
3	Body Orientation	.61
4	Head Orientation (a)	.87
5	Head Orientation (b)	.89
6	Head Orientation (c)	.80
7	Gaze Direction	.84
8	Manipulation	.78
9	Interaction	.86
10	Arm Symmetry	.90
11	Gestures	.79
12	Facial Expression	.86
13	Head Movement	.80
	Overall Coefficient	.85

During the pilot study phase of the project the pilot tapes were divided into five-minute segments using the tape counter on the video tape recorder. Ten of the five-minute segments were re-recorded onto one 50-minute tape which was set aside until the observation instrument was worked into its final form.

Upon completion of the instrument two researchers independently coded* each of the five-minute segments through all 13 categories, the results were compared, and coefficients of inter-observer agreement were calculated. The tape was prepared prior to the coding* by voice numbering each segment with a five-second interval. Thus each five-minute segment was numbered from 1 to 60, and it was assured that the researchers while working independently were coding* exactly the

same behaviors viewed on the video tape. The coefficients were calculated using Scott's (1955) formula for inter-observer agreement.

The inter-observer agreement coefficients ranged from .61 for Body Orientation to .99 for Sideways Lean. As discussed in Chapter III there was virtually no disagreement as to the particular behavior being exhibited by the subject. Disagreements were primarily a function of timing. Further, when the number of choices is small, the Scott coefficient is sharply reduced due to the chance factor in the formula. Thus, the values of the coefficients appear satisfactory due to the magnitudes of the coefficients, plus the fact that many authorities consider .70 an approximate acceptable lower limit for the inter-observer agreement coefficients.

Method of Encoding. When behavioral data were quantified, each category was coded*separately. The 20-minute sample was numbered by having an audio tape sound numbers consecutively from 1 to 240, each number beginning a five-second interval. The numbers were recorded onto the audio track of the video tape, and the 20-minute segment was then divided into 240 five-second intervals. The tape was then played. At the sound of each number the observer would mark a symbol on a data sheet which represented the particular cue being manifested by the subject. This cue would be one of the choices within the particular category being quantified. Upon completion of the 20-minute segment, the tape was rewound and replayed while a second

category was coded.* This process was repeated until all 13 categories had been quantified. Thus, as noted previously, the number of choices the observer was forced to select among for each coding* was small, and the observer had few decisions to make while coding*. In addition the nature of the cues and the precise definitions prevented the observer from being forced to infer the nature of the behaviors. As Arrington has noted both factors contribute to the objectivity and reliability of an observation method.

The instrument was designed to be used with video tape as a method of capturing behaviors. Thus, the tape could be stopped and rewound whenever a question arose. The observer could view the tape as often as desired to allow accurate measurement of each behavior. Further, the use of the video tape meant that only an inanimate and noiseless camera was needed in the classroom as opposed to a live observer.

Finally, the length of the time sample was quite short preventing appreciable "loss" of behaviors and concomitantly the number of samples per segment was large (although the instrument could be adapted to a different length time sample). This added to the comprehensiveness of the sampling and increased the instrument's validity and reliability.

Summary of Hypothesis One. In summary the following arguments are outlined and reviewed:

It is argued that the instrument developed for the purposes outlined in this writing possesses high validity, reliability and objectivity. The method of development, the nature of the instrument, and the method of encoding* all contributed to the instrument's validity and reliability. The method of development provided a comprehensive catalogue of behavioral cues that was built on a sound theoretical frame. The instrument by its nature provides precise definitions of the behaviors and prevents necessary inference on the part of an observer.

Objectivity as it has been used in previous studies refers to the extent to which independent observers using the instrument could agree upon the encoding* of particular behaviors. Ease of discrimination depends on the difficulty of the judgements required, the method of encoding* and the precision with which the behavioral basis for discrimination is spelled out. The coefficients of inter-observer agreement attest to the fact that independent observers could agree. The precise definitions and the small number of choices in coding* lend to ease of judgements required by the observer.

However, more agreement among independent observers doesn't guarantee that what is agreed upon has any meaning in the real world, i. e. , high agreement doesn't insure validity. The instrument developed in the present study overcomes this problem by coding* cues themselves, i. e. , signs, and not requiring that they be

subheaded under an arbitrary classification. Further, virtual elimination of inference assures that the observed behavior is "real". Thus, Hypothesis One, that a valid and reliable instrument for the systematic observation of student nonverbal behaviors can be developed is accepted. The Hypothesis is accepted based on the preceding discussion of the development of the instrument, its inherent characteristics, and the method of encoding* the behavioral data.

Hypothesis Two

Hypothesis Two - A significant positive relationship exists between the measured nonverbal behaviors exhibited by students and their attitude toward their teacher and/or their class - is supported by the following discussion of the collection, presentation, and analysis of the data.

To gather behavioral data the researcher first identified subjects with polar positive and negative attitudes toward the class and teacher. This was accomplished by using a questionnaire, the conceptual basis of which was developed by Osgood, Succi, and Tannenbaum (1957).

The questionnaire revealed 25 subjects showing the desired response toward the class and teacher. These subjects were taped in a manner that allowed the simultaneous recording of pairs of polar respondents. From the 25 subjects, 54 20-minute segments of behavior

were gathered using the video tape camera and recorder. Twenty-seven of the segments were recorded from subjects with a positive attitude, and 27 were recorded from subjects with a negative attitude. The subjects were taped during the lecture-discussion phase of normal classroom activity, and the taping was begun as soon as the teaching-learning process proceeded for the day.

The tapes were quantified using the instrument developed for that purpose. The resultant data were used for the analysis used to test Hypothesis Two. A detailed description of the method of gathering behavioral data is presented in Chapter III.

The behavioral data were analyzed by using discriminant analysis, which is a statistical technique designed to classify subjects into one of two groups. For the present study the classification would be into either the group of students showing a positive attitude or the group showing a negative attitude toward the teacher and class. The data analysis was essentially a determination of the behavioral differences that were exhibited by subjects with positive attitude compared to subjects with a negative attitude.

The discriminant function is as follows: $Y = (\bar{x}_1 - \bar{x}_2)' S^{-1} X$ where $(\bar{x}_1 - \bar{x}_2)'$ represents the row vector of the mean differences between the two groups. The vector will have an order equal to the number of variables being considered. S^{-1} is the inverse of the covariance matrix for all the variables and X is the column vector of the

respective variables.

A stepwise discriminant analysis program was available at the Oregon State University Computer Center. This program had a capacity of 40 variables, which meant some of the cues in the instrument could not be entered in the analysis. The number of variables could be reduced with no loss of information as the following explanation points out.

Each category had n integral cues which make up the category. If the number of entries for each cue in the category is n_i , then $\sum n_i = 240$ for "duration" measures. This means the category is completely described by entries for $n-1$ cues, and one cue could be disregarded. Further, for "frequency" measures categories with only two cues could be adequately described by recording values for one of the two cues. If n_i entries are made for one cue, the number of entries for the other cue must necessarily be n_i , $n_i + 1$, or $n_i - 1$. $n_i + 1$ and $n_i - 1$ differ by an insignificant amount from n_i making the correlation between the two cues very high. Thus, the computer would use only one of the two cues in its analysis, and the description would be complete by initially entering values for only one of the cues.

Finally, cues with a very small measure of occurrence, i. e. , subjects seldom manifested the cue, provided no information and were thus valueless as entries. These cues were also disregarded.

The results of the selection left 39 cues which were the independent variables in the discriminant function. The variables and their description are shown in Figure 4.

Variable (Cue)	Category	Description
1	Forward Lean	Forward
2		Erect
3		Back
4	Sideways Lean	Sideways Lean
5	Body Orientation	Immediate
6		Less than 90° from Immediate
7	Head Orientation (a)	Immediate
8		Less than 90° from Immediate
9	Head Orientation (b)	Below Parallel
10		Parallel
11	Head Orientation (c)	Tilt
12	Gaze Direction	Teacher
13		Down
14		Closed
15	Manipulation	Other
16		Object
17		Self
18		Takes Notes
19		No Manipulation
20	Interactions	Teacher
21		Friend
22		No Interactions
23	Arm Symmetry	Asymmetric Open
24		Asymmetric Closed
25		Symmetric Open
26		Symmetric Closed
27		Supporting Head
28		Folded Front
29	Raised Hand	
30	Head-Hands Hands-Desk	Below Desk
31		Head-Hands Hands-Desk
32	Gestures	Gestures
33		Neutral Expression
34	Facial Expression	Other Expressions
35		Yawns
36		Smiles
37	Head Movement	Positive Nod
38		Negative Shake
39	Head Orientation (a)	Greater than 90° from Immediate

Figure 4. Variables selected for analysis.

The data and results are presented in the following order:

(1) Data from all subjects using "duration" measures, (2) Data from all subjects using "frequency" measures, (3) Data from all subjects ranking the respective "duration" and "frequency" measures (variables), (4) Data from girls only using "duration" measures, (5) Data from boys only using "duration" measures, (6) Data from boys and girls in a select group using "duration" measures designed to check the results obtained using the total sample.

Data from All Subjects Using "Duration" Measures. The mean values for the total sample, the positive group, and the negative group are presented in Table 2.

Table 3 shows the variables in the order of entry into the mathematical model.

Table 3. Discriminating variables in order of entry into mathematical model using "duration" measures.

Variable	Description	F Value	Degrees of Freedom	Significance Beyond
12	Teacher	37.3	1 52	.005
18	Takes Notes	32.5	1 51	.005
16	Object	20.5	1 50	.005
20	Teacher	12.6	1 49	.005
14	Closed	10.6	1 48	.005
1	Forward	6.1	1 47	.05
27	Supporting Head	8.0	1 46	.01

The criterion used to determine the order of entry into the model is related to correlation. The variable selected first is the one which correlated the highest-positively or negatively- with the

Table 2. Mean values for "duration" measures using total sample.

Variable	Negative Group	Positive Group	Total Sample
	Mean%	Mean*	Mean*
1	145.4	194.3	169.9
2	53.6	31.6	42.6
3	41.1	14.1	27.6
4	10.8	6.7	8.8
5	211.9	238.5	225.2
6	27.4	1.4	14.4
7	167.0	200.6	183.7
8	69.2	38.1	53.7
9	119.9	78.2	99.1
10	119.8	161.3	140.5
11	46.1	35.7	40.9
12	53.4	122.8	88.1
13	119.6	81.3	100.4
14	1.4	.4	.9
15	65.6	35.6	50.6
16	86.9	64.5	75.7
17	55.8	49.6	52.7
18	2.8	26.8	14.8
19	94.3	96.8	95.5
20	.9	5.9	3.4
21	28.5	15.4	21.9
22	210.5	218.6	214.6
23	54.9	79.9	67.4
24	11.7	5.6	8.7
25	19.0	29.9	24.5
26	29.2	20.7	24.9
27	32.5	31.4	31.9
28	19.6	5.9	12.7
29	5.9	7.2	6.5
30	7.6	7.8	7.7
31	18.0	4.8	11.4
32	6.2	6.8	6.5
33	171.7	165.4	168.6
34	7.6	5.5	6.5
35	5.6	7.9	6.8
36	13.6	18.5	16.0
37	5.1	3.7	4.4
38	7.2	3.5	5.4
39	8.0	2.7	5.3

* Mean values are expressed as the number of five-second intervals in which the variable was manifested.

dependent variable (attitude). The variable selected second is the variable that correlates most highly with the dependent variable after a mathematical adjustment has been made for the presence of the variable selected first. The process continues until the allowed number of variables have been entered. This means that when taken individually, the first variable entered is the best discriminator. It means further that the second variable entered is the second best discriminator when the first variable is already in the model and so on for the rest of the variables. It must be remembered that the entire model building process is an interactive and relative one, and each successive variable is entered with respect to all of the preceding variables. For example, suppose the stepwise process was undertaken and variables U, V, W, X, and Y were entered in that order. Suppose further that the investigator was particularly interested in variable Z and put it in the model to check its effect. As a result of "forcing" Z into the model U, V, W, X, and Y would not necessarily follow in that order. In fact some of them could be deleted or replaced by other variables.

The order of entry into the model isn't necessarily in a one-to-one correspondence with the weights of the variables when the model is completed. This will be developed further at a later point in this section.

The number of allowed variables is determined by preset F values. An analysis of variance is performed which essentially tests whether or not the two groups - the group with positive attitude and the group with negative attitude - are the same. From the analysis of variance, F values are obtained which are compared to the preset values. When the F value for a variable falls below the preset value the variable is not entered in the model. The F values are set at a level which is designed to allow a model which will provide maximum capability for classification with a minimum number of variables in the model.

Within the limits of the sample used in the present study measurements taken on the cues shown in Table 3 would allow an investigator to classify a subject into the group of subjects having a positive attitude or the group having a negative attitude. As Table 3 shows, the variables are all significant and most are highly significant. The approximate overall F value is 46.49 which is significant well beyond .005.

The classification process is accomplished by inserting behavioral data into a mathematical model derived as an integral part of the analysis. The derived model is $A = .25X_{12} + .25X_{18} + .09X_{16} + .42X_{20} - .95X_{14} + .05X_1 - .08X_{27} - 39.7$. Measurements of the respective variables can be taken as was done when behavioral data were gathered, can be put in the equation, and can be numerically

calculated. If A is positive the subject is classified into the positive group, and if A is negative the subject is classified into the negative group.

As part of the analysis process data from each of the segments were put in the model, calculations were made, and the probabilities of misclassification were determined. The probabilities ranged from .000 to .027, which showed that the probabilities of misclassification were extremely small, and hence, the function was a very good discriminating vehicle.

The reader should be aware of several factors when interpreting and using the previous results. First, the data and coefficients in the model are representative of a 20-minute behavioral sample and a five-second interval used as the time sample. The model cannot be directly employed for a different length behavioral sample or a different length time sample. Second, the data were gathered from a sample not randomly selected from the entire population of school students, and one must be careful about generalizing on the results beyond the sample used.

Third, when applying and drawing conclusions from the model itself, it should be remembered that each of the variables operates as an integral part of the total model, and extracting a particular variable and drawing conclusions based on the magnitude of its coefficient can lead to serious misinterpretation.

However, the coefficients inescapably represent the relative weights that each variable provide in evaluating the dependent variable. As can be seen in comparing the model to Table 3 variable 12 entered first, but variable 14 carries the most weight. A literal interpretation of the model would show that a subject showing a high measure of variable 14 would have a high probability of being classified as negative.

Thus, a measure of direct information can be gained from the model itself, but this information must be combined with the results in Table 3 to obtain a complete picture. Reference to Table 4 will further illustrate this point.

Table 4. Classification of subjects by respective variables when entering model.

Step	Variable Entered	Positive Subjects Classified Correctly	Positive Subjects Misclassified	Negative Subjects Classified Correctly	Negative Subjects Misclassified
(1)	12	21	6	21	6
(2)	18	23	4	23	4
(3)	16	25	2	26	1
(4)	20	27	0	26	1
(5)	14	27	0	27	0
(6)	1	27	0	26	1
(7)	27	27	0	27	0

Reference to Table 4 shows that variable 12 alone was capable of correctly classifying 42 of the 54 subjects while variable 18 only increased the number of variables correctly classified to 46, and variable 16 increased the number of correct classifications to 51. No other variable would classify as well initially as would 12, and because

of this it was selected first for entry into the model. Hence, all information must be considered when interpreting the results of the data analysis.

The model ($A = .25X_{12} + .25X_{18} + .09X_{16} + .42X_{20} - .95X_{14} + .05X_1 - .08X_{27} - 39.7$) shows coefficients with positive signs and others with negative signs, which suggests a positive or negative relationship between the particular independent variable and the dependent variable (attitude). Note particularly variable 16 with a coefficient of .09. Checking the value of +.09 against the mean values for the groups shows what appears to be a discrepancy, inasmuch as the mean value for the negative group exceeds the mean value for the positive group. The apparent discrepancy can arise when a skewed distribution of values for the variable is obtained from the subjects, and this distribution interacts with all the other variables. Thus, the interactive process can and does show a positive relationship between X_{16} and the dependent variable. No other variable shows this apparent discrepancy.

The results relate to the professional literature, which suggests that a measure of generalization from the psychotherapy session to the classroom is possible.

Mehrabian (1969a) notes that immediacy cues relate primarily to attitude. Forward Lean and Eye Contact are listed in that order of importance as being measures relating to attitude. The present study

also finds both of the cues as indicators of attitude but the order of importance is reversed. The reversal doubtless is due to the nature of the classroom setting as opposed to the typical setting in which psychologists work. Further, the cue is generalized in this work to include a broader scope of gaze direction than the strict eye contact discussed by Mehrabian.

Mehrabian reports further that lengthier communications between communicators is a significant measure of positive attitude. This again relates, even though a bit indirectly, to a higher measure of interactions directed toward the teacher by the student.

Higher measures of note taking intuitively make sense as being an indicator of interest, if not positive attitude, but theoretical support for this behavior is missing. However, interest and affect may be difficult to differentiate between from the start.

Object Manipulation and Head Support are less conclusive in their conceptual relationship, and reference to the mathematical model shows that they have small coefficients, which means they are only weakly related to the dependent variable. Rosenfeld (1966a) reports that infrequent self-manipulations were correlated to positive impressions received by addressees, but the finding is so peripherally related to the present results that any suggested relationship or discrepancy would be extremely questionable.

Supporting of the head is again intuitively sensible as negatively related to attitude as is Closed Eyes. However, support beyond intuition is not available except for the obvious fact that a communicator with closed eyes cannot maintain eye contact with his addressee. Again Supporting Head is only weakly related to the dependent variable - attitude.

Data from All Subjects Using "Frequency" Measures. Means for the total sample, the positive group and the negative group, are shown in Table 5. Table 6 shows the variables in order of entry into the model together with F values and levels of significance.

Table 6. Discriminating variables in order of entry into mathematical model using "frequency" measures.

Variable	Description	F Value	Degrees of Freedom	Significance Beyond
18	Takes Notes	11.99	1 52	.005
31	Head Hands - Hands Desk	9.43	1 51	.005
38	Negative Shake	8.46	1 50	.01
39	Greater than 90° from Immed.	7.63	1 49	.01
29	Raised Hand	8.93	1 48	.005
35	Yawns	4.29	1 47	.05
3	Back	3.27	1 46	Not significant
34	Other	4.03	1 45	Not significant

The approximate overall F was 11.12 which is significant beyond .005.

The interpretation and limitations of the data are similar to those discussed for the "duration" measures. Two factors are immediately noteworthy. First, the significances of the variables as

Table 5. Mean values for "frequency" measures using total sample.

Variable	Negative Group	Positive Group	Total Sample
	Mean*	Mean*	Mean*
1	4.4	27.9	36.0
2	4.7	5.2	4.9
3	7.1	10.4	8.8
4	8.0	12.1	10.2
5	1.9	1.6	17.6
6	1.3	.4	.9
7	18.5	17.3	17.9
8	18.6	18.7	18.6
9	14.7	16.6	15.7
10	14.0	16.2	15.1
11	61.2	68.3	68.3
12	18.5	21.7	20.1
13	21.1	20.9	21.0
14	.3	0.0	.2
15	20.3	15.7	17.9
16	10.0	12.6	11.3
17	77.6	77.7	77.6
18	10.4	5.7	3.4
19	18.4	19.1	18.7
20	.8	3.3	2.1
21	11.8	8.1	9.9
22	11.3	11.0	11.2
23	15.5	18.3	16.9
24	3.0	1.9	2.5
25	7.1	12.3	9.2
26	6.6	6.7	6.6
27	10.1	9.3	9.7
28	2.4	.7	1.6
29	.4	2.3	1.3
30	.8	.8	.7
31	1.4	.1	.7
32	1.3	1.4	1.3
33	12.3	15.5	13.9
34	.8	1.7	1.3
35	3.0	1.7	2.4
36	7.6	11.2	9.4
37	.6	.8	.7
38	1.1	.2	.7
39	2.1	.8	1.5

* Mean values are expressed as the number of times a variable was manifested without regard to the duration of the manifestation.

a result of the analysis of variance are not as impressive as were the significances for the duration measures. Second, the model doesn't have the classificatory ability that was provided by the previous model, i. e. , the probability of misclassification is higher. Table 7 shows the 54 segments and the probabilities of being misclassified. A similar table was not shown for "duration" measures because the probabilities of misclassification closely approached zero.

Table 7 shows that six segments would be misclassified using "frequency" measures while classification using "duration" measures was perfect. Five of the negative segments were classified positive, and one of the positive segments was classified negative. This means that 89% of the cases were accurately classified which is still highly significant. The model is $A = .024X_{18} - .965X_{31} - 1.748X_{38} - .906X_{39} + .480X_{29} - .325X_{35} + .057X_3 + .507X_{34}$. The model is derived using the same method of analysis as was employed with the "duration" measures, and thus, the same precautions should be observed when interpreting the results.

The cues are all intuitively sensible, and variable 18 lends further support to the results derived from the "duration" measures where 18 was also a significant discriminatory variable.

Variables 38 and 39 support results reported by Mehrabian (1969a). Thirty-nine (Head Greater than 90° from Immediate) relates to the immediacy cues strongly related to attitude as reported by Mehrabian.

Table 7. Probabilities for misclassification using "frequency" measures.

Segment	Measured Attitude	Probability of Being Classified into Positive Group	Probability of Being Classified into Negative Group
1	+	1.000	.000
2	+	.700	.300
3	-	.001	.999
4	-	.549	.451*
5	+	.995	.005
6	-	.000	1.000
7	+	.992	.008
8	-	.029	.971
9	+	.980	.020
10	-	.554	.446*
11	+	.715	.285
12	-	.238	.762
13	+	.604	.396
14	-	.231	.769
15	+	.998	.002
16	-	.207	.793
17	+	.970	.030
18	-	.001	.999
19	+	.998	.002
20	-	.003	.997
21	+	.996	.004
22	-	.001	.999
23	+	.999	.001
24	-	.003	.997
25	+	.999	.001
26	-	.034	.966
27	+	.995	.005
28	-	.001	.999
29	+	.764	.236
30	-	.038	.962
31	+	.924	.076
32	-	.033	.967
33	+	.739	.261
34	-	.267	.733
35	+	.961	.039
36	-	.101	.899
37	+	.997	.003
38	-	.002	.998
39	+	.984	.016
40	-	.007	.993
41	+	.660	.340
42	-	.565	.435*
43	+	.923	.077
44	-	.002	.998
45	+	.998	.002
46	-	.011	.989
47	+	.474	.526*
48	-	.019	.981
49	+	.872	.128
50	-	.562	.438*
51	+	.796	.204
52	-	.001	.999
53	+	1.000	.000
54	-	.549	.451*

* Would be misclassified.

Thirty-eight (Negative Shake) relates to Rosenfeld's (1966a) cues where he states that approval seeking communicators will show fewer negative head nods.

Variables 31, 29, and 35 all seem sensible, but as with some of the cases for duration measures the relationships between these results and the results in professional literature are missing. Variables 3 and 34 were not statistically significant, and their relationships are inconclusive at best.

Results from Combining "Duration" and "Frequency" Measures.

The previous two sections covered the results of the data analysis where "duration" measures and "frequency" measures were each analyzed separately. Seven "duration" variables were demonstrated to be discriminators capable of accurate classification of subjects, and eight "frequency" variables were shown to have reasonable discriminative capability.

The 15 variables were then analyzed to determine their ranked ability to classify subjects. This analysis would allow insight into the respective measures and into some behaviors if mixing of "duration" and "frequency" measures occurred in the ranking process. The means for the variables are shown in Table 8.

Table 8. Mean values for total sample using combined "duration" and "frequency" measures*.

Variable	Negative Group	Positive Group	Total Sample
	Mean	Mean	Mean
d ₁	145.4	194.4	169.8
d ₁₂	53.4	122.8	88.1
d ₁₄	1.4	.4	.8
d ₁₆	86.9	64.5	75.7
d ₁₈	28.1	26.8	14.8
d ₂₀	.9	5.9	3.4
d ₂₇	32.5	31.4	31.9
f ₃	7.1	10.4	8.8
f ₁₈	1.0	5.7	3.4
f ₂₉	.4	2.6	1.3
f ₃₁	1.4	.1	.8
f ₃₄	.8	1.7	1.3
f ₃₅	3.0	1.7	2.4
f ₃₈	1.1	.2	.7
f ₃₉	2.1	.9	1.5

* Group means for the variables d₁-d₂₇ are expressed as the number of five-second intervals in which the variable was manifested. Group means for variables f₃-f₃₉ are expressed as the number of times a variable was manifested without regard to the duration of the manifestation. The data from Table 8 were used to get a comparison of the relative classification ability of "duration" and "frequency" measures.

Table 9 presents the variables in order of entry into the model together with F values and levels of significance.

Table 9. Discriminating variables in order of entry into mathematical model using selected "duration" and "frequency" measures.

Variable	Description	F Value	Degrees of Freedom		Significance Beyond
d ₁₂	Teacher	37.3	1	52	.005
d ₁₈	Takes Notes	32.5	1	51	.005
d ₁₆	Object	20.5	1	50	.005
d ₂₀	Teacher	12.6	1	49	.005
d ₁₄	Closed	10.6	1	48	.005
d ₁	Forward	6.1	1	47	.05
d ₂₇	Supporting Head	8.0	1	46	.01

The derived model is $A = .25X_{d12} + .25X_{d18} + .09X_{d16} + .42X_{d20} - .95X_{d14} + .05X_{d1} - .08X_{d27} - .39.7$.

A comparison of Table 9 and Table 3 shows the two to be identical. Further, a comparison of the model derived using "duration" measures with the model using both measures again shows the two to be identical. Thus, the order of selection of variables was identical to the order when "duration" measures only were used. Also, the overall F was 46.49 which was the F for "duration" measures. This means that none of the "frequency" variables had the discriminative capability of any of the "duration" variables, i. e., the "duration" variable with least discriminative capability could classify better than the "frequency" variable with most discriminative capability.

The above results suggest that "frequency" measures provide no classification capability beyond that provided by "duration" measures alone. However, the "frequency" measures provided insights into behaviors that do have inherent discriminative capability, and thus, have practical ramifications.

The results do not support Eckman (1957) who in a methodological discussion argues that frequency measures may provide more information than other measures about nonverbal behaviors. The contention was based on Skinner's theory of probability of action. However, the measure used in the present study is not a frequency measure used in the strict sense, and hence, the comparison may only be

tangential.

Results Using Data from Male Subjects and Female Subjects Separately. The results from the previous sections indicated that further investigation of "frequency" measures would provide little information, so the investigation was continued using only "duration" measures.

Tables 10 and 11, respectively, show the means for male subjects and female subjects taken separately.

Table 10. Mean values for male subjects using "duration" measures.

Variable	Negative Group	Positive Group	Total Sample
	Mean*	Mean*	Mean*
1	123.6	159.7	140.7
3	71.3	37.4	55.3
7	194.9	208.8	201.5
9	149.7	58.9	106.7
12	71.5	154.0	110.6
13	128.7	56.6	94.5
14	3.4	.9	2.2
16	75.0	60.1	67.9
17	45.5	59.1	51.9
18	4.9	13.7	9.1
20	.1	4.7	2.3
21	12.0	11.2	11.6
26	28.5	32.3	30.3
27	24.2	4.6	14.9
30	38.6	5.6	22.9
35	9.7	16.6	12.9

* Mean values are expressed as the number of five-second intervals in which the variable was manifested.

Table 11. Mean values for female subjects using "duration" measures.

Variable	Negative Group	Positive Group	Total Sample
	Mean*	Mean*	Mean*
1	158.2	211.7	185.7
2	58.4	25.9	41.7
3	23.4	2.4	12.6
4	11.6	9.1	10.3
6	37.5	1.3	18.9
7	15.1	196.4	174.2
8	86.4	42.0	63.6
9	102.4	87.9	94.9
11	46.2	37.6	41.8
12	42.8	102.2	75.9
13	114.2	93.6	103.6
14	.2	.1	.1
15	82.9	39.1	60.3
16	94.0	66.7	79.9
17	61.9	44.8	53.1
18	1.6	33.3	17.9
19	81.9	93.7	87.9
20	1.4	6.6	4.1
21	38.3	17.5	27.6
22	200.3	215.9	208.3
23	65.8	81.8	74.1
25	19.1	31.3	25.4
26	34.6	20.8	27.5
27	34.9	31.0	32.9
28	16.9	6.6	11.6
29	6.5	8.2	7.4
31	5.9	4.4	5.2
32	6.9	6.8	6.8
33	172.9	172.9	172.9
34	6.4	7.6	6.9
35	15.9	19.5	17.7
36	6.1	4.1	5.0
37	187.3	190.3	188.8

* Mean values are expressed as the number of five-second intervals in which the variable was manifested.

Table 12 shows the variables in order of entry into the model for male subjects with an overall of 30.16, which is significant well beyond .005.

Table 12. Discriminating variables for male subjects in order of entry into mathematical model using "duration" measures.

Variable	Description	F Value	Degrees of Freedom	Significance Beyond
12	Teacher	23.07	1 17	.005
27	Supporting Head	14.09	1 16	.005
13	Down	8.79	1 15	.01

The model is $A = .084X_{12} - .253X_{27} - .107X_{13} + 5.436$. The model classified all male subjects in the study perfectly with the largest probability of misclassification being .288.

As would be expected there is considerable overlap between the results using male subjects only and those using all subjects as a comparison of Table 12 and Table 3 show. Variable 13 didn't appear in the original model where all subjects were classified, but this fact doesn't mean it would not be a capable discriminating variable. It merely means that for the entire sample other variables were better discriminators than variable 13.

No direct reference to variables fitting the descriptions of 27 and 13 can be found in the professional literature, but 13 can be related to Mehrabian's conceptions regarding immediacy. A subject manifesting the behavior described by variable 13 would be in a less immediate state than if his head was directly oriented toward an addressee.

Thus, with the strong relationship between attitude and immediacy the appearance of the variable in the model seems sensible.

Table 13 shows the variables in order of entry into the model for female subjects with an approximate overall F of 44.22 which is significant well beyond .005.

Table 13. Discriminating variables for female subjects in order of entry into mathematical model using "duration" measures.

Variable	Description	F Value	Degrees of Freedom		Significance Beyond
12	Teacher	24.68	1	33	.005
18	Takes Notes	30.64	1	32	.005
16	Object	19.39	1	31	.005
20	Interact Teacher	9.58	1	30	.005
27	Supporting Head	5.84	1	29	.05
17	Self	6.01	1	28	.05
1	Forward	4.43	1	27	.05

The model is $A = .392X_{12} + .364X_{18} + .130X_{16} + .864X_{20} - .140X_{27} - .120X_{17} + .055X_1 - 48.88$.

Again a comparison of Table 13 and Table 3 shows considerable overlap. Variable 20 supports Mehrabian's (1969a) results which state that longer communications significantly determined more positive attitude communication. Mehrabian reports that status is communicated by relaxation cues and some activity cues, among them self-manipulation. The fact that variable 17 has a negative relationship with the dependent variable may suggest that female subjects with a negative attitude were less impressed with the status of teachers. The conclusion is a tenuous one and should be considered carefully

before being accepted.

The remaining variables are all intuitively sensible, but none relate to the professional writing beyond what has been previously discussed.

Data from Selected Subjects Using "Duration" Measures. As noted earlier in this writing the experimental subjects were taped no less than two times and no more than five times. This means that all subjects did not appear in the same number of segments, and a subject manifesting a behavior unique to himself could bias the data with this behavior if he were one of the subjects most frequently taped. As a method of insuring unbiased results due to these causes, the researcher selected subjects that had been taped exactly three times. It was found that 12 girls and 6 boys fit the criterion. Five of the girls were recorded as positive and seven were recorded as negative while three boys were recorded as positive and three were negative.

The 18 subjects each recorded twice for data gathering purposes provided 36 20-minute segments.

The means for the positive group and the negative group are shown in Table 14.

Table 14. Mean values for "duration" measures using selected subjects.

Variable	Negative Group Mean*	Positive Group Mean*	Total Sample Mean*
1	145.8	195.9	168.1
2	60.6	29.8	46.9
3	33.7	14.3	25.0
4	9.2	3.7	6.8
6	34.7	1.1	19.8
7	163.4	207.2	182.8
8	72.4	32.3	54.5
9	110.4	74.0	94.2
11	47.3	31.0	40.0
12	52.2	129.4	86.5
13	119.7	80.3	102.2
14	.5	.6	.6
15	67.5	29.7	50.7
16	87.9	55.4	73.4
17	59.1	53.6	56.7
18	2.2	22.9	11.4
19	90.9	105.4	97.3
20	.9	4.1	2.3
21	28.4	11.3	20.8
22	210.7	224.6	216.9
23	54.6	58.2	56.2
24	12.8	3.1	8.5
25	14.1	25.4	19.1
26	36.2	18.0	28.1
27	28.6	36.3	32.0
28	19.2	5.7	13.2
29	6.8	7.4	7.0
31	13.6	7.1	10.7
33	163.3	143.8	154.6
34	8.0	7.8	7.9
35	6.4	10.7	8.3
36	13.7	16.7	15.0
38	7.6	4.5	6.2
39	9.0	2.8	6.8

* Mean values are expressed as the number of five-second intervals in which the variable was manifested.

Table 15 shows the variables in order of entry into the model.

Table 15. Discriminating variables in order of entry into mathematical model using "duration" data from selected subjects.

Variable	Description	F Value	Degrees of Freedom		Significance Beyond
12	Gaze Teacher	26.63	1	34	.005
18	Takes Notes	28.68	1	33	.005
16	Object Manipulation	16.72	1	32	.005
36	Smiles	13.13	1	31	.005
1	Forward	7.02	1	30	.05
27	Supporting Head	4.58	1	29	.05
31	Head-Hands Head-Desk	5.59	1	28	.05

The approximate overall F was 45.45 which was significant well beyond .005. The mathematical model is $A = .440X_{12} + .456X_{18} + .146X_{16} + .411X_{36} + .063X_1 - .143X_{27} - .233X_{31} - 66.219$. The model classified the subjects perfectly with a probability of misclassification of .000.

The results of Table 15 compare very closely to the results of Table 3. In the two tables variables 12, 18, 16, 1, and 27 are duplicates. Variables 36 and 31 are not duplicates, but are certainly reasonable. Thirty-six relates to the professional literature where Mehrabian reports that positive facial expressions have a significant relationship with positive attitude.

Thus, the results of Table 15 show a strong relationship with previous results and provide as bias-free an analysis of the data as the design of the study allows.

Summary of Hypothesis Two. Hypothesis Two - A significant positive relationship exists between the measured nonverbal behaviors exhibited by students and their attitude toward their teachers and/or their classes - is totally accepted in all cases. Two different data measures were analyzed for the entire sample with both measures showing highly significant relationships between attitude and the nonverbal behaviors manifested by students. Further, male and female subjects were analyzed separately, and the relationships were again highly significant. Also, the results for the sexes taken separately supported and overlapped the results for the entire sample as they should.

Finally, data from a selected sample of subjects was analyzed as a check against a possible bias in the sampling procedure for the gathering of behavioral data. The results of this final analysis showed a strong overlap between the results of the selected sample and the results of the entire sample. The outcomes of the analysis support each other and lend credence to the contention that the overall results are valid and reliable within the limitations of the study.

In summary the present study shows that the following variables are significantly related to positive attitude toward the teacher:

- (1) Gaze direction toward teacher, (2) Taking notes, (3) Smiles,
 - (4) Interactions with the teacher, and (5) Frequency of raising hand.
- Positive attitude was found to be weakly (but statistically significant) to (6) Forward Lean, and (7) Object Manipulation.

Negative attitude was found to be communicated by the following variables, each being statistically significant. (1) Head on Hands (or fist) with hands on desk, (2) Eyes closed, (3) Frequency of yawns, (4) Frequency of negative head shakes, and (5) Frequency of turning the head greater than 90° from immediate. A weak relationship was found between negative attitude and (6) Supporting Head, (7) Self manipulation for girls, and (8) Head down for boys.

The behaviors found to be significant support results supported by Mehrabian (1970) and Rosenfeld (1966a). These relationships are discussed further in Chapter V.

Results Not Directly Related to the Hypotheses

As a further investigation the behaviors of male subjects and female subjects were analyzed with respect to each other and without regard to attitude. In other words a behavioral analysis was made which compared all male subjects to all female subjects using duration data. Table 16 shows the means for the groups.

Table 16. Mean values using "duration" measures comparing male and female subjects.

Variable	Female Group Mean*	Male Group Mean*	Total Sample Mean*
1	185.7	140.7	169.9
2	41.7	44.2	42.6
3	12.6	55.3	27.6
4	10.3	5.9	8.8
5	220.7	233.5	225.2
6	18.9	6.3	14.4
7	174.2	201.5	183.8
8	63.6	35.5	53.7
9	94.9	106.7	99.1
10	144.5	133.2	140.5
11	41.8	39.2	40.9
12	75.9	110.6	88.1
13	103.6	94.5	100.4
14	.1	2.2	.9
15	60.3	32.7	50.6
16	79.9	67.9	75.7
17	53.1	51.9	52.7
18	17.9	9.1	14.8
19	87.9	109.5	95.5
20	4.1	2.3	3.4
21	27.6	11.6	21.9
22	208.3	226.1	214.6
23	74.1	55.1	67.4
24	9.3	7.6	8.7
25	25.4	22.7	244.6
26	27.5	20.3	24.9
27	32.9	30.3	31.9
28	11.6	14.9	12.6
29	7.4	5.0	6.6
30	8.5	6.3	7.7
31	5.2	22.9	11.4
32	6.8	6.0	6.5
33	172.9	160.6	168.6
34	4.9	9.5	6.6
35	6.9	6.4	6.8
36	17.7	12.9	16.1
37	5.0	3.3	4.4
38	4.2	7.5	5.4
39	5.9	4.4	5.3

* Mean values are expressed as the number of five-second intervals in which the variable was manifested. The data were used to determine what behavioral differences male and female subjects exhibited without regard to their attitude toward their teacher and class.

Table 17 shows the variables which differentiate between males and females in the order of their entry into the model.

Table 17. Sexual discriminating variables in order of entry into mathematical model using "duration" measures.

Variable	Description	F Value	Degrees of Freedom	Significance Beyond
3	Back Lean	13.29	1 52	.005
31	Hand-Hand Hand-Desk	6.58	1 50	.05
12	Gaze Teacher	3.74	1 49	not significant
9	Head Down	4.96	1 49	.05
2	Erect	3.59	1 48	not significant
25	Symmetric Open	4.49	1 47	.05

The approximate overall F was 9.78 which was significant beyond .005. The function is $M = .049X_3 + .055X_{31} + .054X_{12} + .032X_9 + .020X_2 + .035X_{25} - 12.44$. In evaluating the function as explained earlier in this chapter a positive value for M means the subject would be classified as male while a negative M would classify the subject as female.

The function correctly classified 34 females and misclassified one while correctly classifying 13 males and misclassifying six. The results show that 87% of the subjects were correctly classified, and the overall F value from the analysis of variance shows that the two groups -- the group of males and the group of females -- are not the same, i. e. , males and females exhibit different nonverbal behaviors in the classroom to a statistically significant extent.

None of the variables in the model carries appreciable weight with respect to the others, and it should also be noted that each

variable is related positively to "maleness."

Results of Attitude Surveys

A total of 181 potential subjects were polled to determine their attitude toward their teachers and courses. Table 18 shows the results of the questionnaires.

Table 18. Responses to questionnaire.

(+3) Like Teacher Very Much	19.9%
(+2) Like Teacher Moderately	42.0%
(+1) Like Teacher Slightly	8.8%
(0) Neither Like Nor Dislike Teacher	15.5%
(-1) Dislike Teacher Slightly	2.8%
(-2) Dislike Teacher Moderately	4.4%
(-3) Dislike Teacher Very Much	6.6%
- - - - -	
(+3) Like Course Very Much	12.2%
(+2) Like Course Moderately	21.0%
(+1) Like Course Slightly	12.2%
(0) Neither Like Nor Dislike Course	17.7%
(-1) Dislike Course Slightly	14.3%
(-2) Dislike Course Moderately	7.7%
(-3) Dislike Course Very Much	14.9%

The results shown in Table 18 show that students in general like their teachers more than they like their courses. Each subject's response was analyzed individually, and it was found that 54.3% of the sample liked the teacher better than they liked the course. Sixteen and three-tenths percent liked the course more than they liked the teacher, and 29% liked the teacher and course to an equal extent. Seventy and seven tenths percent of the students expressed some liking for their teachers, 15.5% were neutral, and 13.8% expressed some dislike while 45.4% expressed some liking for the course, 17.7%

expressed a neutral attitude toward the course, and 36.9% expressed some dislike. Only 33.2% expressed at least moderate liking for the courses while 22.6% expressed at least moderate dislike for the courses. Sixty-one and nine tenths percent said they liked the teachers at least moderately while only 11.0% expressed at least moderate dislike for the teachers. In all cases the classes were required for all students as an integral part of their program.

Certain behaviors were selected for further analysis and reporting because of having discriminative capability or because of potential relationships with results reported in the professional literature.

Table 19 shows the average percentage of time subjects in each group spent manifesting certain behaviors.

Table 19. Average percentage of time subjects spent manifesting selected behaviors.

Behavior	Positive Group	Negative Group
	%	%
Forward Lean	81.0	60.3
Backward Lean	5.9	17.1
Gaze Toward Teacher	51.2	21.2
Eyes Closed	.15	.58
Taking Notes	11.1	1.17
Interacting with Teacher	2.46	.38
Interacting with Friend	6.42	11.9
Supporting Head with Hand	13.0	13.5

Table 19 shows that subjects with a positive attitude look at the teacher or his work 51.2% of the time while subjects with a negative attitude look at the teacher only 21.1% of the time. The study showed that on the average students in the classes looked at the teacher or the teacher's work 36.7% of the time. This indicates that nearly two-thirds of the student time was spent looking at something other than the teacher or the teacher's work. If visual contact with the teacher or his work is a measure of or is positively related to the mental attention of the student, then the data suggest that on the average, students are mentally involved with the lecture-discussion activity only slightly more than a third of the time. The data shows that discussion in the activity was minimal inasmuch as the students interacted (verbally) with the teacher only 2.1% of the time on the average.

Table 19 also shows that positive students spent 11.1% of the time taking notes while negative students spent only 1.2% of the time in note taking, and on the average, students spent 6.1% of the class time taking notes.

Table 20 presents the average number of times subjects manifested certain behaviors in the 20-minute segment without regard to the length of time each separate behavior occurred. Thus, Table 20 is a measure of the "frequency" of occurrence of each behavior within the limitations of the time sampling technique.

Table 20. Average "frequency" of occurrence of selected behaviors.

Behavior	Frequency for Positive Group	Frequency for Negative Group
Smiles	11.2	7.6
Yawns	1.7	3.0
Raised Hand	2.25	.41
Interacts with Teacher	3.3	.8
Interacts with Friend	8.1	11.8
Manipulates Object	10.0	12.5
Manipulates Self	21.3	22.0
Glances Around Room	20.3	15.6

Table 20 shows that frequency of manipulations differs only slightly for the two groups and thus does not support Rosenfeld's (1966a) results which show positive subjects engaging in significantly fewer self manipulations than negative subjects.

A check was made of the total number of postural shifts (forward-backward) manifested by the two groups. The literature reports non-verbal behaviors as a possible expression of anxiety or tension release. If negative subjects were uncomfortable in the lecture-discussion situation the tension could be manifested through postural shifts. It was found on the average that positive subjects shifted postures 12.7 times during the 20-minute time period while negative subjects shifted postures 18.2 times on the average.

A t test was run to check whether or not the 18.2 was significantly different from 12.7. The results are shown in Table 21.

Table 21. Analysis of net postural shifts.

Negative Subjects	Positive Subjects
18.2-----Average Postural Shift-----	12.7
2128.83	2752.68
26	26
81.7	105.9

$$F = \frac{\sum x^2 / n - 1}{n - 1} + 18.2 - 12.7 / \frac{(2128.8 + 2752.7)}{52} \left(\frac{1}{26} + \frac{1}{26} \right)$$

The value .76 was not significant at either .01 or .05, revealing no statistically significant difference in net postural shifts.

Attitude and Student Seating Arrangement

An analysis was made of the attitude exhibited by the students as related to their location in the classroom. The results of the questionnaires were again used in the analysis, and inasmuch as the specific location of every subject was known, the attitude of the students in one part of the room could be analyzed in comparison with the attitudes of students in another part of the room. The rooms were divided into blocks with respect to the teacher. The first blocking arrangement is shown in Figure 5.

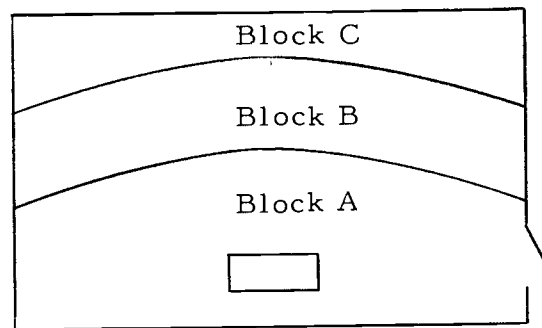


Figure 5. Classroom divided into blocks with respect to radial proximity.

With the blocking arrangement shown in Figure 5, 35.4% of the subjects were seated in Block A, 36.4% were seated in Block B and 28.2% were seated in Block C. The responses expressed as percentages are shown in Table 22 where the numerical values represent the attitudes as shown in Table 18.

Table 22. Distribution of students' attitudes toward their teacher expressed as a percentage comparing Blocks A-C.

	+3	+2	+1	0	-1	-2	-3
Block A	24.6	40.0	4.6	23.1	3.1	0	4.6
Block B	19.4	38.8	11.9	10.4	3.0	7.5	9.0
Block C	11.5	53.8	9.7	11.6	3.8	3.8	5.8

A Chi Square statistical test was run on the distributions to see if the three distributions were statistically significantly different, and

it was found that the distributions showed statistical difference with significance beyond the .05 level. Calculations were made using the expression $X^2 = \left(\frac{\text{Observed Value} - \text{Expected Value}}{\text{Expected Value}} \right)^2$ where the expected value was determined from $\frac{\text{Row Subtotal}}{\text{Total}} \times \text{Column Subtotal}$.

The Chi Square tests the null hypothesis, which states that there is no significant difference between the distributions. The null hypothesis was rejected at the .05 level which means that there was a statistically significant difference between the distributions. However, the statistical result says nothing about differences between the distributions when taken two at a time.

Thus, further analysis was made of the distributions. Intuitively one would expect the possibility of no difference (statistical) between the distributions in Blocks B and C. A Chi Square was run on these Blocks to check the intuition. The results are shown in Table 23.

Table 23. Distribution of students' attitudes toward their teacher expressed as a percentage comparing Blocks B and C.

	+3	+2	+1	0	-1	-2	-3
Block B	19.4	38.8	11.9	10.4	3.0	7.5	9.0
Block C	11.5	53.8	9.7	11.6	3.8	3.8	5.8

It was found that $x^2 = 5.86$ which was not significant ($p < .5$). This allowed the combination of Blocks B and C. The combination was then compared to Block A. The results are shown in Table 24.

Table 24. Distribution of students' attitudes toward their teacher expressed as a percentage comparing Blocks A and B+C.

	+3	+2	+1	0	-1	-2	-3
Block A	24.6	40.0	4.6	23.1	3.1	0	4.6
Block B+C	16.0	45.3	10.9	10.9	3.4	5.9	7.6

It was found that $\chi^2 = 12.92$ which was significant at .05. Thus it can be said that Block A is significantly different from Blocks B and C. Further analysis of the three distributions was not possible inasmuch as the three distributions are not statistically independent, i. e., the total number of degrees of freedom used in analyzing the distributions taken two at a time cannot exceed the number for the three distributions taken simultaneously.

The analysis supports Mehrabian's (1969a) results with respect to attitude being related to proximity. He states that distance from an addressee is a consistent indicator of attitude toward an addressee. The results of the present study are not directly related to Mehrabian's work inasmuch as the subjects involved in this study were committed to a particular seat which was fixed in location. However, the subjects were initially free to choose their location in the room with the exception that a subject could not choose a seat already occupied by another subject. (The seats were chosen on a "first-come first-serve" basis at the beginning of the term.) To the extent that the classroom situation is similar to Mehrabian's experimental situation his results are supported by the present findings. Mehrabian further reports a

relationship between attitude and lateral distance of a communicator from his addressee. Hence, a second blocking arrangement was developed and is shown in Figure 6.

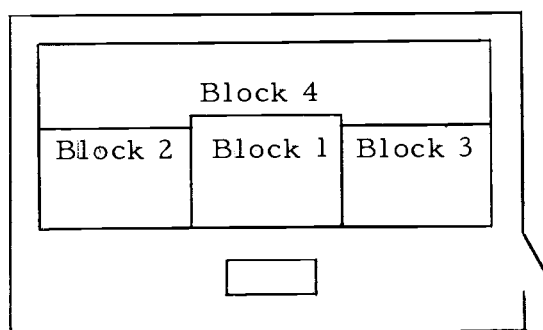


Figure 6. Classroom divided into blocks with respect to forward and lateral proximity.

The blocking arrangement shown in Figure 3 resulted in 22.6% of the subjects in Block 1, 25.4% in Block 2, 22.6% in Block 3, and 29.4% in Block 4.

The distribution of attitudes expressed as percentages are shown in Table 25.

Table 25. Distribution of students' attitudes toward their teacher expressed as a percentage comparing Blocks 1-4.

	+3	+2	+1	0	-1	-2	-3
Block 1	35	35	5	25	0	0	0
Block 2	13.3	53.4	13.3	8.9	2.2	2.2	6.7
Block 3	20	27.5	7.5	15.0	5	10	15
Block 4	11.5	46.0	9.6	17.3	5.8	5.8	3.9

A Chi Square statistical test was run on the data shown in Table 25, and a significant difference was found in the distributions ($p < .001$).

Inasmuch as a significant difference was found between the distributions pairwise analysis was again performed. Block 1 was compared to Block 4 with the data shown in Table 26.

Table 26. Distribution of students' attitudes toward their teacher expressed as a percentage comparing Blocks 1 and 4.

	+3	+2	+1	0	-1	-2	-3
Block 1	35	35	5	25	0	0	0
Block 4	11.5	46	9.6	17.3	5.8	5.8	3.9

Chi Square was found to be 31.8 which is highly significant ($p < .001$) which would be intuitively expected.

It would be further expected that Blocks 2 and 3 would be similar, i. e., not significantly different statistically, which would allow the blocks to be combined. A comparison was made between the two with the data shown in Table 27.

Table 27. Distribution of students' attitudes toward their teacher expressed as a percentage comparing Blocks 2 and 3.

	+3	+2	+1	0	-1	-2	-3
Block 2	13.3	53.4	13.3	8.9	2.2	2.2	6.8
Block 3	20	27.5	7.5	15	5	10	15

It was found that $x^2 = 20.92$ which was significant ($p < .001$), which means the expected result was not found. This prevented a

combining of Blocks 2 and 3 which further prevented a complete analysis of the distribution. A possible explanation for the difference between Blocks 2 and 3 may lie in the fact that Block 3 was always next to the door of the classroom. Perhaps student arrival time which could be a function of attitude, or proximity to the classroom door, which again could be related to attitude, could cause the difference in the distributions.

A final analysis was made which compared Block 1 to Block 2. The results are shown in Table 28.

Table 28. Distribution of students' attitudes toward their teacher expressed as a percentage comparing Blocks 1 and 2.

	+3	+2	+1	0	-1	-2	-3
Block 1	35	35	5	25	0	0	0
Block 2	13.3	53.4	13.3	8.9	2.2	2.2	6.8

Chi Square was found to be 36.1 which again was highly significant ($p < .001$) which shows the distributions to be different. The difference indicates a relationship between attitude and the lateral distance between a communicator and his addressee.

No statistical information regarding the relations between Blocks 2 and 4, Blocks 3 and 4, and Blocks 1 and 3 is available due to degrees of freedom considerations similar to those involved in the analysis of radial proximity.

The analysis of the seating arrangement relates to results reported by Hall (1959, 1963a, 1963b) and to results reported by

Mehrabian (1969a). The results of the present study show that in general subjects with a more positive attitude tend to sit nearer the front of the classroom, which is the teacher's normal position. This was found when a comparison was made of Blocks 1 and 4. This was further verified by the comparison of Block A to Blocks B plus C when the radial blocking arrangement was used.

Finally, it was found that there was a relation between the distribution of attitudes and lateral distance between communicator and addressee. This resulted from the analysis of Block 1 compared to Block 2.

Mehrabian (1969a) reports that immediacy is a strong indicator of communicator attitude toward an addressee. Increasing proximity and decreasing lateral distance would have the effect of increasing immediacy. This conception is supported by the results of the present study to the extent that classroom seating parallels the experimental situations used by Mehrabian in his work.

Summary of Chapter IV

Chapter IV was divided into four major sections. Section One included a brief review of the purposes of and procedures used in the study. Part Two reviewed the method of handling the data. Hypothesis One and Hypothesis Two were investigated in Section Three. Hypothesis One was accepted based on arguments supporting the

validity and reliability of the observation instrument used in the study. Hypothesis Two was accepted based on the results of the statistical analysis of the behavioral data. Results not directly related to the study's hypotheses were presented in Section Four. Empirical results were presented, an analysis of the behavioral differences between males and females was done, and a study of attitude with respect to classroom location was made.

V. SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

The present chapter is divided into three parts which are as follows: (1) Review of the study, including the design and the results, (2) Discussion, which relates the study to the professional literature, and (3) Recommendations for further research.

Summary

Conception of the Problem and Design

As stated in Chapter I the lack of data with respect to student nonverbal behavior constitutes a problem for science educators, particularly at a time when educators are concerned with student attitude. The nonverbal channel is of primary importance because it is through this channel that the teacher receives feedback which he can use to assess student attitude.

The researcher has thus formulated the following hypotheses which relate to the problem.

H1: A valid and reliable instrument for the systematic observation of junior high school and/or secondary school student nonverbal behavior can be developed.

H2: A significant positive relationship exists between the measured nonverbal behaviors exhibited by high school and/or junior high school students and their attitude toward their teacher and/or their class.

The design can be properly conceived of as a form of correlational study. A population of junior high school and secondary school students was selected and two samples were drawn from the population. The sample selection was determined by response to an instrument used to determine student attitude. After the samples had been determined the design dictated that the nonverbal behavior of the subjects in the samples be compared to their attitude. This comparison was accomplished by systematically measuring the behavior of the subjects using an instrument devised for that purpose by the researcher as an integral part of the study described in this writing. The instrument was developed from results derived from a survey of the professional literature combined with empirical results taken from a pilot study of random subjects. The results were then analyzed using a statistical technique which used correlations as an integral part of the analysis.

Design of the Study

A complete description of the design of the study and the obtained results is presented in Chapters III and IV.

The initial phase of the study involved pilot study work. Ten video tapes, each one class period in length, were made of students involved in normal lecture-discussion activity in the typical teaching-learning situation. The students were eighth, ninth and tenth graders in schools with proximity to Corvallis, Oregon. No attempt was made

to select particular student characteristics such as high or low achievers or gregarious or retiring personalities.

The video tapes were studied and the nonverbal behaviors manifested by students were noted in handwritten descriptions. The descriptions together with reported results from the professional literature were compiled and organized into a catalogue of behavioral cues, and this catalogue became the device by which student nonverbal behaviors were quantified. This device, which is an observation instrument, was developed in a combination deductive-inductive manner. It was inductive in that the instrument progressed from a list of particular cues to categories of related cues and finally to the total catalogue of behaviors. The instrument was deductive in that results were taken from the professional literature and were interrelated with the empirical results gathered from the pilot tapes. Thus, the instrument is comprehensive and at the same time was built on a strong conceptual framework.

Description of the Observation Instrument

The catalogue of behaviors consists of two parts, which are the categories of behavioral cues and the criteria for coding the cues. The criteria for coding includes explanations and keys to be used as an aid in the coding process. There are 13 categories of behavior which are as follows: (1) Forward Lean, (2) Sideways Lean, (3) Body

Orientation, (4) Head Orientation (a) (Horizontal Head Swivel), (5) Head Orientation (b) (Vertical Head Orientation), (6) Head Orientation (c) (Head Tilt), (7) Gaze Direction, (8) Head Movement, (9) Facial Expression, (10) Gestures, (11) Manipulation, (12) Arm Symmetry, (13) Interactions. The complete instrument and the precise definition of each category are shown in Appendix A.

Method of Encoding Behaviors

Time sampling was used as a method of gathering behavioral data. An audio tape was prepared which sounded sequential numbers every five seconds, and this audio tape was then re-recorded onto the audio track of the video tape. At the sound of the number the researcher marked a symbol on the data sheet (Appendix C) representing the behavioral cue in a specific category manifested by the subject. This process was continued for the entire video taped segment. The video tape was then rewound, and the process was repeated for a second category. This procedure was continued until all 13 of the categories were coded.*

Selection of Experimental Subjects

After the instrument was completed the researcher again went to schools for the purpose of identifying experimental subjects. Each teacher visited had previously agreed to cooperate with the researcher

and participate in the study. All but one of the teachers had previously been involved in the pilot study phase of the research.

The researcher administered a questionnaire (Appendix C) to the students in each of the teachers' classes. The questionnaire was designed to determine the students' attitude toward their teachers and classes.

A student with a polar positive response and a student with a polar negative response to the questionnaire were selected from each class, and these students were used as the experimental subjects. An effort was made to keep the subjects anonymous. No names were solicited, and no record of background or achievement was requested or checked. A total of 25 subjects were selected.

Gathering of Behavioral Data

Subjects were selected in each class in such a manner that would allow the simultaneous recording of both the positive and negative subjects. The subjects were then video taped in normal classroom activity over a period of three months. The subjects were each taped not less than two times and not more than five times. The taping began as soon as the teaching-learning activity for the period was begun, and it was extended until a 20-minute segment had been taped.

The behavioral data were quantified using the same method as had been previously used for inter-observer agreement. The data

were recorded on data sheets and were ultimately punched onto computer cards to be analyzed.

The behavioral data were analyzed using discriminant analysis, which is a statistical technique designed to classify subjects into one of two groups. In the present study a subject would be classified into the group having a positive attitude toward the teacher or into the group having a negative attitude toward the teacher.

Results of the Study

Hypothesis One. A valid and reliable instrument for the systematic observation of junior high school and/or secondary school student nonverbal behavior can be developed -- is accepted.

The instrument in its final form was the result of work done to insure its validity and reliability and as a result it has several characteristics which contribute to both.

First, the behavioral cues are actually signs as Medley and Mitzel (1963) would classify them. This means that the cue is precisely defined and known, and inference is not required on the part of the observer. Also, the behaviors were recorded in an environment familiar to the subject, and the professional literature suggests that nonverbal behaviors are subconscious manifestations of a psychological force. Both factors argue cogently for the validity of the instrument and the measuring process.

The cues are not classified into arbitrary categories which may not be meaningful in a "real world" sense, or which would require an inference of the motives of the subjects or the effects of his behavior. The cues were categorized only with respect to the various possible manifestations of a particular body region. The categories in general have a small number of cues, which means the observer is required to make only a small number of decisions while coding* behaviors. The instrument is designed to be used with video tape recordings which means a permanent record of the behaviors is captured, and the observer can view a particular behavior as many times as desired in order to analyze the cue with precision.

In addition to the arguments cited, the combination inductive-deductive method of developing the instrument contributes to its validity by insuring its comprehensiveness and providing a sound conceptual framework on which it is built.

Finally, reliability was enhanced by the high degree of objectivity inherent in the instrument. The objectivity was determined by establishing generally high coefficients of inter-observer agreement. To establish coefficients of inter-observer agreement the researcher first randomly selected ten five-minute segments from the pilot tapes. Two observers independently coded* the behaviors manifested by the subjects and coefficients of inter-observer agreement were calculated using Scott's (1955) formula. The coefficients for each category are

included in Appendix A and are also shown in Table 1 of Chapter IV.

Hypothesis Two. Hypothesis Two - A significant positive relationship exists between the measured nonverbal behaviors exhibited by high school and/or junior high school students and their attitude toward their teacher and/or their class - is completely accepted in all cases. Tables 3, 6, 9, 12, 13, and 15 show the results of the data analysis. In each case highly significant relationships were found between the subject's attitude and his nonverbal behavior as measured by the instrument developed for that purpose.

It was found that the following behaviors related significantly to attitude and were capable of classifying a subject as positive or negative. Variables significantly related to positive attitude toward the teacher are as follows: (1) Gaze direction toward teacher, (2) Taking notes, (3) Smiles, (4) Interactions with teacher, and (5) Frequency of raising hand. Positive attitude was found to be weakly related to (6) Forward Lean, and (7) Object manipulation. Weakly related does not imply statistical insignificance. Each variable was significant at least beyond .05.

Negative attitude was found to be communicated by the following variables, each being statistically significant. (1) Head on hands (or fist) with hands on desk, (2) Eyes closed, (3) Frequency of yawns, (4) Frequency of negative head shakes, and (5) Frequency of turning head to greater than 90° from immediate. A weak relationship was

found between negative attitude and (6) Supporting head, (7) Self manipulation for girls, and (8) Head down for boys.

When the statement is made that the relationship between attitude and behavior is weak, it is based on the coefficient of the variable as it appears in the mathematical model. A very small coefficient for a particular variable means the variable in the total model will not normally have significant effect on the independent variable. A weak relationship does not imply statistical insignificance. All variables were significant at .05 and most were significant well beyond .005.

Discussion

This section is devoted to relating the results of the study to other research in the area of nonverbal behavior. The specific behavioral cues found to be significant are discussed, as well as a discussion of the development of category systems.

Studies Related to Categorization of Nonverbal Behavior

As explained earlier in this chapter the instrument used in the present research was developed using a combination inductive-deductive approach, which allowed the instrument to be comprehensive while at the same time providing a sound conceptual framework.

Other studies in the field of education have been reported in which descriptions of the categorization of nonverbal behavior are

presented. Jecker, Maccoby, and Breitrose (1965) studied student nonverbal cues in an attempt to improve teachers' ability to determine student comprehension from perception of the student nonverbal behavior. The researchers developed categories of student nonverbal behaviors which were related to the objective assessment of the students' comprehension. The behaviors were used as training cues designed to improve accuracy in perception of nonverbal cues. The researchers reported significant improvement in teachers' ability to assess the nonverbal cues ($p < .05$). However, in reporting their results the researchers did not consider the possibility of cognitive-affective interaction. They felt they were measuring nonverbal cues related to comprehension, but in fact they could have been measuring affective responses.

The relevance of the work done by Jecker, Maccoby, and Breitrose, for the present study, lies in their work related to the categorization of student nonverbal behavior. Their categories and cues were developed inductively, but the cues were ill-defined and a more detailed account of their work would be required if the system were to be adapted for use with a different population of subjects.

Other studies related to nonverbal behavior in the field of education have been reported. Galloway (1962) and Victoria (1970) studied nonverbal behaviors of teachers, and both developed category systems into which the behaviors were inferred. Evans and Balzer (1962) and

Parakh (1965) in studying teacher behavior and developing category systems for analyzing the behaviors argue the relevance of nonverbal cues. Parakh reported that 37 percent of the laboratory behavior of ten biology teachers was nonverbal and Evans reported that 39.7 percent of all behavior manifested by teachers in his study was nonverbal.

Researchers outside the field of education report work done in the categorization of nonverbal behaviors. Birdwhistell (1970) divided the body into the regions of Total Head; Face; Trunk; Shoulder, arm, and wrist; Hand and Finger Activity; Hip, leg, and ankle; Foot activity, walking; and Neck. Each region is keenly subdivided as to behavioral manifestations, and analysis of patterns of nonverbal behavior is attempted using the behavioral notations. Birdwhistell's emphasis varies from the efforts of the research reported in this writing in that he is concerned with the infracommunication structure of nonverbal behavior while the present study relates primarily to the meanings of the "words" of nonverbal behavior. Nevertheless, the cues often are the same and Birdwhistell's conceptualization provided useful background for the present study.

Eckman and Friesen (1969) developed five categories of nonverbal behavior based on how the behavior came to be a part of the subject's repertoire, the circumstances surrounding the occurrence of the nonverbal act, and how the act is manifested, i. e. , the rule that

establishes the relationship between the act itself and what the act signifies.

The present study relates to the work done by Eckman and Friesen in that an effort was made to establish a relationship between a manifested cue and the meaning of the cue. The scope was limited in that only attitude was analyzed as a behavioral concomitant as opposed to studies of anxiety, frustration, and so forth.

Krout (1954a) categorized gestural manifestations of an autistic nature, and were thus only peripherally related to the present study. However, Krout asserted that nonverbal behavior could be a manifestation of energy release and as such is probably unconscious. This conceptualization has proved useful for the research reported in this writing.

Mehrabian (1969a) categorized nonverbal behavior as communicating with reference to attitude or feeling of liking or disliking, status or potency, and responsiveness, all toward some addressee. Mehrabian's categories of cues are directly related to the work of the present research, particularly with respect to attitude. The relationships between the results of the present study and Mehrabian's reported work are summarized in the next section.

Studies Related to Significant Cues in the Present Study

The findings of the present study support results reported by Mehrabian (1965, 1968, 1969a, 1969b) who as a psychologist has done considerable work in the area of nonverbal behavior and its relationship to attitude.

Mehrabian (1969a) reports that immediacy cues such as forward body lean, direct orientation of an encoder toward his addressee, and eye contact are strongly linked to an encoder's positive feeling toward his addressee. The results of the present study show a strong relation between attitude and Gaze Direction Toward Teacher and a weaker relationship between attitude and Forward Lean. The study showed a relation between negative attitude and Eyes Closed and frequency of turning Head Greater Than 90° from Immediate as well as Head Down for male subjects. In each case the cue reduced the immediacy between the subject and his addressee (the teacher). These results directly support the results reported by Mehrabian.

Mehrabian (1969a) further reported straight-ahead and lateral distance as being significantly related to communicator attitude toward an addressee. He conceives decreased straight-ahead and lateral distance as being more immediate and thus as immediacy cues relate to communicator attitude. The conception of distance being related to attitude is further supported by the work of Hall (1959, 1963a, 1963b).

As part of the present study an investigation of student seating arrangement and its relationship to attitude was conducted. Highly significant relationships between classroom seating location and attitude were found. To the extent that classroom arrangement parallel Mehrabian's experimental situations his results are strongly supported by the results reported in this writing.

Rosenfeld (1966a) reported that approval-seeking subjects tended to be involved in longer speech communications, fewer negative head nods and more smiles directed toward an addressee than did approval avoiding subjects. The research reported in this writing showed a significant relationship between positive attitude and Interactions With Teacher and positive attitude and Smiles. The results further showed a relationship between negative attitude and Negative Head Shake. These results relate to Rosenfeld's findings, although not as directly as the variables which relate to Mehrabian's Immediacy Cues. It cannot be conclusively stated that approval seeking and positive attitude are linked in a one-to-one correspondence, particularly in a school situation.

Mehrabian (1965) reported that lengthier communications are associated with more positive attitude, which offers a direct relationship for the cue Interactions With Teacher. Mehrabian (1969a) notes that positive facial expressions relate to positive attitude, which again provides support for the variable Smiles.

Mehrabian reports that status or dominance is communicated by lower rates of trunk swivel, higher rates of self manipulation, less facial pleasantness, and longer communications. The results of the present study are inconclusive with respect to Mehrabian's findings. The relationship between feelings of status and attitude is unknown, and the study reported in this writing showed inconsistent results with respect to the status cues reported by Mehrabian. For example, a positive relationship was found between attitude and Object Manipulation and Interactions between the subjects and the teacher, while a negative relationship was found between higher rates of trunk swivel and self manipulation. If the results of this study were consistent with respect to Mehrabian's status cues, i. e. , if the status cues all related to a negative attitude as found in this study, a relationship could be suggested. The results disallow any such suggestion.

Mehrabian reports that the cues of Head Nodding, Trunk Swivel Movements, Rocking Movements, and Self-Manipulation denote responsiveness to an addressee. Bentler (1969) reported a positive correlation (.33) between activity or responsiveness and attitude, which suggests that responsiveness is more likely to be related to positive attitude than to negative attitude.

The results of the present study are again inconclusive with respect to Mehrabian's reported findings. A t test shows a statistical difference that was not significant with respect to the rocking

movements manifested by positive and negative subjects. Trunk swivel movements were found to be related to negative attitude, and self manipulation was found to be related to negative attitude for girls and not related to attitude for boys. Frequency of negative head shakes was found to relate to negative attitude (weakly), but this does not necessarily imply the converse, i. e., that positive head nods relate to positive attitude. No such relationship between positive head nods and positive attitude was found. Thus no conclusive relationship was found that would support the relationship between Mehrabian's activity cues and attitude as reported by Bentler.

In summary it was found that the results of the present research relate closely to the immediacy cues as reported by Mehrabian. This suggests that Mehrabian's reported results with respect to positive attitude being communicated by greater immediacy could be generalized to the classroom situation at least within the limitations of the sample used in the present study. Further, a relationship even though less direct was found between Rosenfeld's approval seeking cues and the results of the study reported in this writing. No conclusive relationship was found between Mehrabian's status or potency cues, and the results of the present study, nor was any conclusive trend found with respect to Mehrabian's activity cues and the present results.

Recommendations for Further Study

The results of the present study were found to be highly significant. However, the sample size was small, and the sample was not randomly selected, thus disallowing generalization to a larger population of students. The results show promise, and it is recommended that the study be repeated with a larger sample and a more desirable selection process which would allow more generalization.

The present study involved students in the lecture-discussion phase of the teaching-learning classroom activity. Specific context, i. e. , actions and behaviors of the teacher as they directly affect student behavior, were not recorded or analyzed. It is therefore recommended that an analysis of teacher behavior be made in addition to the analysis of student behavior. The most desirable design would provide for simultaneous recording of teacher and student behaviors, which would in turn provide for analysis of specific context and a relationship between teacher and student behaviors. It is further recommended that the scope of the study be broadened to include all forms of student classroom activity.

The research presented in this writing involved students with polar attitudes toward their teachers and classes. A recording and analysis of a more complete spectrum of attitudes and a statistical technique such as multiple regression analysis would give a vastly

improved picture of the range and variety of student behaviors. It would further provide insight into how keenly student nonverbal behaviors could be differentiated within the limitations of a design similar to the one used in the present study. The professional literature suggests a plethora of possible connections between psychological forces and their subtle nonverbal behavior manifestations. A complete empirical study such as suggested in this paragraph would begin to lend insight into these relationships in the classroom.

Jecker, Maccoby, and Breitrose (1964) found that teachers did not accurately perceive student nonverbal cues related to comprehension of subject matter. A valuable study could undertake to measure teacher perception of affective student nonverbal cues. A more complete description of teachers' abilities to perceive student nonverbal feedback could lead to training of teachers resulting in increased teacher awareness of and sensitivity to student nonverbal cues.

The present study involved behavioral data gathered from subjects in eighth, ninth, and tenth grades. It is recommended that the analysis be broadened to include a wider age range of subjects.

Results reported by researchers such as Mehrabian, Krout, and Eckman established relations between behavioral manifestations such as tension and relaxation and specific categories of nonverbal cues, e. g. , arm symmetry. Studies could analyze with precision particular behavior typologies allowing study of subtle behaviors,

which would have high probability of being unconscious. These behaviors when quantified could potentially provide keen insight into psychological forces operating within the subject.

The questionnaire presented the students provided them with the opportunity to give a response in reference to both the teacher and the course. Subjects who gave a polar response to both the teacher and course were selected. Therefore, it is unknown if the strong relation between the behaviors and attitude reflects the students' attitudes toward the teacher primarily, the class primarily, school in general, or perhaps in reference to life as a whole. A study with a design that could differentiate among these possibilities would be valuable.

The use of the video tape recorder shows promise as a vehicle for the capturing of nonverbal behaviors. It is therefore recommended that video tape recordings be used in further studies involving the analysis of nonverbal behavior.

The study reported in this writing had no provisions for cultural differences among students or for students with different school success patterns or different personality characteristics. A study involving analysis of these differences would substantially increase the body of knowledge with respect to student nonverbal behavior.

Finally, the present study was strictly an analysis of nonverbal behavior without a verbal context. The study of nonverbal behavior in the classroom context must necessarily remain in its infant

development phase until an analysis can be made of verbal and non-verbal behavior simultaneously. The nonverbal results remain suspect until verbal context can be established. It is therefore recommended that studies be conducted in which verbal and nonverbal behavior are simultaneously examined.

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APPENDICES

APPENDIX A

OBSERVATION INSTRUMENT

Seated-Subject (Student) Catalogue of Nonverbal Behaviors

Body Region	Category	Cues	Coding Symbol	π
Upper Body	Forward Lean	Forward	1a	.89
		Erect	1b	
		Back	1c	
	Sideways Lean	Sideways Lean	2a	.99
		No sideways lean	2b	
	Body Orientation	Immediate	3a	.61
		Less than 90 from immediate	3b	
		90 or greater from immediate	3c	
	Head	Head Orientation (a)	Immediate	4a
Less than 90 from immediate			4b	
90 or greater from immediate			4c	
Head Orientation (b)		Above parallel	5a	.89
		Parallel	5b	
		Below parallel	5c	
Head Orientation (c)		Tilt	6a	.80
		No tilt	6b	
Head Movement		Positive nod	7a	.80
		Negative shake	7b	
		No movement	7c	
Gaze Direction		Teacher	8a	.84
	Down	8b		
	Closed	8c		
	Other	8d		

Body Region	Category	Cues	Coding Symbol	r	
	Facial Expression	Smiles	9a	.86	
		Frowns	9b		
		Neutral expres- sion	9c		
		Other expres- sions	9d		
Hands and Arms	Gestures	Gestures	10a	.79	
		Does not gesture	10b		
	Manipulation	Self	11a	.78	
		Object	11b		
		Takes notes	11c		
		Drums	11d		
		No manipulation	11e		
	Arm Symmetry		Symmetric open	12a	.90
			Symmetric closed	12b	
			Folded front	12c	
			Folded behind	12d	
			Head hands- hands desk	12e	
Raised hand			12f		
Supporting head			12g		
Asymmetric open			12h		
Asymmetric closed			12i		
Below desk			12j		
Whole Body	Interactions	Teacher	13a	.86	
		Friend	13b		
		No interactions	13c		

Criteria and Explanations for Scoring Postural-Gestural Cues
of a Seated Communicator

General Criteria:

Each category is coded separately. At the sound of a number, or whatever signals the beginning of a time interval, the observer records a symbol on a tally sheet representing the particular cue within the selected category being manifested by the subject. If at the signal the subject is in the process of moving from one cue to another cue within the category, the symbol representing the cue exhibited prior to the beginning of the transfer is recorded. The median position will be referred to in the explanations of the specific cues. The median position is defined as the position the subject manifests when the lines of intersection of the plane bilaterally bisecting the subject's head and torso, the plane dividing the body and head into a front and back half, and the plane parallel to the floor form a cartesian coordinate system.

Specific Criteria:

Category 1: Forward Lean: Forward Lean is defined as the angle that the plane parallel to the plane of the upper body makes with the plane parallel to the back of the chair.

Cue a: Forward: The subject leans on his elbows on a desk with his back losing contact with the back of the chair, or the subject turns such as to a friend and leans with his elbows on his knees

or any other support. The shoulders are noticeably forward when the forward cue is manifested.

Cue b: Erect: The subject sits with his back in contact with the back of the chair, and the legs and lower back are not slid forward in the seat of the chair. The shoulders may or may not be forward from the plane through their natural positions.

Cue c: Back: The subject sits with his back in contact with the back of the chair, and the legs and lower back are slid forward in the seat of the chair as an individual would look as if he were slouching in a seat. Also, the subject is coded as back if the legs and lower back are not slid forward on the seat of the chair, but the subject is sitting with the front two chair legs raised so the chair is supported only by the back legs.

Category 2: Sideways Lean: Sideways lean is defined as the angle the plane bilaterally bisecting the subject's upper body makes with a vertical plane separating the subject's legs to either side of the plane.

Cue a: Sideways Lean: The subject sits so the planes described above make a measurable angle with each other (approximately 10° or more). Slight shifts in position as in adjustment of the body in the seat to reestablish comfort are not coded as sideways lean. The subject may often lean sideways and support the upper body with an arm which can be used as a key in coding the cue.

Cue b: No Sideways Lean: The above mentioned planes are identical or make an angle of less than 10° with each other.

Category 3: Body Orientation: Body orientation is defined as the angle a vertical plane bilaterally bisecting a subject's torso if he were in the median position makes with a vertical plane through the median lines of the subject and the addressee (teacher).

Cue a: Immediate: The above two planes coincide. The primary key in coding the cue is the orientation of the shoulders. Neither shoulder should be forward of the other shoulder with respect to the plane through the two median lines. The definition holds when the teacher moves around the room, i. e., to code the cue as immediate

the subject's orientation must follow the teacher's movement.

Cue b: Less Than 90° From Immediate: The two planes make an angle of greater than 0° but less than 90° with each other without respect to a positive or negative direction.

Cue c: 90° or Greater From Immediate: The two planes make an angle of 90° or greater with each other without respect to positive or negative direction. Again the shoulders can key the coding. If either shoulder is hidden behind the other, or if both are visible from the back, Cue c is coded.

Category 4: Head Orientation (a): Head orientation is defined as the angle the vertical plane bilaterally bisecting the subject's head if he were in the median position makes with the plane through the median lines of the subject's torso and his addressee's (teacher's) torso.

Cue a: Immediate: The two planes coincide. As with body orientation the definition holds when the teacher moves back and forth across the front of the room. Brief movements by the teacher may not be followed by very slight movements of the subject's head, and thus the cue will be

recorded as if the teacher had remained stationary.

Cue b: Less Than 90° From Immediate: The two planes make an angle of less than 90° but greater than 0° with each other without respect to positive or negative direction.

Cue c: 90° or Greater From Immediate: The two planes make an angle of less than 90° or greater without respect to a positive or negative direction.

Category 5: Head Orientation (b): Head Orientation (b) is defined as the angle a plane separating the head into an upper and lower half makes with a plane parallel to the floor.

Cue a: Above Parallel: The plane separating the head into an upper and lower half makes a positive angle with the plane parallel to the floor.

Cue b: Parallel: The two planes coincide.

Cue c: Below Parallel: The plane separating the head into an upper and lower half makes a negative angle with the plane parallel to the floor. The eyes can be used as an aid in coding the cue in cases of uncertainty. If the observer is uncertain and the eyes are focused downward Cue c is recorded. If the eyes are focused on a line

parallel to the floor, Cue b is coded. Care must be taken to avoid relying too heavily on the eyes as an aid, or the process becomes essentially one of coding gaze direction and the head orientation loses its meaning as a cue.

Category 6: Head Orientation (c): Head orientation (c) is defined as the angle a plane bilaterally bisecting the head when the head is in the median position.

Cue a: Tilt: The planes make a positive or negative angle with respect to each other. Positive and negative angles are defined in the same way as they would be in mathematics.

Cue b: No Tilt: The two planes coincide.

Category 7: Head Movement: Head movement is defined as the cyclical up and down or side to side movements manifested by the subject.

Cue a: Positive Nod: The subject must move his head in an up and down motion such that he passes through the "neutral position" (Category 5, Cue b) at least twice, or if the subject begins in the "neutral position," he must move the head so it passes through the "neutral position" at least once and returns to rest at the "neutral

position." The motion in either case must be continual and with an oscillatory period of not greater than two seconds.

Cue b: Negative Shake: The subject moves his head in an oscillatory manner in a plane parallel to the floor. He must move his head in a left and right motion such that the head passes through the Immediate cue (Category 4, Cue a) at least twice; or if he begins at the Immediate cue, he must move the head so it passes through the Immediate cue at least once and returns to rest at the Immediate cue. The motion in either case must be continual and with an oscillatory period of not greater than two seconds.

Cue c: No Movement: The subject's head remains motionless or the movement is such that the oscillatory period is greater than two seconds.

Category 8: Gaze Direction: Gaze direction is defined as the object or person upon which or with which the subject makes visual contact.

Cue a: Teacher: The subject is involved in visual contact with the teacher, or any object to which the teacher is referring such as writing on the

chalkboard, charts, models, projected images, etc. However, if the teacher addresses another student in the class and the subject looks at the other student, Cue a is not recorded. If the subject refers to the above examples when the teacher is referring to something else, Cue a is not recorded.

Cue b: Down: The subject looks down as he would when reading, taking notes, arranging papers, etc., or down to his right or left as he would if looking at the floor.

Cue c: Closed: The subject's eyes are closed.

Cue d: Other: Cue d is recorded when the subject's gaze direction cannot be coded as Cue a, b, or c. This would be in effect when the subject interacts and looks at a friend, when he looks at an object or person outside the observer's view or when the eyes are not visible but are inferred as open.

Category 9: Facial Expression: Facial expression included all the possible expressive manifestations a subject is capable of exhibiting with the face.

- Cue a: Smiles: Cue a is recorded when the subject smiles. The object of the smile is not taken into account inasmuch as the orientation of the head and the gaze direction are coded in another category which allows an analysis of the object to which the smile is directed.
- Cue b: Frowns: Cue b is recorded when the subject frowns. As with Cue a the object of the frown is not taken into account.
- Cue c: Yawns: The subject yawns, which is self explanatory.
- Cue d: Neutral Expression: Cue d is recorded when the subject maintains an expression that appears to be his normal expressional mode. This normal mode is inferred from extended observation of the subject's expressional pattern.
- Cue e: Other Expressions: Cue e is recorded when the subject manifests an expression that cannot be properly recorded as cue a, b, c, or d. Typical examples could be expressions of surprise, confusion, bemusement, etc., or any expression not understood.

Category 10: Manipulation: Manipulation is defined as any relative motion of a body part in contact with another body part or an inanimate object or the directed relative motion of an object in contact with another object.

In certain rare cases a subject may manifest two manipulative acts simultaneously. In these instances the dominant behavior is inferred and that cue is recorded.

Cue a: Self: The subject moves a part of the body over another part of the body while the parts are in contact. Common examples would be the scratching or rubbing of the face or head with the fingers or hand, or the preening of the hair with the hand common with girls. The motion may be slow or rapid, oscillatory or non-oscillatory.

Cue b: Object: The subject moves a part of the body slowly or rapidly over an object such as a desk or book. Further, cue b is coded when the subject slides one object such as a book over another object such as the desk. A subject manipulating an ornament on the body such as a ring, watch, or necklace, etc., is coded as

manifesting cue b, while motion over clothing such as scratching a shoulder, etc., is coded as cue a. Exceptions to the general type of motion that would fit cue b are Takes Notes and Drums.

Cue c: Takes Notes: The subject is involved in a process of writing which reflects the topic of the teaching-learning situation. The behavior is keyed by noting frequent looks toward the teacher followed by looks down at a paper on the desk while intermittent motion of a writing instrument on the paper takes place. Activities such as doodling, etc., are recorded as cue b.

Cue d: Drums: The subject moves the fingers or the hand in an up and down motion on an object as tapping. The fingers or hand must break and make contact at least twice in order to record cue d. Tapping on the body is coded as cue a.

Cue e: No Manipulation: The subject's hands, arms, and fingers remain motionless or move such that no contact between body parts or a body part and an object exists during the relative motion, e. g., lifting a book from one part of a

desk to another is coded as Cue e.

Category 12: Arm Symmetry: Arm symmetry is defined as the orientation of the arms with respect to each other and/or with respect to the subject's trunk or head.

Cue a: Symmetric Open: The arms but not necessarily the hands are mirror images but are not in contact with each other. Examples of possible arm arrangements could be both arms hanging at the sides, the arms resting on the desk, the elbows resting on the desk while the forearms are raised above the desk, or both arms raised above the head. Cue a is recorded if the arms are symmetric and one hand is involved in manipulative activity while the other is not.

Cue b: Symmetric Closed: The arms are mirror images and the hands or fingers are touching, clasped, or intertwined. Cue b is also recorded if the arms are symmetric and one hand grasps the opposite wrist or lower half of the forearm.

Cue c: Folded Front: The arms are symmetric with the arms and hands intertwined having the hands fitted into the crease of the opposite elbow. The arms may rest on the subject's chest or

abdomen, or the forearms and elbows may rest on the desk and support the upper torso. Also, the arms may be arranged with one arm and hand resting on the desk with the second hand grasping the first upper forearm.

Cue d: **Folded Behind:** The arms are symmetrically arranged with the hands of fingers clasped behind the head, neck, the lower back, or clasped behind the back of the chair.

Cue e: **Head Hands-Hands Desk:** The subject is seated such that one or both arms are resting on the desk and the side of the head or the chin is resting on the desk and the side of the head or the chin is resting on the hand or arm (in contact with the desk if only one arm rests on the desk.) Cue e is also recorded if the arms are arranged such that one rests on the other and the head or chin rests on the top arm or hand. The arms may or may not be arranged symmetrically.

Cue f: **Raised Hand:** The subject has one arm arranged in a random position while the other is raised above the head as in desiring to attract the

attention of the teacher. Both hands raised above the head is coded as cue a if not touching or cue b if touching.

Cue g: Supporting Head: The subject has one arm arranged in random position while the other hand is in contact with the head (which could include chin, face, neck, or forehead, etc.) in a supportive fashion. Certain keys are helpful to determine what is a "supportive fashion," which are outlined as follows: There must be no relative motion between the hand and the head. If the palm is facing the head, complete contact with the open palm and/or the heel of the hand and the head is necessary. Fingertips touching the head is not recorded as Cue g. If the hand forms a fist, and the fingers between the second joint and the knuckle are in contact with the head Cue g is recorded while the fingers between the first and second joint or before the first joint in contact with the head are not recorded as Cue g.

Cue h: Asymmetric Open: The arms are above the line of the desk and are visible but are arranged in a

random fashion, make no contact with each other and are not arranged in a manner that would allow the orientation to be coded as any of Cues a through g.

Cue i: Asymmetric Closed: The arms are above the line of the desk and are visible but are arranged in a random fashion, making contact with each other and are not arranged in a manner that would allow the orientation to be coded as any of Cues a through g.

Cue j: Below Desk: Both arms are below the line of the desk top such that they are not visible to the observer, and such that the arrangement of the arms cannot be inferred. In a case such as arms hanging at the subject's sides such that the hands and lower forearms are not visible Cue a is recorded rather than Cue j due to the ease of inferring the position. Cue j is recorded whenever the arms are not visible to the observer such that the orientation cannot be inferred.

Category 13: Interactions: Interactions are defined as any verbal or nonverbal messages sent by the subject to a receiver who is detectable by the observer.

- Cue a: Teacher: The subject sends a verbal message directed toward the teacher. The message could be in the form of an asked question, answered question, or random statement, etc.
- Cue b: Neighbor: The subject sends a verbal or non-verbal message to a receiver visible to the observer. Examples could be talking to a classmate, smiling at a person who is smiling or returning the gaze, or merely exchanging glances. Further, the subject and a classmate simultaneously looking at an object between them is coded as Cue b. (If both look to a third person talking or to an object across the room Cue b is not recorded.) The subject looking at or smiling at an individual who doesn't return the look or smile is not coded as manifesting Cue b, nor is a subject looking or smiling at an object or person not visible to the observer.
- Cue c: No Interactions: Verbal or nonverbal manifestations not capable of being coded as Cue a or Cue b.

APPENDIX B. DATA SHEET

Category _____

 Pos. _____ Neg. _____ Pos Sex _____ Tape # _____
 Neg Sex _____ Period _____
 Dur a _____ Freq _____

1	31	61	91	1	31	61	91
2	32	62	92	2	32	62	92
3	33	63	93	3	33	63	93
4	34	64	94	4	34	64	94
5	35	65	95	5	35	65	95
6	36	66	96	6	36	66	96
7	37	67	97	7	37	67	97
8	38	68	98	8	38	68	98
9	39	69	99	9	39	69	99
10	40	70	00	10	40	70	00
11	41	71	01	11	41	71	01
12	42	72	02	12	42	72	02
13	43	73	03	13	43	73	03
14	44	74	04	14	44	74	04
15	45	75	05	15	45	75	05
16	46	76	06	16	46	76	06
17	47	77	07	17	47	77	07
18	48	78	08	18	48	78	08
19	49	79	09	19	49	79	09
20	50	80	10	20	50	80	10
21	51	81	11	21	51	81	11
22	52	82	12	22	52	82	12
23	53	83	13	23	53	83	13
24	54	84	14	24	54	84	14
25	55	85	15	25	55	85	15
26	56	86	16	26	56	86	16
27	57	87	17	27	57	87	17
28	58	88	18	28	58	88	18
29	59	89	19	29	59	89	19
30	60	90	20	30	60	90	20

1a	4a	7a	9a	11a	12e
1b	4b	7b	9b	11b	12f
1c	4c	7c	9c	11c	12g
2a	5a	8a	9d	11d	12h
2b	5b	8b	10a	11e	12i
3a	5c	8c	10b	12a	12j
3b	6a	8d		12b	13a
3c	6b			12c	13b
				12d	13c

APPENDIX C. ATTITUDE QUESTIONNAIRE

DO NOT WRITE YOUR NAME ON THIS PAPER.

As part of a research project at Oregon State University we are studying students' attitudes toward their teachers and courses. It is crucial to the success of the project that you give your honest response to the questionnaire. Your reaction to the items will not be related to your class performance or grades in any way, and no judgements will be made of you or your teacher. Neither your teacher nor your classmates will see your response.

Please check the boxes that best describe your feelings.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like this teacher as a person very much.	I like this teacher as a person moderately.	I like this teacher as a person slightly.	I neither like nor dislike this teacher as a person.	I dislike this teacher as a person slightly.	I dislike this teacher as a person moderately.	I dislike this teacher as a person very much.
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I like this course very much.	I like this course moderately.	I like this course slightly.	I neither like nor dislike this course.	I dislike this course slightly.	I dislike this course moderately.	I dislike this course very much.

Please check the box that in your opinion best describes the feelings of the person sitting on your right.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
He/She likes this teacher.	He/She neither likes nor dislikes this teacher.	He/She dislikes this teacher.	I don't know if he/she likes or dislikes this teacher.	No one is sitting on my right.

Please check the box that in your opinion best describes the feelings of the person sitting next to you on the left.

<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
He/She likes this teacher.	He/She neither likes nor dislikes this teacher.	He/She dislikes this teacher.	I don't know if he/she likes or dislikes this teacher.	No one is sitting on my left.

APPENDIX D. LETTER TO SCHOOLS

January 26, 1971

Dear _____:

This letter is written to request permission to contact science teachers in your schools. As a partial fulfillment for the requirements of the Ph. D. in Science Education, Oregon State University, Paul Eggen, as the primary investigator, plans to research student nonverbal behaviors in the normal classroom situation.

Essentially the intent of the study is to observe and categorize science student nonverbal behavior and to compare the observed behavior to the student's attitude. The observation will be accomplished by means of a video tape camera set up in the classroom prior to the beginning of the class, which will record the entire period without interruption. No human observer will be in the room during the taping period, and hence, disruption will be virtually eliminated. The class will be taped no less than one and no more than five times with the first time serving the function of a pilot study. At the beginning of the second taping session the students will be asked to react to a written instrument which will determine the students' attitude toward their teacher. This process will take approximately five minutes, and it will be the only time the investigator will have verbal contact with the students. The instructor is asked to conduct the class in a normal manner, and he will not be asked to try and manipulate his or the students' behaviors in any way.

The participating teacher and students will remain completely anonymous, and no judgements of teaching ability will be made. The purpose of the study is only to gather the empirical data. The integrity of both students and teacher will be preserved.

If your permission is granted, your science teachers will be contacted regarding their willingness to participate. Mr. Eggen will be happy to explain in detail the nature and purpose of the research whenever convenient for you. Participating schools will ultimately be given a summary and results of the study.

Mr. Eggen will contact you by phone within the next few days regarding your response. Please feel free to call Dr. Fred Fox at 754-1986 or Mr. Eggen at 752-2866 if you have any immediate questions or comments.

Sincerely yours,