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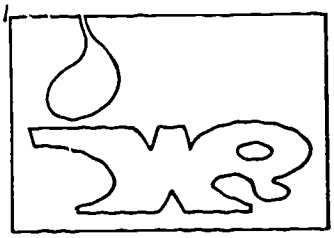
ABSTRACT

This research was conducted to compare the effects of a cooperative instructional context with a competitive instructional context on the verbal and nonverbal behaviors of same-sex student pairs within a microcomputer environment. Subjects were 20 male and 20 female sixth-grade students who were randomly assigned to same-sex pairs. All pairs were assigned to both experimental conditions, which consisted of playing the educational game, "Dueling Digits." In the cooperative condition, students worked together to score 100 points within a 20-minute session; in the competitive condition, students worked individually and the winner was the one who scored 100 points first. Videotapes were made during the experimental sessions and students completed self-evaluative questionnaires at the end of each session for both treatments. The statistical model used to analyze the data was analysis of variance with repeated measures. Findings indicated that competitive instructional contexts promoted more self-oriented and besting behaviors than a cooperative one, and that the cooperative instructional context promoted more other-oriented and positive behaviors, although some negative behaviors occurred in both contexts. The pairing of students by sex was not found to be a basic determinant of variance in student interaction. A 10-page reference list is provided, and appendices include excerpts from student observation records, the conventions used to code data, the student questionnaire, and statistical data. (DJR)



Microcomputer Experiences and Student Interaction in Small Groups

by Mary Alice Vereen

August 1983

Wisconsin Center for Education Research
an institute for the study of diversity in schooling

MICROCOMPUTER EXPERIENCES AND STUDENT INTERACTION IN SMALL GROUPS

BY

Mary Alice Vereen

A thesis submitted in partial fulfillment of the requirements for the degree of

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Microcomputer Experiences and Student Interaction

in Small Groups

by

Mary Alice Vereen

Under the direction of Professor M. Vere DeVault

ABSTRACT

The purpose of the study was to compare the effects of a cooperative instructional context with a competitive instructional context on the verbal and nonverbal behaviors of same-sex pairs of students within a microcomputer environment. This was an experimental study using a repeated-measures design.

A total of forty sixth-graders (20 males and 20 females) composed the sample. The subjects were stratified by sex and randomly assigned to same-sex pairs to the experimental conditions, with each student pair experiencing the two instructional contexts. These subjects were videotaped during the experimental conditions and were administered a self-evaluative questionnaire following each condition.

Instrumentation used in the study was the Student Interaction Observation Record and the Student Self-Evaluative Questionnaire.

The Student Interaction Observation Record was used to code the verbal and nonverbal behaviors of same-sex pairs. The Student Self-Evaluative Questionaire contained either twenty-eight or twenty-nine items using Likert response categories.

The major findings of the study were as follows: a) the cooperative instructional context and the competitive instructional context significantly affected the student interaction occurring within the microcomputer environment, b) the pairing by sex factor significantly affected only one of the behavioral categories, positive nonverbal behaviors, and c) there was no significant interaction of the instructional context and pairing by sex on the student interaction occurring within the microcomputer environment.

Major Professor _____

Rank _____

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CHAPTER I

INTRODUCTION

Student interaction in the classroom has rarely been explored to explain its influence on the learning process. The emphasis on individualization of instruction and on the teacher-student dyadic unit has been a basic determinant of successful schooling, excluding the relative importance of student interaction (Johnson, 1980). Recent research suggests that interaction of students in the classroom is not antithetical to academic performance (Slavin, 1980; Lewis & Rosenblum, 1975; Allen, 1975) and that interaction among students may enhance social interaction in the classroom (Johnson & Johnson, 1975). Hence, student interaction exercises subsequent effects on the learning process. To ascertain the relative importance of student interaction as a viable predictor and linkage to student learning, researchers have urged the study of constructive use of the student-student dyadic unit or small groups (Johnson, 1980; Webb, 1980).

Microcomputers present educators with an instructional tool that may facilitate or exacerbate the constructive use of student-student interaction. The fundamental difference occurs as a consequence of the use of microcomputers in the classroom. Nilles (1981) addresses the effects of disparate uses of microcomputers on students. He queries:

> If personal computers become prevalent in primary and secondary schools will the population of desocialized or unsocialized individuals increase as a consequence . . . (or) will personal computers to the extent that they increase individual feelings of self-worth because of successful participation in the instructional process, increase the ability of some people to participate in[2] social interaction where they might not otherwise have done so? (p. 79).

Concerned with the potential consequences that microcomputers may have on student interaction in the classroom, the researcher undertook this study to compare the effects of a cooperative instructional context with a competitive instructional context on the verbal and nonverbal behavior of same-sex pairs of students in a microcomputer environment.

Statement of the Problem

Contemporary computers in education have been transformed from mainframe and time-sharing systems to microcomputers, affording education an incredible tool to assist in accomplishing principal objectives such as providing for academic and social development of students and providing for individualized learning.

Microcomputers in the classroom, for the most part, offer a myriad of applications to the classroom teacher. For example, most teachers have chosen to use microcomputers to deliver supplementary or remedial instruction, to provide accelerated instruction to gifted students, and to assist in computer literacy and programming courses (Pitts, 1981). The indication is that current applications of microcomputers in the classroom involve, first, academic

achievement through individualized instruction, and secondarily, acquisition of computer-operational skills such as programming. These predominant uses of microcomputers in education parallel, to some extent, prior applications of mainframe and time-sharing computer systems (Jamison, Suppes, & Wells, 1974).

Educators generally acknowledge that the purpose of schooling is attainment of a mixture of cognitive and affective objectives as delineated by Bloom et al. (1956). Nonetheless, the influx of microcomputer-supported instruction into the schools predominantly emphasizes academic achievement through cognitive objectives. Although the emphasis is warranted, the capabilities of microcomputers can be extended to accommodate social development through the affective objectives. To date, educators have not fully investigated this particular use of microcomputer technology. It is, therefore, a challenge to exploit the use of this interactive technology to enchance educational environments that promote student learning and social development.

One way to exploit microcomputer technology for educational purposes is through its interactive mode. This key feature of the technology generates student-computer interaction through student programming and microcomputer-supported instruction. Typically, microcomputer-supported instruction, such as simulation, drill and practice, tutorials, games and problem-solving, stimulates interactive learning. Simply stated, interactive learning is characterized as learning in which students are full-time

participants rather than spectators in the learning process (Bork, 1982).

By extending the prevalent CAI paradigm (a remnant of mainframe and time-sharing systems) of one student interacting with one computer (Golton, 1975) to two or more students interacting with each other and the computer, the interactive learning environment may be further enhanced.

The design of an effective learning environment that facilitates social interaction among students demands special consideration in terms of classroom management and organization of instruction by educators. Watts (1982) views classroom management and organization of instruction as critical to the psychological impact of computers on students. Specifically, Watts (1982) asserts:

> Computer activities may lead to isolation or separatism among students or to cooperation and appropriate social interaction, depending largely on pedagogical and classroom management decisions (p. 62).

At the classroom level, pedagogical and classroom management decisions are designated to the classroom teacher. Hence, the implementation of an effective, interactive learning environment becomes a function of the knowledge base and perceptions of the teacher. Lipson (1981) offers an analytical description of the learning environment to aid teachers when microcomputers are present:

1) We should not design computer-based learning environments

that do not allow for human interaction, except as homework.

2) We need a great deal more attention (given) to the emotional factors that attend learning.

3) We need to pay more attention to how we can present knowledge so that it can be grasped by a student who doesn't already know.

4) We need a great deal more attention to the social factors of the learning situation because the simple argument is that a lot of what we do is determined by our perception of what other people expect of us (p. 59).

Background and Rationale for the Study

The use of computers in education may be classified into three eras: the use of mainframe systems in the 1960s, the use of minicomputer systems in the 1970s, and the use of microcomputers from the mid-70s to present (Charp, 1982). The first two eras employed computer-assisted instruction (CAI) and computer-managed instruction (CMI) to assist educators with providing for individualized instruction. As a result, research trends on the effects of computer-based education have generally been saturated within the following areas: 1) comparisons of computer-based education to traditional teaching methods, 2) student achievement, and 3) individual differences that may interact with computer use. Although the research trends from the first two eras revealed

conflicting results, the current research trend in the microcomputer era is being influenced by the former trends.

A search of the literature on the influence of computers in education has reflected these research trends. For example, Kulik, Kulik, and Cohen (1981) conducted a meta-analysis of 59 studies comparing the effects of computer-based instruction with traditional teaching methods. They describe four major applications of computers in the classroom: tutoring, computer-managed teaching, simulation, and programming for problem solving. In relationship to these uses, these researchers reported five major results from computer use: improved student achievement, minimal effect on the correlation between aptitude and achievement, small but positive effects on attitudes of students toward instruction and subject matter, reduction in instructional time, and trivial differences in course completion. Their findings suggest that the computer has made a small, but significant contribution to the effectiveness of college teaching.

In a similar review, Kulik, Bangert, and Williams (1983) used quantitative techniques to synthesize findings from 51 studies of computer-based teaching. This time the population was taken from grades 6 through 12. The results were similar to the study on college students: computer-based instruction raised student's scores on final examinations, computer-based teaching had smaller, positive effects on scores on follow-up examinations, computer-based instruction assisted in developing very positive

attitudes toward the computer and courses, and computer use reduced substantially the amount of time needed for learning. This review confirmed the findings of Edwards et al. (1975) on the effectiveness of CAI programs in elementary schools when used as a supplement to traditional teaching.

Another review of the literature was conducted by DeVault (1981). His review examined instruction in elementary and secondary schools using computer-assisted instruction and compter-managed instruction. Of these two applications, DeVault described the Computer Curriculum Corporation and Programmed Logic for Automated Teaching Operations packages for CAI in mathematics. Studies on CCC had findings: 1) time children spent at CAI terminals was positively related to their achievement, 2) there was substantial evidence that actual achievement gains exceeded gains based on previous experience of students, 3) there was evidence that grade placement as determined by the CAI program was highly correlated with grade placement on standardized tests, and 4) there was much subjective evidence to support the claim that attitudes of students and teachers toward CAI were positive (p. 135). In comparison, studies on PLATO revealed similar results. The latter application, computer-managed instruction, as described by DeVault (1981) has been reported as having positive results that favor computer students over non-CMI students. In his closing remarks, DeVault asserts that "the research of the past decade has been

conducted on programs using facilities of large scale computers (p. 142)." In view of the microcomputer era, DeVault proffers that:

> the flexibility of these computers, the control of these microcomputers at the local level (even at the classroom level) and the potential for involving students and teachers in a wider range of computer problems and technologies place issues raised during the past decade into new contexts (p. 143).

The last area of concentration and the least explored in computers in education has been in studies conducted about individual differences. Two studies have been found pertaining to this area. Both studies (Sutter & Reid, 1969; Reid et al., 1972) investigated psychological factors such as dominance and anxiety and the pairing of students based on these factors at the CAI terminal. In both studies, the results indicated that students who were paired with another student showed higher achievement and more positive attitudes toward CAI than students who worked alone.

In summary, the research on computers in education has focused on comparisons of computer-based instruction with traditional teaching methods, student achievement, and to some extent, individual differences and their interaction with computer-based instruction. For the most part, the interest in these research efforts has been centered on academic achievement of students through attending to cognitive objectives.

Fewer studies have been conducted on socio-affective outcomes resulting from use of computers in education. Typically, these studies have dealt with student attitudes toward computer-based

instruction (Asay & Schneider, 1972; Magidson, 1978; Smith, 1973; Murphy & Appel, 1977). Although these studies considered affective domain issues in education, they dealt with a narrow perspective of this domain as delineated by Bloom et al. (1974) and neglected the social context in which students interacted.

A recent study by Kearsley, Hunter, and Seidel (1983) focused on the use of computers in education that traversed the three eras of computer technology. These authors reviewed over 50 major computer-based instruction projects and evaluated them in terms of: development of prototypes, conceptual demonstrations, major implementations and evaluations, dissemination, authoring language/systems, intelligent CAI, innovation environments, and new theory. In their findings, these authors reported that: 1) there is ample evidence that computers can be used to make instruction more effective and efficient, 2) very little is known, still, about how to individualize instruction, 3) much is not understood about the effects of major instructional variables underlying CBI (i.e., graphics, speech, interactions, etc.), 4) knowledge has been gained about institutional and organizational inertia, 5) obstacles have been created by inadequate software, 6) a number of different mechanisms have been developed to disseminate CBI information and coursework, 7) CBI has drawn detailed attention to the nature of the learning process, individual differences in learning, instructional strategies, and instructional sequencing, 8) federal

government has played a pivotal role in advancing CBI, and 9) much more needs to be done relating to the potentials of CBI (p. 90).

As pointed out by Kearsley, Hunter, and Seidel (1983), computer-based instruction has stimulated responsiveness from educators about what exactly happens in the learning environment through managerial and organizational decisions and through the nature and needs of the students. With the proliferation of more microcomputers into schools, affecting these decisions and students, more research is needed to assist in planning for the achievement of educational objectives, particularly, social-affective development through affective objectives.

Another consideration in planning for the achievement of educational objectives through the use of microcomputer technology has recently been acknowledged. Watts (1982) posits that inappropriate use of computers may polarize and reinforce male/female stereotypes. Generally, males are considered to be more mechanically-oriented, more math-oriented, and more aggressive and competitive than females who are considered more cooperative, more submissive, and less math-oriented. These stereotypes have adverse effects which may become more pronounced with computer use. Though 50% of the students in school are females, more than two-thirds of the students learning about computing are male (Lipkin, 1983). This inequity must be addressed in order that achievement of educational objectives be facilitated for males and females through computer use. Further exploration into the

questions of access, computer activities that appeal to male and female students, and behavioral patterns of these students is warranted.

In relationship to planning for the achievement of educational objectives, Loop and Christensen (1980) observed that the horizontal (proliferation of microcomputers) spread of microcomputers in education throughout the U.S. population has been more rapid than expected; whereas, the vertical (new knowledge of how to use computers for learning) has made little progress. The widespread implementation of computers in education and the relative lack of fundamentally sound prescriptions for computer use have unfolded a precarious situation for educators. In the words of Hunter, Seidel, and Hargun (1979):

> Decisions are being made daily at all levels of education regarding the adoption and implementation of these innovations (microcomputers), without any systematic base of information on the expected cognitive, affective, or social outcomes (p. 22).

Hence, educators have a responsibility to exercise precaution when considering appropriateness of computer use to the learning process.

The study, therefore, was undertaken to extend existing knowledge about the microcomputer environment as it relates to social development through affective objectives. Also, the study is needed because of the neglect in previous research studies to investigate the social context in which microcomputers and students come into contact. Both of these factors attest to the importance

of studying the affective variables relating to student interaction, for it is ultimately the student who will be subject to consequences of the technology as the technology becomes an integral part of the educational setting.

Purpose of the Study

The purpose of the study was to compare the effects of a cooperative instructional context with a competitive instructional context on the verbal and nonverbal behavior of same-sex pairs of students in a microcomputer environment. The underlying assumption guiding this study is that students in the course of daily instructional tasks participate in unstructured interaction and form social behavior patterns. As a result, unstructured interaction, when present, has minimal effects on academic achievement and social development (Bossert, 1979). The use, however, of microcomputers within cooperative and competitive instructional contexts when consideration is given to sex composition of groups, may provide a rich interactive environment, resulting in a powerful predictor of student academic and social development.

Statement of the Research Questions and Null Hypotheses

The research questions for this investigation were derived from the problem and rationale of the study, in regard to the use of microcomputers in instructional procedures and their subsequent

effects on student-student interaction in the classroom. The research questions posed by this study and hypotheses formulated were as follows:

Question One

Will student interaction occurring in a cooperative instructional context differ from student interaction occurring in a competitive instructional context within a microcomputer environment?

Hypothesis 1.1. There will be no significant differences between the mean of self-oriented verbal and nonverbal behaviors of student pairs in a cooperative instructional context and the mean of self-oriented verbal and nonverbal behaviors of student pairs in a competitive instructional context within a microcomputer environment.

Hypothesis 1.2. There will be no significant differences between the mean of besting verbal and nonverbal behaviors of student pairs in a cooperative instructional context and the mean of besting verbal and nonverbal behaviors of student pairs in a competitive instructional context within a microcomputer environment.

Hypothesis 1.3. There will be no significant differences between the mean of other-oriented verbal and nonverbal behaviors of student pairs in a cooperative instructional context and the mean of other-oriented verbal and nonverbal

behaviors of student pairs in a competitive instructional context within a microcomputer environment.

Hypothesis 1.4. There will be no significant differences between the mean of negative verbal and nonverbal behaviors of student pairs in a cooperative instructional context and the mean of negative verbal and nonverbal behaviors of student pairs in a competitive instructional context within a microcomputer environment.

Hypothesis 1.5. There will be no significant differences between the mean of positive verbal and nonverbal behaviors of student pairs in a cooperative instructional context and the mean of positive verbal and nonverbal behaviors of student pairs in a competitive instructional context within a microcomputer environment.

Question Two

Will student interaction occurring in female pairs and male pairs differ within a microcomputer environment?

Hypothesis 2.1. There will be no significant differences between the mean of self-oriented verbal and nonverbal behaviors of male pairs and female pairs within a microcomputer environment.

Hypothesis 2.2. There will be no significant differences between the mean of besting verbal and nonverbal behaviors of

male pairs and female pairs within a microcomputer environment.

Hypothesis 2.3. There will be no significant differences between the mean of other-oriented verbal and nonverbal behaviors of male pairs and female pairs within a microcomputer environment.

Hypothesis 2.4. There will be no significant differences between the mean of negative verbal and nonverbal behaviors of male pairs and female pairs within a microcomputer environment.

Hypothesis 2.5. There will be no significant difference between the mean of positive verbal and nonverbal behaviors of male pairs and female pairs within a microcomputer environment.

Question Three

Will there be an interaction of cooperative and competitive instructional contexts and sex of pairs which affects student interaction occurring within a microcomputer environment?

Hypothesis 3.1. There will be no significant interaction between instructional context, cooperative and competitive, and pairing by sex on the mean of self-oriented verbal and nonverbal behaviors of female pairs and the mean of self-oriented verbal and nonverbal behaviors of male pairs within a microcomputer environment.

Hypothesis 3.2. There will be no significant interaction between instructional context, cooperative and competitive, and pairing by sex on the mean of besting verbal and nonverbal behaviors of female pairs and the mean of besting verbal and nonverbal behaviors of male pairs within a microcomputer environment.

Hypothesis 3.3. There will be no significant interaction between instructional context, cooperative and competitive, and pairing by sex on the mean of other-oriented verbal and nonverbal behaviors of female pairs and the mean of other-oriented verbal and nonverbal behaviors of male pairs within a microcomputer environment.

Hypothesis 3.4. There will be no significant interaction between instructional context, cooperative and competitive, and pairing by sex on the mean of negative verbal and nonverbal behaviors of female pairs and the mean of negative verbal and nonverbal behaviors of male pairs within a microcomputer environment.

Hypothesis 3.5. There will be no significant interaction between instructional context, cooperative and competitive, and pairing by sex on the mean of positive verbal and nonverbal behaviors of female pairs and the mean of positive verbal and nonverbal behaviors of male pairs within a microcomputer environment.

These research questions and null hypotheses were the foci of the study; however, an ancillary question was explored in regard to students' perceptions. The ancillary question posited was: How do students perceive their experiences in a microcomputer environment?

Definition of Key Terms

MSI (Microcomputer-supported instruction): MSI is the interaction of students at a microcomputer wherein the microcomputer technology is a delivery system of instruction in some form (i.e., by words, graphics, etc.). The student responds by using the keyboard or paddles to input information and the system responds by using or supplying additional instructional stimuli (adapted from Thomas, 1979).

Microcomputers: A microcomputer is a general purpose computer that is small, self-contained, and inexpensive. It has a smaller word size, less memory than a standard system, and a reduced capability for peripherals (McIsaac, 1979).

Student interaction: The overt behavior, verbal and nonverbal, of one student interacting with another. These behaviors can be classified into task-oriented and social-oriented behaviors (Johnson & Johnson, 1975; Webb, 1980). For the purpose of the study, student interaction is referred to as self-oriented,

besting, other-oriented, positive, and negative verbal and nonverbal behaviors.

Instructional context: The set of circumstances surrounding an instructional event. In this study, the set of circumstances include the educational task, the task structure and the social aspects of small-groups. The instructional contexts used are cooperative and competitive:

(a) cooperative instructional context--the set of circumstances wherein the task structure is group-oriented and the success of the group in balancing mathematical expressions (e.g., 45 = 15 x 3) is a shared experience. (See Slavin, 1980 for a discussion of task structure.)

(b) competitive instructional context--the set of circumstances wherein the task structure is individually-oriented within a small group and the success of one individual results in the failure of another in the group in balancing mathematical expressions.

Microcomputer environment: The total set of circumstances surrounding an instructional event. In this study, the total set of circumstances includes the physical and social dimensions wherein an instructional event occurs. The physical dimension is referred to as the microcomputer and the laboratory

setting. The social dimension is referred to as and inclusive of instructional context.

The Significance of the Study

This study may be useful to educators in planning for computer use in the classroom. First, managerial decisions can be made in regard to scheduling of computer time for students. This scheduling allows each student to gain access to the computer. By using pairs or other small groups, the teacher will be able to attend to achievement of affective and cognitive development of students through student interaction and the interaction of the task with the students. Secondly, the organizational decisions in planning for computer use may be assisted by the study. For example, the use of a cooperative instructional context may accomplish educational objectives that the use of a competitive instructional context may not and vice versa. As shown in the literature, different instructional contexts and issues will surface that demand diverse organizational patterns. Another aspect that may be derived from this study for educators is the use and identification of student experts. This would allow for peer tutoring in a micro- computer environment, a frequently successful method for teaching. Moreover, this study may help educators select coursework/software that furthers their philosophical and practical orientations in attainment of educational objectives. In view of what educational objectives have already been shown to be

affected by computer use, this study offers an extension for educators into the affective domain.

This study may be useful to other researchers interested in examining student interaction and its effects on the learning process and social environment of the classroom, when micro-computers are present. As Hoban (1977) states:

> the social technology of instruction is probably more dominant, more pervasive, than machine technology. To greater or lesser degree, the social technology of instruction is also a determinant of the effectiveness of machine technology (p. 224).

Hence, for educators and researchers the study of technological influences cannot be examined without the corresponding study of the classroom processes.

Chapter Overview for the Study

Chapter I has introduced the study by presenting the statement of the problem, providing the background and rationale for the study, stating the purpose of the study, and clarifying research questions and stating null hypotheses and key terms.

Chapter II presents the review of the literature and the theoretical framework for the study. The review chapter consists of literature from small-group research, interdependent learning environments, sex differences, and student-computer interaction. Each of these sections attempts to synthesize research efforts and methodologies use.

Chapter III discusses the design and methodology used in the study. It is a descriptive presentation of the movement of the research, subject characteristics, instrumentation, and statistical procedures.

Chapter IV provides an analysis of data, findings, and discussion. This chapter presents the hypotheses of the study and data in tabular formats, also.

Chapter V presents a summary of major findings, conclusions, and implications for future research.

Chapter II

THE REVIEW OF THE RELATED LITERATURE

In this chapter, a review of the theoretical and empirical research pertinent to this study is presented. In the first section, the social-psychological perspective is described. The remaining sections: student-interaction in small groups, cooperative and competitive instructional contexts, group characteristics based on sex, and student-computer interaction, pertaining to the predictors of interaction, are delineated.

The Theoretical Framework

The present study is based on a social-psychological perspective and, thereby, focused on the social and psychological aspects of conditions predicting interaction. The major emphasis of this perspective is directed toward the identification and interpretation of individual and environmental characteristics implicated in interpersonal interaction (McMillan, 1981). Specifically, the behavior of a person in situation-specific contexts is influenced by a multitude of variables, with the most prominent ones categorized as: individual characteristics, needs of the person, and the feedback provided in the situation. This global overview of social psychology is depicted by McMillan (1981)

in his "cognitive social-psychological model of learning." This model is presented in Figure 1.1.

The cognitive social-psychological perspective is an integration of Getzels and Thelen's (1959) social systems theory, Brookover and Erickson's (1969) social-psychological process of decision-making theory, Bandura's (1977) social learning theory, and others who have contributed to the study of person-situation interaction. This perspective represents a scheme for conceptualizing social-psychological influences on student behavior in the classroom group as well as in the school. Further, this perspective presupposes that one student's interactions with another are a primary determinant of behavior (McMillan, 1981).

Within this comprehensive model of learning, there exists a representative model of group processes proffered by McGrath (1964), derived from her review of small group research. In Figure 1.2, this model is presented. This model depicts the antecedents of the group interaction process: individual-level factors, group-level factors, and environmental-level factors. Also, this model poses consequences of the interaction process: performance outcomes. The basic assumption of this paradigm is that input factors affect, to some extent, performance outcomes through the group interaction process. Although the characteristics of the group interaction process are implicit, these characteristics have considerable importance as mediators between input factors and performance outcomes.

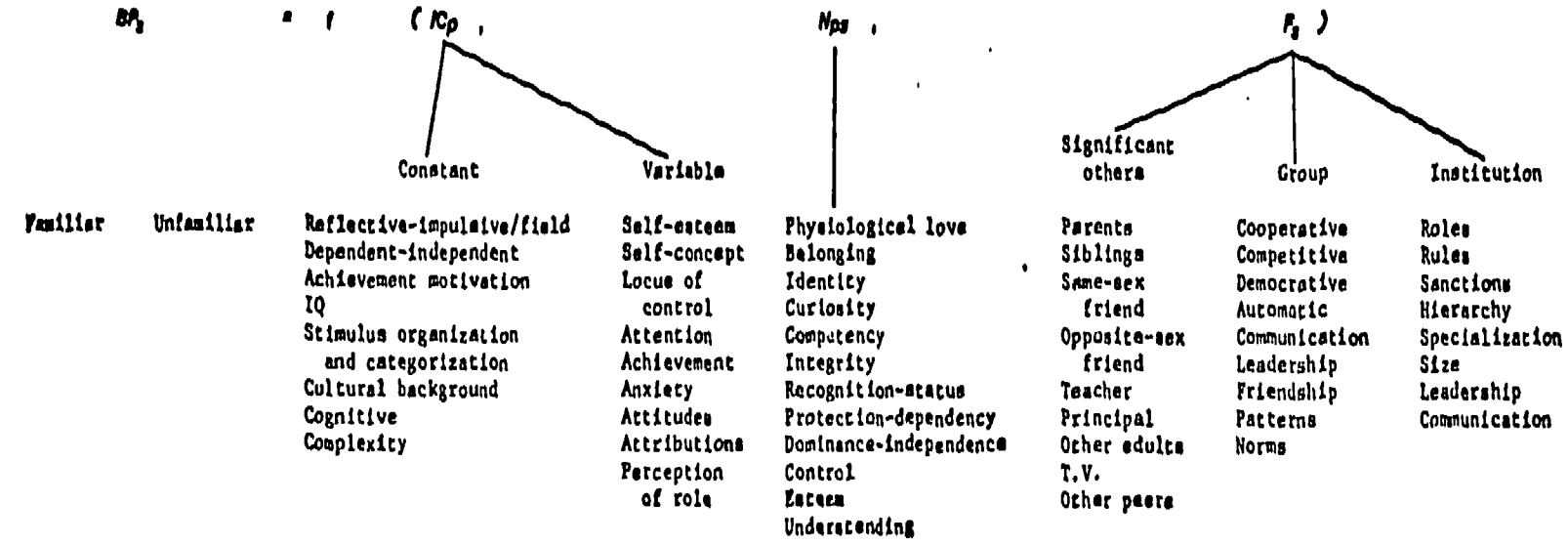

Figure 1.1. This diagram represents the cognitive social-psychological model of learning developed in the chapter and lists examples of specific variables of each major component in the model. The major components are Behavior of a Person in a Situation (BP_S), Individual Characteristics of a person (IC_p), Needs of a Person in a Situation (N_{ps}), and Feedback from Other Persons in a Situation (F_s). (Take from McMillan, 1981)

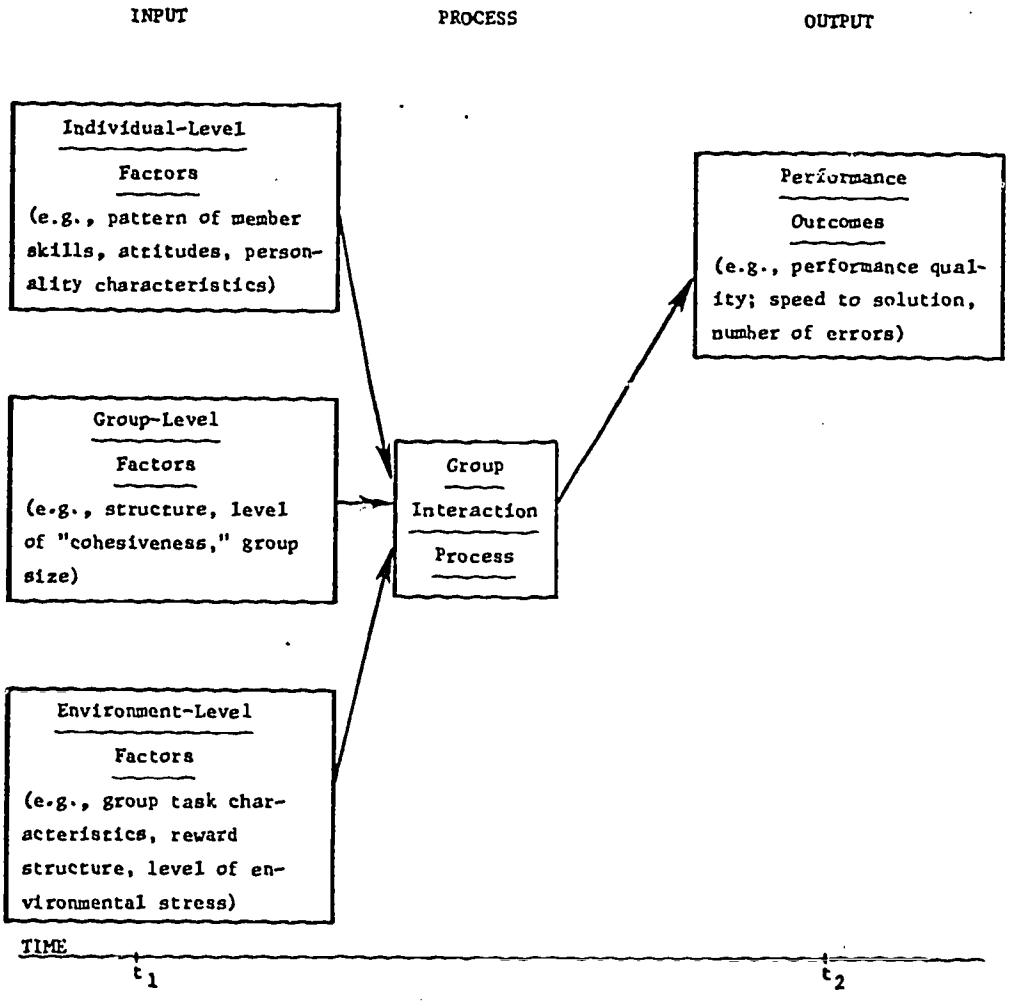

Figure 1.2. A traditional paradigm for analysis of group interaction as a mediator of performance outcomes. (Adapted from McGrath, 1964)

Based on this social-psychological perspective, the researcher posed an input-process model for conceptualizing the relevant factors that predict interaction and the characteristics of that interaction. In Figure 1.3 this conceptual model is delineated. The input factors or predictors of interaction are described at the group-level: sex composition of groups and at the environmental-level: the instructional contexts of cooperation and competition. The interaction process is characterized by verbal and nonverbal behaviors within student interaction. The emphasis is on the content of the interaction process and the predictors of this interaction. Hence, the present study employed this input-process paradigm as a lens for viewing student interaction between same-sex pairs of students while involved in cooperative and competitive instructional contexts within a microcomputer environment.

Student Interaction in Small Groups

In this section, the researcher reviews empirical studies that have focused on student experiences in small group interaction. The organization of the review is structured for research pertinent to the identification of student behaviors in small groups. Research studies were selected on the basis of: 1) those that investigated small group interaction within educational settings, and 2) those that, somewhat, systematically analyzed interaction. These two criteria eliminated inclusion of studies that directed

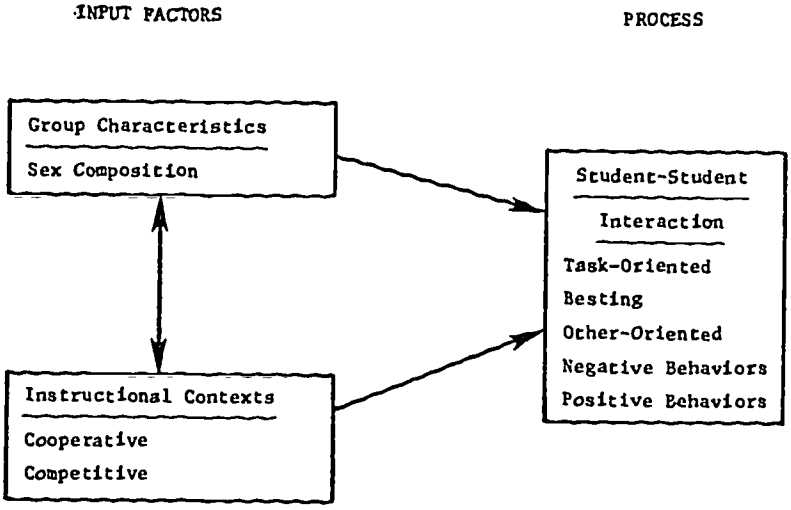

Figure 1.3. Variables in conceptual model of input-process.

cursory attention toward the observation of small group interaction.

Webb (1982a) reviewed literature on student interaction and learning in small groups. From this review and her own studies, Webb posed an inputs-interaction-achievement model (Figure 2.1) that attempted to encompass students' experiences in small group interaction. Under input characteristics of this model were individual characteristics (ability), group characteristics (ability and racial composition), and reward structures (group and individual). These input characteristics were subsequently referred to as "predictors" of interaction. The interaction variables were described as group helping, giving help, receiving help, off-task behavior, passive behavior, and nonspecific. Webb (1982a) asserted that these interaction variables were linked to achievement, which comprised the latter part of her model. Webb (1982a) concluded that giving help and receiving help were beneficial, however, off-task and passive behaviors were detrimental to achievement. Moreover, Webb stressed that observations of these interaction variables must be fine tuned and recorded accurately by observers through extensive note-taking, audiotaping or videotaping. These observational procedures were critical because a significant finding in several studies was that achievement depended not on isolated events but on sequences of interaction (Webb, 1982a).

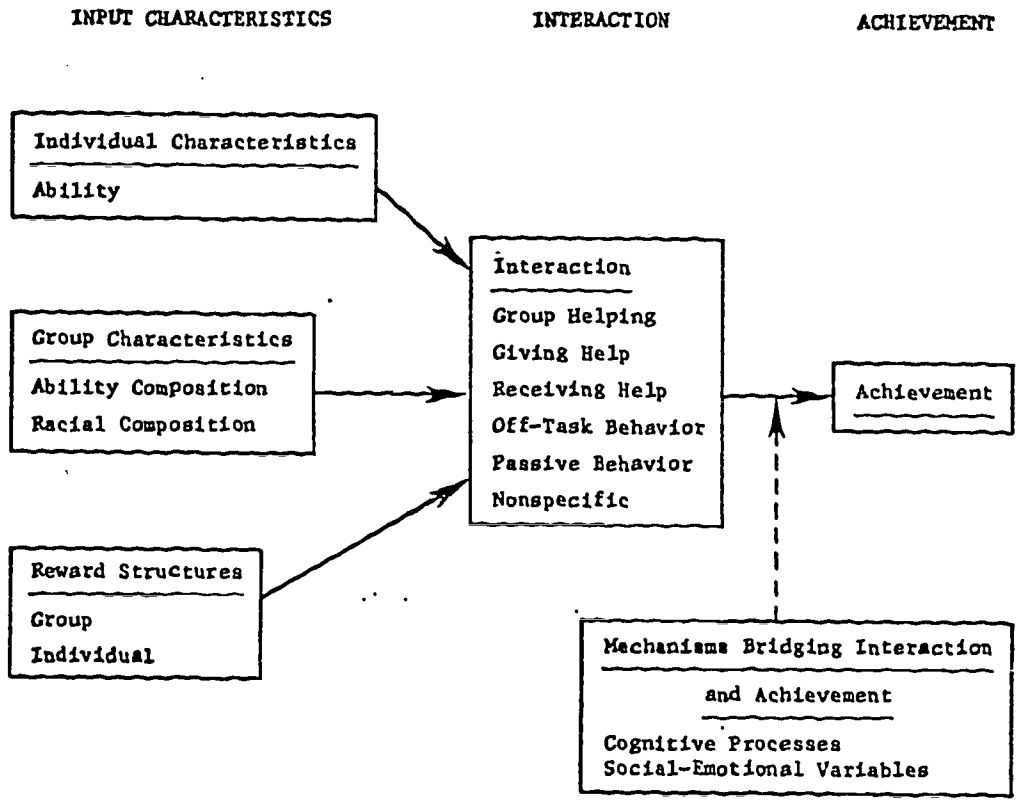

Figure 2.1. Variables in the inputs-interaction-achievement system. (Taken from Webb, 1982)

Evidence that supported the input characteristics and interaction variables were found in Webb's (1980) study. In this study, Webb compared mathematics learning of eleventh-grade students in groups of four to learning individually. The ability level of each student was determined from a battery of aptitude and achievement tests. Then, students were assigned to mixed-ability or uniform-ability groups. The experimental conditions proceeded in three phases: phase 1: all students received individual instruction on component concepts and skills of mathematical problems; phase 2: some students worked individually and some worked in groups--and students were instructed to work together to help each other learn how to solve the problem in the group setting; phase 3: all students were tested individually.

While phase 2 was in progress, students were observed and interaction among students' group work was recorded. In this phase, the task was to calculate an algebraic expression for the nth polygonal number focusing on the value of the difference (d) between layers of the array. The "d" was important for calculations to be correct.

Webb's findings from the analysis of verbal interaction among group members revealed that whether a student obtained the correct value of "d" on the test depended upon the events in group interaction that pertained to "d." For example, only those students who received an explanation after being corrected (in the group) solved the problem correctly on the test. In addition, Webb

found that social-psychological mechanisms such as group composition, personality and perceived status, and motivation may have been factors influencing participation or lack of participation in the group setting which subsequently affected interaction and test performance.

In a similar study, Webb (1982b) investigated the relationship between students' interaction and their achievement in mixed-ability and uniform-ability small groups in junior high school mathematics classrooms. Other characteristics of students were included as predictors of achievement and interaction: ability and extroversion-introversion. This study explored the function of group interaction as the mediating variable between group and individual characteristics and achievement.

The sample consisted of students in grades 7, 8, and 9 who came from two average and two above-average general mathematical classes. These students were given four topics from consumer mathematics with answer sheets for work on in small groups within a special classroom. At the end of the unit on consumer mathematics, all students took an achievement test and were given a two-part questionnaire composed of the extroversion-introversion scale of the Eysenck Peronality Inventory and an open-ended question on whether students liked working in small groups and their reasons.

The other data gathering instrument was an observation instrument designed to assess interaction among students in a group and interaction between the teacher and students. The observers

wrote notes about all interaction in the group, noting the speaker and recipient of each interchange, the observation category, and whenever possible, the content of the interchange. The observation categories were: student gives help, student receives help, student asks a question, student asks a question and receives a response, student asks a question and receives no response, student works alone, student interacts with another student and student is off-task.

After students were assigned to mixed-ability and uniform-ability groups of three, students were given the tasks, according to Latin square design, so that groups worked on activities on different days during the week. Students were instructed to work together and not to divide the work, to help group members experiencing difficulty, and to ask for help if they needed it. Students also engaged in intergroup competition wherein the group with the highest score received a prize; however, group rewards (intragroup cooperation) were distributed equally.

Webb's findings indicated that students who worked in mixed-ability groups tended to score higher on achievement tests than students who worked in uniform-ability groups, although the difference was not statistically significant. A statistically significant difference was found, however, between "student asks a question and receives no response" when group composition was considered. That is, students in uniform-ability groups showed higher frequencies of "asking questions and receiving no answers"

than students in mixed-ability groups. This variable, "receiving no response to a question," was the sole variable that discriminated between group conditions, occurring almost twice a class period for a student in a uniform-ability group and only once in 61 minutes for a student in a mixed-ability group. In addition, the hypothesis that extroverted persons would be more aggressive in asking for help and more successful in obtaining it than introverted persons, was supported: extroverted students tended to be ignored less often than were introverted students.

Webb (1982b) concluded that group composition and student personality had no direct effects on achievement, but they did have indirect effects on achievement through interaction in the group. She asserted that the strong relationship between group composition and interaction may be better understood by examining the influence of group composition on interaction, using a variety of rules for assigning students to groups.

In a similar vein, Swing and Peterson (1982) studied student aptitudes and student behaviors during small group interaction as mediators of the effectiveness of small-group learning. These authors tested two hypotheses that: (a) the effects of small group learning on student achievement are produced by students' participation in small-group interaction, particularly in providing and receiving higher-order explanations; and (b) high- and low-ability students are more often involved in this process than are medium-ability students.

The sample consisted of 43 fifth-graders from two intact classes. Within each class, students were stratified by ability and assigned to work in groups of four, having one high-, one low-, and two-medium ability students. These groups were, then, randomly assigned to either the trained or control condition.

Students assigned to the trained condition participated in sessions designed to improve the quality and quantity of task-related small-group interaction. Two sessions were used to train these groups. Students were instructed in session one through demonstration and discussion of interpersonal relations, "good" teaching behaviors, and general behavior guidelines for interacting in small groups. In session two, students practiced explaining to other group members.

Both groups of students (trained and control) were given a 10-day unit on long division and a 10-day unit on fractions. After completion of each unit, students were assessed on their learning. The students' behaviors during these sessions were observed using an adapted version of an observation instrument developed by Peterson and Janicki (1979).

The observation system included categories for off-task behaviors and on-task behaviors such as listens to teacher, works, explains, asks question of students, receives student explanation and/or checks answers. The category "explains" was further subdivided into student provides an answer, higher order (conceptual/sequencing) explanation or procedural information. The

researchers performed correlational analysis relating division achievement, fractions achievement, and retention scores to the explaining, receiving, answer checking, total task-related interaction, working, and off-task behavioral categories.

Swing and Peterson (1982) found that providing conceptual/sequencing explanations was related positively to the achievement scores of high-ability students for division achievement. Also, in division achievement, high-, medium- and low-ability students receiving a higher proportion of answers during seatwork performed poorer than did students receiving fewer answers during small-group interaction.

Likewise in fractions achievement, low-ability students who more often provided or received conceptual/sequencing explanations during seatwork obtained higher achievement scores for explaining and receiving. As for high-ability students, the more often they engaged in off-task behavior, the poorer they performed on the fractions achievement test.

Therefore, Swing and Peterson (1982) concluded that their findings support previous ATI studies indicating that low-ability students benefit from the small-group approach and that a number of task-related small group behaviors were positively related to the academic achievement of low-ability students. These authors claimed support for a general ATI hypothesis: instructional methods that increase support to the learner through eliciting student response, providing feedback, or more tightly organized

material will differentially promote the achievement of students with prior achievement.

In conclusion, these studies by Webb (1982a; 1982b) and Swing and Peterson (1982) concentrated on the relationship of small-group interaction to achievement. The findings suggested strong support for Webb's model of inputs-interaction-achievement paradigm. The next section, however, extended this model, especially the presence of specific interaction variables, to effect not only achievement (as previously discussed), but social development as well, to be a function of interaction variables and input characteristics.

Cooperative and Competitive Instructional Contexts

The preceding section probed into the characteristics of student interaction that were linked to achievement in small-group settings. Certain verbal interaction was shown to contribute to achievement while other interaction was harmful to achievement. The findings from these studies are useful to educators, if educators are also provided with suggestions on how to plan the instructional contexts to effect desired student interaction. The research, in this section, is structured: 1) to present a description of instructional contexts that generate student interaction, and 2) to describe the effects of these instructional contexts to specify interaction variables linked to social behavior of students.

In recent years, types of instructional contexts which promote student interaction in the classroom have been studied extensively. Sharan (1980) characterized five instructional contexts and conducted a review of the research to determine their differential effects on achievement, on students' attitudes, and on ethnic relations in desegregated classrooms. The five methods were: Aronson's Jigsaw classroom, DeVries" Teams-Games-Tournament (TGT), Slavin's Student Teams and Academic Divisions (STAD), the Johnsons' cooperative learning approach, and the Sharan's Small-group Teaching method. In his review, Sharan (1980) reclassified these five instructional contexts under the heading of "team-learning methods" with two subdivisions: peer tutoring (Aronson's Jigsaw classroom, TGT, and STAD) and group-investigation model (the Johnson's cooperative learning approach and the Sharan's small-group investigation model).

These five team-learning methods had commonalities: 1) small teams of students were used to promote peer interaction and cooperation during academic subjects, 2) the teacher's role was modified to allow for student-student interaction, and 3) the foci were on social process and its subsequent effects (Sharan, 1980). The team-learning methods differed, however, in their conceptual framework of appropriate means and goals of peer cooperation in teams (Sharan, 1980). The peer tutoring methods made use of cooperative, competitive, and individual classroom techniques as a means of peer collaboration. The goal was for the teams to

generate a product. On the other hand, the group investigation model made use of cooperation as a means and the goal of peer collaboration (Sharan, 1980; Slavin, 1977).

In similar reviews of team-learning methods (Johnson, Maruyama, Johnson, Nelson, & Skon, 1971; Slavin, 1977, 1980), the influence of cooperative, competitive and individualistic means in peer interaction was examined to determine its relationship to student achievement and affective outcomes.

Johnson et al. (1981) reviewed 122 studies and compared the effectiveness of cooperation, cooperation with intergroup competition, interpersonal competition and individualistic goal structures in promoting achievement and productivity. They examined input characteristics believed to relate to achievement which were, to name a few: sex of subjects, grade level, type of task, resource sharing, and on-task interaction which took place among subjects. Some of their findings indicated that group composition influenced the effectiveness of cooperation over competition; that type of task such as simple rote decoding and correcting tasks tended not to favor cooperation over competitive or individualistic efforts. In regard to the sex input characteristic, Johnson et al. could not make a definite conclusion because greater than 90% of the findings were pooled across males and females. Although these researchers favored cooperation over competition and individual conditions, evidence supporting this bias was conflicting.

Similarly, Slavin (1980) reviewed 28 primary field projects in which cooperative learning techniques were used in schools. In his review, Slavin (1980) advanced that there were two primary outcomes in research on reward structures: "performance and cohesiveness" (p. 316). First, "performance" was referred to as individual or group productivity on a variety of tasks. The other outcome, cohesiveness, was inclusive of such variables as liking of others, feeling of being liked, group evaluation, etc. From this review of cooperative learning techniques, Slavin (1980) formulated the following conclusions: 1) for academic achievement, cooperative learning techniques are no worse than traditional techniques, 2) cooperative learning techniques appear to be more effective than traditional techniques for low learning outcomes, 3) for high level cognitive learning outcomes, less structured cooperative techniques may be more beneficial, 4) cooperative learning techniques have relatively consistent effects on mutual concern among students.

The effects of instructional contexts on educational objectives have been documented in the preceding discussion. It has been shown that instructional contexts do affect, to some extent, achievement as well as affective outcomes. Johnson (1980) further explored the affective outcomes of instructional contexts that generated student interaction within the classroom.

Johnson (1980) asserted that interpersonal interaction (e.g., student interaction) is the basis for learning, socialization, and development. He reviewed literature that indicated student

interaction contributed to general socialization, future psychological health, acquisition of social competencies, avoidance of engaging in antisocial or problem behaviors, mastery and control of impulses such as aggression, development of a sex-role identity, emergence of perspective-taking ability, and development of high educational aspirations and achievement. Johnson further argued that for student interaction to be a constructive influence it must promote feelings of belonging, acceptance, support, and caring, rather than feelings of hostility and rejection. Therefore, it was hypothesized that the quality of student interaction for purposes of learning, socialization and development of students had to consider goal structure, the way conflict is managed, the composition of the group, the norms instituted within the group, and the size of the group (p. 132).

Schmuck (1977) also confirmed these factors as predictors of learning and development of students. He stated that as peers interact, by giving and taking, they learn ways of relating to others with new levels of empathy and reciprocity. In this way, peers perform many pro-social functions for one another through interaction variables. The positions taken by Johnson and Schmuck have received partial support from the body of research on cooperative learning environments which compare cooperative and competitive as well as individualistic conditions and subsequent effects on student interaction.

In relationship to cooperative and competitive instructional contexts, interaction variables have been conceptualized from Deutsch's theory and generally denoted as positive and negative behaviors. These behaviors have been confirmed with research on team-learning. Specifically, the positive social behaviors included giving attention and approval, giving affection and personal acceptance, submitting to another's wishes, and giving things to another (Hartup, Glazer, & Charlesworth, 1967). On the other hand, negative behaviors included noncompliance, interference, derogation, and attack. These behaviors formed what Slavin (1977) referred to as "resource sharing" and Johnson et al. (1980) referred to as differentials in sharing behaviors. Therefore, an extended model of student interaction may be posited which not only includes task-related interaction but social-oriented interaction variables that may operate in various instructional contexts.

Pepitone (1980) further developed the notion of interaction variables in competitive and cooperative contexts. In this work, Pepitone presented the idea that each of these instructional contexts involved very different behaviors in the interaction process. Based on the conceptual analysis of cooperation and competition, Pepitone (1980) delineated behaviors of the competitive condition: attentional behaviors, evaluative behaviors, and besting behaviors. Behaviors in the cooperative condition were discussed as other-oriented. Using this

categorization of behaviors, Pepitone (1980) and her associates investigated children's social behaviors and performance in controlled competitive and cooperative situations. This scheme included verbal and nonverbal interaction variables, an extension of previous research into the interaction process.

In the reviews of literature on cooperative-competitive learning environments, there was a lack of systematic observation of the interaction process occurring within the small group setting. Basically, studies conducted in these environments used observations as a supplement to other instrumentation. For example, Johnson et al. (1976) investigated the effects of individualistic and cooperative conditions on the ability of students to take the affective perspective of others, on altruistic behavior, on attitudes toward learning and on achievement. These researchers used interviews and questionnaires as main data gathering devices and observations as a secondary instrument. However, observations by teachers did indicate that students in the cooperative condition had less difficulty following directions, spent less time waiting for teacher help, and had fewer problems in understanding the assignment.

In contrast, Lazarowitz, Sharan, and Steinberg (1980) used observation and judgmental measures with equal importance in their study. These researchers investigated the following problems: (1) does children's cooperative learning in small groups influence their cooperative behavior when their task-oriented interactions

with peers are not structured by the teacher, (2) does experience with cooperative small-group learning in the classroom transfer to children's behavior with peers who were not members of the original learning group, or is it restricted to interaction with peers who experienced collectively the same training activities, and (3) can pupils learn to interact cooperatively without the use of special rewards for stimulating cooperative or competitive behavior generally not used in schools.

These researchers conducted two experiments to test these questions. The second experiment related directly to student interaction variables. Fifty-four groups of five children were selected for this experiment. Each group of five students, ranging in grades 3 through 7, was presented a well-known epigram. These groups were instructed to recombine letters into new words not appearing in the epigram by working together on the task. While the groups were working on the task, all behavior was recorded at the end of every 2-minute interval during each 15-minute session. These behaviors were analyzed by two "blind" judges on six indicators of cooperation, including announcing new words to group members, having new words accepted by group mates, consulting with others about new words, requesting help, offering help, and accepting help. Five indicators of competition were used: rejecting new words, comparing the quantity of words created, hiding one's pages from others' views, rejecting others' requests

for help in creating new words, and offering help in creating new words.

The analysis of these ratings revealed that children who studied in cooperative small groups were more cooperative and less competitive than were children in the control classroom; that children in the control group seldom cooperated spontaneously; that greater group productivity was related to cooperative small groups.

To summarize, five noteworthy instructional contexts have been studied to determine their effects on cognitive and affective outcomes in educational settings. These instructional contexts have some regularities, but they differ in the means and goals of student-student interaction in context-specific learning environments. Second, the use of these instructional contexts have differential effects on student learning, attitudes, and social development. Finally, the structuring of cooperative and competitive instructional contexts generated cooperative and competitive behaviors that could measure and identify the interaction process.

Group Composition: Sex Differences in the Interaction Process

Group composition was listed as an input variable to the interaction process and subsequent learning, as posed by Webb (1982). Similarly, Johnson (1980) also emphasized that a group's behavior will be affected by the distribution and patterning of such individual characteristics as abilities, knowledge, resources,

attitudes, age, sex, and social [illegible]. Since the reviews of the literature on cooperative-competitive learning environment pooled the information regarding sex, as an input characteristic, there seemed reason to suspect that findings may have been influenced by this condition. In this section, psychological research on sex differences is presented with research studies that investigated sex differences in the interaction process.

Maccoby and Jacklin (1974) reviewed sex differences in the literature from cooperative-competitive learning environments as well as within other social contexts. They prefaced this review of social behavior with the assertion that prevailed in the literature: females are more passive than males (1974, p. 166). Maccoby and Jacklin explained what passive meant in behavioral terms supplied from the research: "submissiveness, lack of aggression, dependency, and by extension, more oriented toward social approval, and more likely to seek proximity to others rather than working or playing independently (p. 167)." These behavioral sex differences were tested in the research reviewed under power relationships. Findings, however, favored neither males nor females conclusively as being more aggressive or more submissive.

Early on, Borgotta and Stimson (1963) investigated sex differences for interaction characteristics. They exposed subjects, primarily sophomores, to an experimental procedure wherein like-sex groups of five persons were compared without

purposive selection and participation was in a timed 80-minute session with four topics to be discussed as tasks. Interaction characteristics were scored on a set of categories adapted from Bales (1956). Following collection of data, these researchers analyzed interaction rates of males and females and found that there was no substantial difference occurring in interaction rate. Rather, they found that the profiles of groups differed significantly on "social acknowledgement," "draws attention," and "disagrees." In summary, the total interaction rate of males and females was not significantly different, but the amount of interaction on certain tasks was not necessarily similar.

Research on sex differences in individualistic, cooperative, and competitive behavior of elementary children has shown inconsistent findings (Cook & Stingle, 1974). For the most part, these findings have been attributed to the methodology and design considerations of the studies. For example, some studies (Sharin & Moely, 1974; Ahlgren & Johnson, 1979) used questionnaires to ascertain preferences or attitudes not observed behaviors.

Several studies, however, investigated sex differences in cooperative-competitive conditions focusing on verbal and nonverbal interactions. Sagan and Pickert (1979) examined dominance attempts of grade school children engaged in a cooperative task. The subjects were selected from grades levels K, 1, and 3. These subjects were assigned to eight mixed triads randomly. The experimental condition used a task wherein each group had to build

a house of undefined dimensions together. While students worked on the task cooperatively, conversations were taped and a running narrative was kept of the children's behavior. Two observers performed the coding of tapes and narratives, paying particular attention to who was speaking to whom and gestures, facial expressions, and motor behavior.

Sagan and Pickert's findings indicated that for grade levels K and 1, boys were more dominant than girls and attempted to dominate other boys, primarily. The findings suggested that with age girls showed increasing verbal assertiveness toward boys as well as girls and by grade 3, girls' overall dominance attempts equalled that of boys. These findings resulted from an analysis of categories, such as commands, threats, suggestions, need, bargains, explanation, positive and negative evaluation (of self, of task, or other child) and attention bids.

Examining older students, Crockenberg, Bryant, and Wiles (1976), investigated two hypotheses: (1) children in the cooperative condition (where all children win) will be more helpful to each other after the experience than in the competitive condition (where only one child wins); (2) female subjects will tend to help and share more than will male subjects, regardless of the goal structure. The subjects in this study were 180 Caucasian fourth graders (90 boys and 90 girls). The subjects were assigned to learning groups of three children by a stratified (sex and reading ability) random sampling procedure. Then groups were

randomly assigned to either the group (cooperative) or individual (competitive) condition.

The investigators used a story writing task in the experimental conditions. In the cooperative condition, group members worked together and received a reward for the quality of group efforts. In the competitive condition, each child wrote his/her own story and only one child (within the group) was rewarded. During these conditions, the experimenter observed the cooperative groups and the kinds of interaction transpiring. The experimenter, however, did not systematically analyze these observations. Rather, results were analyzed from a prize-giving task and questionnaire. Hypothesis 1 received partial support: boys, but not girls, in an individually structured, competitive learning environment were more likely to show ill feeling toward others than were boys in a group-structured, cooperative learning environment. Hypothesis 2 also received some support: girls gave more prizes to others and more frequently let another child keep a toy than did boys. It should be noted, however, that findings on sex differences were not statistically significant.

Another psychological approach to sex differences in the interaction process was posited by Lockheed and Hall (1976). These researchers used the theoretical framework of diffuse status characteristics and expectation status to explain sex differences, unlike the notion of culturally patterned sex roles. Lockheed and Hall (1976) stated the theory:

> when a group is working on a valued task, when there is some competence which is instrumental to the successful completion of the task, when the individuals in the group are task-focused and collectively oriented, and, finally, when the individuals involved differ on one and only one diffuse status characteristic, the group members will expect high-status individuals to be more competent at the task (1976, p. 115).

Correspondingly, if sex functions as a status characteristic with the male state more highly valued than the female state, the theory held that males will be more likely to hold position of power and prestige in mixed sex groups than will females. Evidenced by a study (Lockheed, 1975) cited in the present article, Lockheed investigated whether the observed sex differences in activity are "true" as opposed to situational for task activity of all-male groups and all-female groups from a high school population. Findings indicated no differences between the mean number of acts initiated by females in all-female groups and the mean number of acts initiated by males in all-male groups. These findings led Lockheed (1975) to conclude that males and females do not differ in any general way, either in terms of verbal activity levels or overall task orientation.

As evidenced by this brief review of sex differences in cooperative-competitive learning environments, findings were not consistent depending on theoretical frameworks used, data gathering instruments, and operational definitions. Apparently, the investigation of sex differences in the interaction process has implications for intervention strategies needed to strengthen the learning environments.

Studies on Student-Computer Interaction in Small Groups

The three areas of research, previously presented, provide educators with the knowledge that student interaction is an important variable in the learning process, that various instructional contexts are effective for accomplishing educational objectives, and that group composition influences, to some extent, the interaction process and its subsequent effects on student achievement and development. In view of these factors and the proliferation of microcomputers in the classroom, an integration of conceptual and practical strategies may dispel the myths surrounding student interaction as detrimental and computers as dehumanizing to the classroom environment.

To date, few studies have investigated student interaction in a microcomputer environment. No studies have been located which investigated, systematically, student interaction which transpired in such a setting with computers. For these reasons, the studies reviewed in this section have been included to give a state-of-the-art on research about small groups in computer learning environments.

Okey and Majer (1976) approached small-group learning from the standpoint of cost-efficiency. They proposed that one way to attack the problem of efficiency with computer instruction was to create instructional settings with multiple simultaneous users. In their study, 60 students who were enrolled in four undergraduate elementary teaching methods classes were assigned to three

treatment conditions: the first group studied alone, the second group studied in student pairs, and the third group studied in groups of three to four.

Using a PLATO IV instructional module based on Bloom's mastery learning strategy, groups were told to complete the module. The students were scheduled for three hours of computer terminal time in two sessions. Attitude measures and criterion-based tests on the CAI programs were administered.

The findings indicated no significant differences among the three groups in cognitive achievement or attitude toward the content of CAI materials. The amount of time that it took to learn the objectives of the module varied, however, among the three groups with those who worked in groups taking less time to learn the material. Thus, Okey and Majer concluded that pairing or grouping students in the CAI setting was an efficient technique for delivering instruction.

Although these investigators were not interested in the social interaction that occurred within the groups, they found that observers of the experimental conditions reported occasional problems of incompatibility, domination of a group by a strong leader, and a reluctance to participate when three or four persons attempted to study together. In contrast, the students working in pairs had harmonious and constructive discussion.

Golton (1975) compared the achievement of students learning alone with the achievement of students working in groups on CAI

materials. In his study, two experimental groups received CAI in Probability and Statistics for a period of 15 days, 55 minutes per day. Management aspects of the CAI program were modified for the group working in pairs to facilitate and encourage cooperation between partners. Pretests and posttests on Probability and Statistics were administered and scores on two retention tests were also obtained. His findings indicated no significant differences between the two treatment groups on any of the posttest measures, and no significant differences between treatments when the data were analyzed by sex (boys, girls) and by mathematics ability (high, middle, and low). Golton concluded, however, that the per student cost may be halved by pairing students at computer terminals without apparent reduction in students' learning efficiency.

Emphasizing individual characteristics and competitive-cooperative environments, two studies were conducted using computer-assisted instruction. Sutter and Reid (1969) conducted a study comparing the achievement and attitudes of students who took a CAI problem-solving course with a partner (interpersonal condition) and those who took the course alone (noninterpersonal condition). They hypothesized that any differences in student achievement and attitudes were a result of the interaction between certain personality traits and the interpersonal versus noninterpersonal nature of the learning situation. The subjects were 100 male undergraduates

taking a problem-solving course at the computer terminal. Anxiety, sociability, and dominance of the students were assessed. Data were gathered from scores on the California Psychological Inventory and Sarason's Test Anxiety Scale as well as from criterion-referenced tests and questionnaires administered before and after the CAI course.

Their findings indicated that effectiveness of CAI in teaching a problem-solving course was no different for the student working alone or for the student working with a partner. This occurred when personality factors were not considered. When personality factors were considered, the interpersonal (working with a partner) condition seemed to affect learning and attitude. In addition, high test anxiety was associated with negative attitudes toward CAI in both the paired and alone groups. In this study, dominance was not significantly correlated with achievement for either group. Dominance, however, did correlate significantly with attitude in the paired group. In summary, the results did not support the position that lack of interpersonal contact hampered learning, although the results suggested that interpersonal stimulation could serve practical interests: teaching twice as many students at the same number of terminals.

In the second study, Reid, Palmer, Whitlock, and Jones (1972) focused on the performance of students working together in pairs. They examined the effects of individual differences on the productivity of the groups. These researchers grouped students

into 81 pairs. These students came to the CAI laboratory and worked together at a computer terminal on a course called Preskills. Students were "naive," in that, they were not given instructions on the physical operation of the machine. Students were selected by their SAT--Math scores and scores on the California Psychological Inventory on scales of achievement, motivation, dominance, flexibility, and sociability. Three groups of pairs were formed: MM(male), FF(female), and MF(male-female).

Their findings indicated that paired subjects performed as well as the control group; females tended to require more time to complete programs while mixed pairs tended toward less achievement than homogeneous pairs. In summary, no overall relationship between achievement motivation and performance was found; high anxious pairs with high achievement motivation demonstrated superior performance, especially in female pairs; homogeneous groupings on the bases of sex, test-anxiety, and possibly other characteristics may lead to better performance.

The aforementioned studies about student-computer interaction dealt specifically with CAI terminals. More recently, two studies have been conducted which examined student interaction in a microcomputer environment. Cox (1981) studied two major areas: (1) the evaluation of the characteristics, interactions, problem-solving strategies and achievement of junior high school students as they interacted with a microcomputer in three problem-solving sessions, and (2) determination of the

effectiveness of three original microcomputer programs in a problem-solving and a fourth program in specific skills training. Of these two areas, the former had relevance for this study.

Cox (1981) posed the hypothesis: there are unique motivational and interactive trends and patterns that occur when adolescents interact with a microcomputer. She collected data for this hypothesis on volunteers from seventh and eighth graders. These students were randomly assigned to either work alone or work in groups of two, three, or five during three sessions. To analyze the data, Cox (1981) used anecdotal records and audiotapes of the interaction occurring.

Her findings for this hypothesis were as follow:

1. Students appeared to adapt very quickly and easily to the mechanics of the microcomputer.
2. Subject interest remained consistently high throughout all sessions.
3. Most subjects did not change the standardized seating arrangements although they were free to do so.
4. All subjects indicated that they were unfamiliar with this particular style of complex problem.
5. Most individuals within groups insisted on everyone taking turns. In most groups where turns were not taken in a somewhat organized fashion, friction within the group usually resulted.
6. Subjects who were within one grade average level worked

> together as a team. Subjects who were two or more grade averages apart had difficulty working together and did not seem to understand the strategy employed by others. The "D" grade-average subjects were erratic, impatient, impulsive and demanded attention, approval, and encouragement from the adult present (p. 80).

From these findings, Cox (1981) concluded that there were unique patterns and trends when students interacted with a microcomputer to solve complex problems. Second, she concluded that the technical aspects of operating a microcomputer were minimal, for all subjects adapted easily and quickly to it. Also, Cox (1981) inferred that subject interest was consistently high during the sessions, regardless of achievement or variances of individual characteristics. This suggested that there was a high motivational trend created by the microcomputer. In relationship to this conclusion, Cox (1981) asserted that individuals worked better in teams than alone.

In view of this study, Cox (1981) recommended that: (1) varying levels of problem-solving should be made available to any student who wishes to participate in a microcomputer-supported task and (2) consideration should be given to a study of attitudes of the general population of students toward computers, for in her study, more males than females volunteered for the microcomputer sessions.

A more in-depth study into the interaction process within a microcomputer environment was conducted by Hawkins, Sheingold, Gearhart, and Berger (1982). Hawkins et al. (1982) conducted two studies that dealt with the social impact of computers in the classroom. Specifically, these investigators examined social effects of the use of microcomputers in elementary school classrooms where children were learning to program in LOGO. Their basic assumption was microcomputers provided opportunities for student interaction and collaboration in classrooms.

The first study investigated the question: Is social interaction around the computer different in quality and/or quantity from other peer interactions in the classroom? In their second study, Hawkins et al. (1982) posed the question: Does the computer work provide a context within which students can emerge as expert resources for their peers? In both studies, the subjects were drawn from grades three through six in a private school. There were two classroom groups: (1) one classroom included 13 boys and 13 girls (third and fourth graders), and (2) the other classroom included 14 boys and 13 girls (fifth and sixth graders). Each classroom was provided with six microcomputers with the younger group having Texas Instruments 99/4 and the older group, having Apple II Plus computers.

Employing an observation system to record classroom activity, Hawkins et al. (1982) coded types of behavior referred to as "interactive terms," defined as teaching or collaborative turns.

In the first study, interaction was compared at time 1 (before computers) and time 2 (after computers). They found that there were no differences for noncomputer activities in the frequency of task-related talk or in number of teaching and/or collaborative episodes in either the younger or older classrooms. When interaction "after computers" was compared with interaction "before computers", there were significant differences in both classes, indicating that more task-related interaction occurred during a computer activity. In addition, Hawkins et al. (1982) found that there was more "connected talk" among children of both classrooms. This was indicated by the occurrence of more collaborative episodes in the computer context.

Hawkins et al. (1982) concluded that students appeared to be interacting more about their work and doing so in a collaborative fashion when these students were working with the computer than when they were involved in other classroom activities. These investigators advanced the notions that computers may facilitate joint activity because of hardware configuration (i.e., large screens) and visibility of procedures on the screen to public scrutiny, and the novelty of computers in the classroom.

In their second study, Hawkins et al. (1982) administered questionnaires before and after the introduction of computers in the classroom. Subjects were asked to select the name of one classmate whom they would seek help from on a number of classroom tasks. In addition, subjects were to select a partner whom they

would prefer working with on these tasks. These researchers chose this approach as a means of understanding whether subjects were able to distinguish expertise in a computer and noncomputer task from friendship patterns in a computer and noncomputer task.

Hawkins et al. (1982) reported the following findings: (1) for the noncomputer activities, there was relatively little consensus among students in either classroom about who would be selected as a resource; (2) for the computer activities, approximately half of the students in each class made similar selections of peers as computer resources. In regard to the distinction between resources and friendships, Hawkins et al. (1982) reported that fewer than half the students in each class selected the same individual as both partner and helper for computer tasks. Also, there were no sex differences apparent in the selection of the same individual as both partner and expert.

The research by Cox (1981) and Hawkins et al. (1982) is pertinent to issues involving instructional contexts that promote student interaction, the power of social interaction to influence or contribute to the learning process and social development of students, the validity of students' perceptions about their classroom experiences, and the impact of computer technology on classroom processes. In the study by Cox (1981), the instructional context was manipulated so that student interaction would be generated. Hawkins et al. (1981) on the other hand, investigated the naturalistic environment before and after computer use. Both

studies indicated that student interaction in the computer context was enriched although both studies used different approaches to view this process. Neither study made claims of the relative influence of student interaction on subsequent outcomes such as social development; the indications, however, appear favorable for the proposal of a model that may guide the study of social development and learning within the computer context.

Conclusion

Student interaction within a microcomputer environment is a relatively new field of research. It was, therefore, helpful to consider suggestions and directions from social-psychological theory and empirical research, applicable to the study of interpersonal interaction.

From the research on student interaction in small groups, the implications directly related to this study suggested that:

1. Interaction variables such as group helping, giving help, and receiving help were positively related to achievement; whereas, off-task behaviors were negatively related to achievement. These interaction variables represent one level of variables present in the interaction process: task-related behaviors.
2. The observation of the interaction process may be facilitated by using audiotapes, videotapes, and note-taking. These techniques permit a relative degree of

accuracy for recording quality, quantity, and range of interaction variables.

Secondly, the research conducted on cooperative and competitive instructional contexts provided further directions for this study:

1. There are a variety of team-learning methods that may be incorporated into classroom techniques. These methods have the potential for generating and facilitating student interaction.
2. The use of cooperative and competitive instructional contexts have been shown to influence educational objectives: achieve-ment and social development of students.
3. Specific interaction variables have been identified that are peculiar to cooperative and competitive instructional contexts. These variables are classified: competitive behaviors--attentional, evaluative, and besting, and cooperative behaviors--other oriented. From this classification, another level of interaction variables is surmised: socially-oriented behaviors.
4. The interaction process has been characterized as possessing verbal and nonverbal behaviors.

Next, the research exploring group composition directed attention toward its influence on the interaction process. In particular, the sex of members in a group may have served as a

predictor of student interaction. From the survey of research, the implications for this study suggested that:

1. Males and females react differently to instructional contexts. That is, males were cast as more competitive than females.
2. Males demonstrated less socially-oriented behaviors than females did.
3. Females tended to help and share more than males, regardless of the instructional context.
4. Females initiated the same number of task-related acts as males initiated.

Overall, this line of research has presented conflicting findings concerning sex differences in groups.

Finally, the research on student-computer interaction offered implications for this study by suggesting that:

1. Pairing students at microcomputers may be better for obtaining beneficial student interaction. The indications were that a pair of students have less friction and less struggles for power and authority.
2. Homogeneous groupings on the basis of sex or other in-dividual differences affect the interaction process within a microcomputer environment.
3. The use of computers tended to motivate students and facilitate joint activity within the classroom.
4. The quality of student interaction within the

micro-computer environment indicated more task-related and social-oriented behaviors.

5. The use of computers in the classroom may provide occasions for students to become resources for others and for students to recognize each other's competence.

Collectively, these conclusions indicated that the use of computers in instructional contexts warrants investigation in order to assess what effects computers have on the social processes within a classroom.

CHAPTER III

METHODOLOGY

In this chapter, the methodology of the study is delineated. It has been divided into five sections: 1) the population and sample selection, 2) the research design of the study, 3) the treatment procedure and experimental conditions, 4) the instrumentation and data collection, and 5) the statistical methods utilized for data analysis. The present study was designed, then, as an experimental test of the hypotheses that student interaction may or may not be a function of instructional contexts and pairing by sex within a microcomputer environment.

Population and Sample Selection

For the purpose of addressing the effects of instructional contexts within microcomputer environments, managing resources, and allowing more in-depth observational procedures, the decision was made to focus upon a student population who would probably be introduced to microcomputer technology during their academic tenure. Since the use of microcomputer technology in public schools has increased so rapidly, the decision to concentrate on gaining access to a public school was made, also. In relationship to public school entry, a grade level was specified in order to satisfy the requirements of the research study. The sixth-grade

population was chosen on the basis of these criteria of the study: a) this grade level would have received instruction in basic mathematical operations such as multiplication, division, etc.; b) those students in this age range would have acquired the developmental stage wherein they would be able to take the perspective of others and to engage in decision-making about their behavioral responses within a given situation.

Contact was made with school districts to obtain permission to conduct research within the district. Of the school districts contacted, one district agreed to a presentation of the study before making a final decision. Due to the structural organization of the first school's curriculum plan, the school's representatives felt that the research study would not blend in with the school's operation. The second school within the same district that requested a presentation agreed to participate in the research study.

The research site, then, was a public elementary school located in a suburb of Madison, Wisconsin. This elementary school provided instruction for grades K-6. For the most part, the student population was from middle-class backgrounds and largely homogenous, with a small per cent identified as members of minority groups.

Three sixth-grade classes were identified as prospective participants for the study. These three classes were grouped by ability with a total of 65 students; this represented the total enrollment for sixth-graders at the school.

Initial contact was made with these three sixth-grade classes. A videotaped presentation introducing the students to the Apple microcomputer and the educational activity used in the research study was made to all 65 students. After the presentation, sixth-graders were recruited to participate in the research study. Each of the students was given a letter requesting permission to participate from their parents (see Appendix A). The permission forms were to be returned to their teachers within a two-week period.

Of the 65 students who received permission request forms, 46 students returned signed forms granting permission for their participation. The breakdown of those students was 24 females and 22 males. Additional recruitment efforts were made which resulted in two males being added to the original 46 students. The adjusted sample was 48 students: 24 females and 24 males.

Of these 48 students, 24 females and 20 males completed the research sessions. The reduction in male participation was due to relocation to another school and absenteeism. Thus, to gain equal numbers of male and female participants, data were analyzed from 20 females and 20 males who were paired by using a stratified (by sex) random sampling procedure, yielding 10 all-female pairs and 10 all-male pairs. These pairs were, then, randomly assigned to experimental conditions. All pairs were assigned to both experimental conditions.

Design of the Study

This research was conducted to compare the effects of a cooperative instructional context with a competitive instructional context on the verbal and nonverbal behaviors of same-sex student pairs within a microcomputer environment. Hence, an experimental approach was required. The experimental design that allowed for these comparisons to be made is classified as a repeated measures design (Fox, 1969; Sowell & Casey, 1982; Winer, 1974).

In this study, the research design in symbolic form is presented in Figure 3.1. In this notation, the R represented a stratified (by sex) random sampling with R_F representing randomization of females and R_M representing randomization of males. The symbols, O_1 and O_2, represented the repeated measures used to assess verbal and nonverbal behaviors of student pairs. Experimental conditions are represented by X_1 and X_2 which denoted the cooperative instructional context and the competitive instructional context, respectively. The perforated line indicated the use of intact classroom groups. As shown in this figure, there were four groupings of same-sex student pairs: two groups (A and B) were exposed to the cooperative instructional context initially while two groups (C and D) were exposed to the competitive instructional context initially. Latin square techniques (Winer, 1974) were used to structure the sequence of the experimental conditions.

The repeated measures design permitted subjects to serve as their own controls. Student pairs were assumed to be homogeneous

on the basis of the stratified (by sex) random sampling and random assignment of student pairs to experimental conditions. Carry-over effects were minimized by the use of Latin square techniques. For these reasons the repeated measures design seemed appropriate for the study.

Group A	R_F	X_1	O_1	X_2	O_2
Group B	R_M	X_1	O_1	X_2	O_2
Group C	R_F	X_2	O_1	X_1	O_2
Group D	R_M	X_2	O_1	X_1	O_2

Figure 3.1. Repeated Measures Design for the Present Study.

The repeated measures factors in this study were the instructional contexts, cooperative and competitive. These factors constituted the independent variables or within subjects factor. The other independent variable, pairing by sex, was the between subjects factor. The dependent variable of the study was student interactions subdivided into verbal and nonverbal behavioral

dimensions of self-oriented behaviors, besting behaviors, other-oriented behaviors, negative behaviors, and positive behaviors, as measured by the Student Interaction Observation Record.

Treatment Procedures

The treatment procedures in this study were divided into two phases: pre-experimental and experimental. The pre-experimental phase consisted of practice sessions for the students. These practice sessions were conducted to provide familiarity with and operational skills of the microcomputer and educational game to the students. The experimental phase exposed the students to the experimental conditions. Each phase is described with its format of presentation to the subjects.

Pre-Experimental Phase

During the pre-experimental phase, the format of presentation to the subjects was as follows:

(1) subjects were brought to the microcomputer laboratory for individual five-minute sessions;

(2) subjects were given instructions related to the operation of the microcomputer and paddles to be used;

(3) subjects were given instructions on the rules of the educational game;

(4) subjects were allowed to practice on level 1 of the educational game before being sent back to classes.

The determination of five-minute practice sessions was derived from a pilot study which revealed that this time period was adequate for familiarizing students with equipment and procedures for participating in the educational activity.

Experimental Phase

In the second phase, the experimental phase, the format for presentation to same-sex student pairs was as follows:

(1) Student pairs were brought to the microcomputer laboratory which had this configuration: a) an Apple microcomputer with monitor was positioned in the center of the table; b) seating of subjects was directly in front of the computer with chairs arranged side-by-side; c) video equipment was secured so that subjects would be facing the camera at all times; d) a microphone was placed in a prominent position on the table.

(2) Student pairs were given hand-outs with instructions on the rules of the game and were instructed to read them carefully.

(3) Student pairs were questioned on the rules and operational procedures of microcomputer.

(4) Student pairs were given directions to follow for the specific experimental condition.

(5) Student pairs were, then, instructed to begin the

activity and were videotaped by the researcher during this activity.

(6) Student pairs were told when the condition was over and administered a student self-evaluative questionnaire.

(7) Student pairs were thanked for their participation and sent back to their classrooms.

During the experimental phase, the researcher monitored closely the functioning of the equipment utilized to record student interaction.

Also, during the experimental phase, the scheduling of student pairs was accomplished through a two-tier arrangement. The first tier was sequenced so that all twenty-four pairs were exposed to their initial instructional context before any pair of students entered into the second instructional context. The second tier was sequenced in the exact same order of student pairs. This type of tier arrangement provided for equal amounts of time to elapse between experimental conditions for the student pairs. There were, however, instances where equal amounts of time between treatment were not possible.

Procedural presentation of experimental conditions did not differ in the two experimental conditions. The instructions for each condition and mode of activity did differ due to the requirements of the specific condition. The experimental conditions with these factors are described in the following sections.

Cooperative Instructional Context

The cooperative instructional context featured the following: (a) a student pair worked together as a team to balance mathematical expressions* (e.g., 3 x 3 - 2 = 7, 10 + 4 = 8 + 6, or 1 + 1 = 2) and to prevent the microcomputer as the team's opponent from "shooting" the team's machines, (b) a student pair had to score 100 points in order to be declared the "winners" and (c) the microcomputer as opponent did not balance mathematical expressions; its only goal was to "capture" the team's machines through a "shooting" feature. In relationship to scoring procedures, each time the team used an addition sign, the team scored one point; a subtraction sign resulted in two points; a multiplication sign resulted in three points. When the expression was balanced, the computer added the values of the signs used and multiplied the total by 10. Points were also awarded for "shooting" or "capturing" the opponents' machines; however, only five points were given for [illegible].

In the cooperative instructional context, each of the twenty-four pairs of students was brought to the microcomputer laboratory. Upon arrival, the two students were seated together in front of the microcomputer and questioned about working knowledge of the microcomputer with paddles and the rules of the educational activity. The researcher had to obtain satisfactory responses from the

*Balanced mathematical expressions were referred to as "balancing equations" in the instructions of the educational game.

student pair about these factors before instructions could be given. If no satisfactory responses were given, the researcher gave more instructions. Then, directions on the blackboard and hand-outs were pointed out to refresh minds of students and to provide check points for students once they began the activity.

After the preliminary settling of student pairs, the researcher gave the following instructions: "Today, you will be working together as a team. Your goal is to balance equations and score 100 points. You may talk to each other as much as you like. Remember the computer will be working against you. The two of you must keep the computer from winning while you try to balance equations and score points. You can do this by capturing the computer's machines. To begin the game, you will press '3' for the level to play on and you will press '1' for number of players. Now, you are ready to play. Talk to each other as much as you want to." Student pairs were not told how to take turns operating the sole paddle used in this condition.

The student pair was then instructed to press the numbers on the keyboard. At the end of the twenty minute interval, the student pair was informed that the session was over, and then, the student self-evaluative questionnaire was administered individually to each student.

Competitive Instructional Context

The competitive instructional context featured the following: (a) a student pair worked as individual members to balance mathematical expressions and to prevent the opponent from "shooting" or "capturing" machines, and (b) the "winner" was declared as the one who scored 100 points first. The same scoring procedures were used in the competitive and the cooperative instructional contexts.

The competitive instructional context followed the same general procedures as those used in the cooperative instructional context. The differences in this condition were in the instructions and operation of paddles. In this condition, each student was instructed to work against the other in order to score 100 points by balancing equations and capturing his/her opponent's machines. The number pressed for number of players was "2" instead of "1". Both members of the pair operated paddles in this condition. The same instructions for talking to each other were given as in the cooperative condition. At the conclusion of the activity, the student self-evaluative questionnaire was administered and pairs were sent back to their classrooms.

Selection of Educational Task

The educational software selected for this study was based on instructional design principles posited by Gagne (1974) and Tennyson (1971), on appropriateness of activity for the grade level

used, and on educational software that would lend itself to the needs of the research. First, Gagne (1974) and Tennyson (1971) emphasized the importance of students being actively involved in the processing of information via a learning activity. Gagne (1974) described events of learning that must be built into the design of instruction. For example, events of learning must include a component which provided for motivation and a set of learning objectives and for recall of prerequisite skills. Secondly, the appropriateness of this activity for the grade level under study was considered. This required reviewing software for amount of text displayed on the screen at any given time, the amount of user control, and the appearance of the display on the screen. The final criterion was finding educational software that would be utilized in a dual role: cooperative and competitive.

The selection of "Dueling Digits" as the educational game for the experimental conditions was arrived at, for this game met most of the pre-established criteria for the needs of the research: 1) it had three levels of difficulty, 2) it used basic mathematical concepts, 3) it was easily adaptable to a cooperative or competitive mode, and 4) it incorporated the design principles, for the most part, espoused by Gagne (1974) and Tennyson (1971). (See Appendix F for description of Dueling Digits.)

Support for this type of game is found also in the research of Malone (1980) relating to the theory of intrinsically motivating instruction organized into three categories: challenge, fantasy,

and curiosity and in the research of Frederiksen, Warran, Gillote, and Weaver (1982) who reported that these games are fast-paced, involving simple as well as complex coordinations, provided clear-cut goals, gave immediate feedback where speed of responding was as important as appropriateness, and offered various levels of difficulty to players as their proficiency increased.

Instrumentation and Data Collection

The intent of the study was to assess accurately the student interaction occurring in two instructional contexts for same-sex student pairs within a microcomputer environment. To accomplish this, the method of data collection was through videotapes and student self-evaluative questionnaires. The function of the instrumentation for data collection was to provide observable indicators that could be used subsequently for description and explanation. The two instruments utilized in this study were the Student Interaction Observation Record and the Student Self-Evaluative Questionnaire. A discussion of the development, reliability and content validity of these instruments is presented in this section.

The Student Interaction Observation Record (SIOR)

The Student Interaction Observation Record (SIOR) is a modified version of the categorical system of Pepitone (1980) based on the conceptual analysis of competition and cooperation from the

research. The SIOR was utilized in the study to measure the following, student interactions: a) self-oriented verbal and nonverbal behaviors, b) besting verbal and nonverbal behaviors, c) other-oriented verbal and nonverbal behaviors, d) negative verbal and nonverbal behaviors, and 3) positive verbal and nonverbal behaviors.

The instrument was structured around five major categories which were extended to ten categories when verbal and nonverbal dimensions were considered. These categories are presented in Table 3.1 with their definitions and dimensions. As indicated these categories constitute the observation system as it operationalized student interaction. All categories have verbal and nonverbal dimensions, unlike Pepitone's original system.

A second modification of Pepitone's (1980) system was to incorporate two additional categories which would provide a finite set of categories, advocated by Medley and Mitzel (1963). These categories were 1) nonspecific behaviors and 2) silence/confusion. These categories were gleaned from reviewing Mirrors for Behavior (Simon and Boyer, 1970).

As a result, the SIOR was expanded to assess twelve behavioral acts demonstrated by students. Following development of the instrument, a pilot test was conducted to establish inter-coder agreement and content validity of the Student Interaction Observation Record. Two coders participated in coding of behaviors from selected videotaped segments of student pairs in the experimental

Table 3.1

Five Major Categories of Student Interaction Observation Record with Definitions (Modified from Pepitone, 1980)

1	Self-Oriented Behaviors:	work-oriented comments and gestures about one's own work, related to factual information
2	Besting Behaviors:	any remarks, comments, or gestures that indicate a comparison is being made of one student to another so that one student moves closer to his/her individual goal while preventing another student from achieving his/her goal
3	Other-Oriented Behaviors:	any behaviors that may be inferred as facilitating the work or providing assistance to another student, requiring consideration for the other student's feelings or opinions
4	Negative Behaviors:	comments or gestures considered to be antisocial or harmful to the psychological or physical being
5	Positive Behaviors:	comments and gestures that please or reward a student

conditions. Each coder was trained thoroughly to the desired outcomes, the behaviors to be observed and coded.

The coding procedures utilized by the trained "blind" coders for the pilot test and actual study were the same. These procedures were as follows:

(1) the coders scanned systematically from one subject to the other, recording on the prescribed tallying form the numbers of the observation system that correspond with behaviors exhibited by students. A single-digit number was used for verbal dimensions of the major categories (1 through 5), and a double-digit number was used for nonverbal dimensions of the major categories (11 through 15). The numbers assigned to nonspecific behaviors and silence/confusion behaviors were 9 and 10, respectively;

(2) the coders rewound and restarted videotapes periodically in order to record as accurately as possible those behaviors occurring within each ten-minute segment of videotape;

(3) the coders transferred the recorded behaviors from the tallying forms to a 12 x 12 matrix. Those recorded behaviors were bracketed together by pairs and placed

within the matrix. For example, the tallying form was designed for the coders to record behaviors vertically:

11

2

11

11

1

3

When these behaviors were transferred to the matrix, they were bracketed with the first member of the pair placed in the corresponding column and the second member placed in the corresponding row. This placement allowed for the calculation of row and column totals and percentages of the twelve behavioral categories, individually and in combination. (See Appendix B for samples of the tally form and matrix.)

On the basis of the two coding behaviors inter-coder agreement was .90 for verbal behaviors and .85 for [illegible] verbal behaviors. The mean of these two was .87. According to Fox (1969), an 85 percent agreement of independent observations should be met before conducting the actual research. Hence, the agreement seemed reasonable to conduct the study. The formula used to determine inter-coder agreement was:

$$\text{Agreement} = \frac{P_o - P_e}{100 - P_e} \qquad \text{where}$$

P_o = Total disagreements between observers subtracted from 100.

P_e = The proportion of agreement expected by chance found by using the formula:

$$P_e = \sum_{i=1}^{K} Pi^2$$

This formula is referred to as Scott's coefficient reliability and is used extensively by Flanders (1965) and Ober (1971).

In the case of content validity, the research from student interaction in small groups (Webb, 1982; Swing & Peterson, 1981) has confirmed the presence of behavioral categories represented in the SIOR. In addition, the research literature from Pepitone and associates (1980) reported the conceptual analysis of cooperation and competition as determinant of specific behaviors, also included in the SIOR. The behaviors included in the SIOR reflect those research trends and findings that delineate the elements involved in student interaction. (See Appendix B for the complete SIOR.)

The Student Self-Evaluative Questionnaire

The Student Self-Evaluative Questionnaire was constructed to assess students' perceptions of their microcomputer experiences and behaviors exhibited within this context. The instrument was

structured around self-oriented, besting, other-oriented, negative, and positive behaviors complementary to the coding system.

In the developmental phase of the questionnaire, statements were generated that would reflect the behavioral categories observed for student pairs. In this sense, statements were provided for by the questionnaire that permitted students to evaluate their behaviors while serving as a cross-check for the coding system. In Table 3.2, sample items from the questionnaire are presented. As indicated in Table 3.2, items on the student self-evaluative questionnaire utilized Likert response categories. This type of response category was selected because of its adaptability to various situations and because it allowed for direction and intensity in response to statements by the subjects (Anderson, 1981). Also, as evidenced in the Table, the direction of responses was reversed for those items that were interpreted as negative or besting behaviors. Each of the response categories was assigned a numerical value ranging from 1 to 4 which were later computed for analysis.

There were twenty-five Likert-type items included on the questionnaire. In addition, four open-ended questions were included to permit students to provide personal reactions to the microcomputer experience with more descriptive information. Thus, the questionnaire consisted of twenty-nine items (see Appendix C).

A pilot test of the questionnaire was conducted to determine its reliability. As a result, the items on the questionnaire had

Table 3.2

Sample Items from the Student Self-Evaluative Questionnaire

Subscale	Items				
Besting Behaviors	Item 6. I had better ideas than my partner.				
	Never	Hardly Ever	Sometimes	Always	Don't Know
	(4)	(3)	(2)	(1)	(0)
Other-Oriented Behaviors	Item 3. I helped my partner at the computer with the paddles.				
	Never	Hardly Ever	Sometimes	Always	Don't Know
	(1)	(2)	(3)	(4)	(0)
Negative Behaviors	Item 4. I made fun of my partner's mistakes.				
	Never	Hardly Ever	Sometimes	Always	Don't Know
	(4)	(3)	(2)	(1)	(0)

to be reworded for clarity. Using the Cronbach's Alpha coefficient through the SPSS statistical program (Nie et al., 1975), the alpha coefficient was computed for the total questionnaire at .62. The actual data in the study was computed with an alpha of .70. The Cronbach Alpha coefficient is a measure of internal consistency which represents the expected correlation of one K-item with all other K-item tests (Nie et al., 1975, p. 256).

In summary, the pilot test of the Student Interaction Observation Record and the Student Self-Evaluative Questionnaire indicated reliability, within reasonable degrees for the research, with the SIOR also having content validity.

Data Collection

Videotapes of each student pair were made during the experimental conditions. The videotapes made for each condition were approximately ten minutes in duration. Thus, each student pair was recorded for a total of twenty minutes.

The use of videotapes as a major source of data collection in the study was predicated on the assumptions that: 1) the nature of the dynamic interactive environment created by students and microcomputers required observance of detailed behaviors, 2) the interaction process (student-student) involves both verbal and nonverbal behaviors of which nonverbal behaviors may have been lost with other techniques, and 3) videotapes could be replayed to resolve ambiguous sequences of interaction not ascertainable from other

methods of data collection(Webb, 1982; Lockheed, 1977). Although the obtrusiveness inherent in the use of videotape is considered moderate, the research dictated that this method be employed.

The data collected through the use of videotapes were coded by two trained coders using the Student Interaction Observation Record. These trained coders were instructed to code every act engaged in by the student pair. For the purposes of the data analysis, an act was defined in a two-fold manner that considered the verbal and nonverbal dimensions of behavioral categories: 1) a verbal act was the "period of one child's speech separated by a pause or another child's verbalization," and 2) a nonverbal act was defined as "a change from one activity to another" in terms of facial expressions and movement (Pepitone, 1980, p. 117).

Another method of data collection was the Student Self-Evaluative Questionnaire that was administered after each experimental condition to the subjects. This instrument was scored and scores were analyzed using SPSS (Nie et al., 1975) and BMPD (Dixon and Brown, 1979). Thus, the two methods of collecting data for this study were through videotapes and administering of the student self-evaluative questionnaire.

Data Analysis and Statistical Procedures

The present study was directed toward answering three research questions and exploring an ancillary question stated in Chapter I. From the three research questions, fifteen hypotheses were

formulated for testing utilizing an analysis variance procedures conducted through the use of the BMPD program P2V-Analysis of Variance and Covariance, including repeated measures (Dixon and Brown, 1979). This statistical procedure was used to determine the main effects of the between subjects (pairing by sex) factor and the within subjects factor (cooperative and competitive instructional contexts) and their interaction effect in explaining the variance in the dependent variable, student interaction. The unit of analysis was the mean for the pair obtained from measures on the Student Interaction Observation Record.

In regard to the exploration of the ancillary question, specific items constituted subscales within the questionnaire. These subscales were scored and scores analyzed by using the same procedure from BMPD (Dixon and Brown, 1979). In addition, all items of the questionnaire were scored and the scores analyzed by using statistical procedures conducted through the use of SPSS (Nie, et al, 1975). Means, standard deviations, and reliability procedures were used on these data.

The level of significance for this research study was selected at .05 which is the conventional level in educational research (Fox, 1969).

CHAPTER IV

ANALYSIS OF THE DATA

In this chapter, the results of statistical analyses of data are presented. To provide for clarity in understanding the results, the chapter is divided into five sections: (1) a descriptive presentation of the data, (2) the statistical analysis model, (3) the restatement of the null hypotheses with statistical analyses, (4) the exploration of the ancillary question, and (5) a summary of the results and discussion.

Descriptive Presentation of the Data

This section is based on the results of the analysis of data gathered from twenty pairs of subjects. The data were obtained from the number of occurrences of interaction variables coded through the Student Interaction Observation Record and from the scores of students' perceptions taken from the Student Self-Evaluative Questionnaire. The raw data collected by these instruments were subsequently analyzed using the Biomedical Computer Programs (BMPD) by Dixon and Brown (1979) and the Statistical Packages for the Social Sciences (SPSS) by Nie et al. (1975). The raw data and subsequent analyses for the distribution of the dependent variable are displayed in Tables 4.1 through 4.4 (See Appendix D). These tables provided the

characteristics of the data which were subsequently submitted to statistical testing of the null hypotheses and exploration of the ancillary question.

Dependent Variables

The dependent variable investigated in this study was student interaction, as defined in the literature and operationalized through the observational categories of the Student Interaction Observation Record. Student interaction as a process was subdivided into five major behavioral categories; each category consisted of verbal and nonverbal dimensions. The categories were: (a) self-oriented (verbal and nonverbal), (b) besting (verbal and nonverbal), (c) other-oriented (verbal and nonverbal), (d) negative (verbal and nonverbal) and (e) positive (verbal and nonverbal) behavior. These ten categories, by inclusion of the verbal and nonverbal dimensions, were coded by trained "blind" coders for each student pair. In Table 4.3 the results of the coding are summarized, reporting the means, standard deviations, and range of the ten behavioral categories.

Profiles of the Five Major Behavioral Categories

In Table 4.3, the means and standard deviations as well as the range of behaviors are presented. An examination of this Table indicated the profiles of five major behavioral categories inclusive of the verbal and nonverbal dimensions. The profiles of behaviors for male pairs in the cooperative and competitive

Table 4.3

Means, Standard Deviations, and Ranges of Student Interaction Variables Within a Microcomputer Environment

BEHAVIORS	MALE						FEMALE					
	Cooperative			Competitive			Cooperative			Competitive		
Self-Oriented	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range	Mean	SD	Range
Verbal	41.90	9.38	22-54	72.30	36.11	18-141	41.90	19.55	11-67	69.80	45.22	13-160
Nonverbal	114.70	26.41	60-155	170.50	78.66	76-312	122.90	48.31	60-199	201.60	80.34	67-288
Beating												
Verbal	2.20	2.57	0-6	4.20	4.15	0-13	1.30	2.26	0-6	5.50	5.23	0-16
Nonverbal	.00	.00		.30	.67	0-2	.30	.94	0-3	.20	.63	0-2
Other-Oriented												
Verbal	122.90	38.29	65-194	36.90	31.76	9-113	115.60	53.43	32-179	43.50	35.74	22-138
Nonverbal	.40	.51	0-1	.10	.31	0-1	.80	.78	0-2	.30	.48	0-1
Negative												
Verbal	.60	.96	0-3	1.20	1.68	0-4	.10	.31	0-1	1.10	1.72	0-5
Nonverbal	.80	1.31	0-4	.00	.00		.10	.31	0-1	.10	.31	0-1
Positive												
Verbal	8.60	8.28	3-29	1.10	3.14	0-10	6.80	4.73	0-14	1.90	4.20	0-13
Nonverbal	.80	.91	0-2	.20	.42	0-1	2.90	4.33	0-13	.90	1.37	0-4
Nonspecific	10.40	9.97	1-29	4.40	1.89	1-7	10.00	10.80	0-35	10.30	15.72	1-54
Silence/Confusion	.90	.73	0-2	1.10	.73	0-1	1.00	.10	-	1.10	.31	1-2

instructional contexts were as follows:

(a) in the cooperative instructional context, male pairs exhibited varying behaviors with self-oriented behaviors representing 53%, besting behaviors representing 1%, other-oriented behaviors representing 42%, negative behaviors representing 1%, and positive behaviors representing 3% of the student interaction occurring;

(b) in the competitive instructional context male pairs exhibited behaviors with self-oriented behaviors representing 85%, besting behaviors representing 1%, other-oriented behaviors representing 13%, negative behaviors representing .4%, and positive behaviors representing 1% of the student interaction occurring.

In comparison, the profiles of the behaviors for male pairs indicated that the self-oriented and other-oriented behaviors in both instructional contexts represented the majority of behaviors occurring. Also shown through these profiles was the increase in self-oriented behaviors during the competitive instructional context and the decrease in other-oriented behaviors during the competitive instructional context.

The profiles of behaviors for female pairs in the cooperative and competitive instructional contexts were as follows:

(a) in the cooperative instructional context, female pairs exhibited behaviors with self-oriented behaviors representing 56%, besting behaviors representing 1%, other-

oriented behaviors representing 40%, negative behaviors representing .1% and positive behaviors representing 3% of student interaction occurring;

(b) in the competitive instructional context, female pairs exhibited behaviors with self-oriented behaviors representing 84%, besting behaviors representing 2%, other-oriented behaviors representing 13%, negative behaviors representing .4% and positive behaviors representing 1% of student interaction occurring.

In comparison, the profiles of the behaviors for female pairs were similar to those of male pairs. Again, the self-oriented and other-oriented behaviors comprised the majority of behaviors occurring. Also, there was an increase in self-oriented behaviors exhibited by female pairs during the competitive instructional context.

To summarize, the profiles of the five major behavioral categories for male pairs and female pairs have suggested similarities in regard to the behaviors exhibited with self-oriented and other-oriented being the dominant behaviors. Besting behaviors, negative behaviors, and positive behaviors were exhibited by the student pairs in both instructional contexts, but not to any great extent.

Those five major behavioral categories were distinct from one another. Examples of those behaviors are given below and are taken from sample transcripts made from videotaped segments of student interaction (see Appendix G for complete Sample

Transcripts). In regard to the self-oriented behavior of students, examples were as follows:

John: "I got a three and can't get it over there."

Bobby: "I got an equals."

Linda: "It's not going to work. I don't even know what I got."

Susan: "I just can't wait for the number 10."

Another behavioral category was besting behaviors which referred to a comparison being made during the interaction or attempts to prevent the other student from achieving his/her goal. Examples of this behavior were as follows:

John: "You knew that was too close for comfort."

Bobby: "Got you!"

John: "Nope, you missed. I still have as many men as you do."

or James: "You want a five! Hit the little round thing and you get 100 points." (Deception)

Tom: "I bet!"

James: "You do, too!"

The third category was other-oriented behaviors. Examples of those behaviors were as follows:

John: "Put a 7 there; that would be 35 (Pointing to screen).

Bobby: "Oh, okay, I see what you mean."

Linda: "Oh, I got a minus sign and a seven, where should I put it?"

Susan: "No, throw it away."

The fourth category was negative behaviors. Examples of those behaviors were as follows:

Linda: "Oh, somebody got a four right on the blue line. So, I can't get rid of my screen (widens her eyes). Move over, Susan and get down! (Angrily spoken).

The final category was positive behaviors. Examples of those behaviors were as follows:

John: "What did we get? Oh, good for 36."

Bobby: "No, move it over there (Pointing to screen). Yeah, right. That's pretty good."

John: "Got a plus."

Bobby: "Good job. "

These five behavioral categories were used for subsequent analyses.

In relationship to the ancillary question, the students' responses on the Student-Self-Evaluative Questionnaire were scored and assigned numerical values: Never=1, Hardly Ever=2, Sometimes=3, Always=4, and Don't Know=0. This numerical assignment was related to specific items on the questionnaire which indicated favorable perceptions of students toward their microcomputer experience. The numerical values were reversed, however, for the response categories on specific items of the

questionnaire which indicated unfavorable perceptions of students toward their microcomputer experiences. In Appendix D, Table 4.4 summarized the analysis of scores and reported the means and standard deviations of questionnaire items. Moreover, five subscales were included in the questionnaire which were scored and subsequently analyzed to explore the ancillary question along with open-ended questions, providing anecdotal comments from subjects.

Statistical Analysis of the Data

The relationship of the independent variables, the cooperative and competitive instructional contexts and pairing by sex, and the dependent variable, student interaction, was analyzed by using analysis of variance with repeated measures conducted through the BMPD (Dixon and Brown, 1979) computer program. In this section, a description of the model is presented.

The statistical model, analysis of variance with repeated measures used two factors, with repeated measures across the levels of one of the factors (Huck, Cormier, and Bounds, 1974). That is, one factor had repeated measures across its levels while the other factor had no repeated measures. This classification yielded a between-subjects factor (no repeated measures factor) and a within-subjects factor (repeated measures factor). Essentially, this statistical model allowed

the researcher to focus on three questions relating to analysis of the data: (1) Is there a significant main effect of the first factor?: (2) Is there a significant main effect of the second factor?; (3) Is there a significant interaction effect between the two factors? (Huck et al., 1974).

The specific statistical model used was a split-plot analysis of variance within repeated-measures procedure and the analyses performed through the use of the BMPD program "P2V-Analysis of Variance and Covariance, Including Repeated Measures" (Dixon and Brown, 1979). This model permitted the examination of the individual main effects of the two factors and the combined effects of the two factors accounting for variance in the dependent variable. In the present study, the within-subjects factor or repeated measures factor was the cooperative and competitive instructional contexts and the between-subjects factor or no repeated measures factor was pairing by sex.

Similarly, the treatment of the ancillary question, in part, utilized this statistical model for analysis. The between-subjects factor was pairing by sex and the within-subjects factor was the instructional contexts, cooperative and competitive. The same three questions were focused on as mentioned earlier as a result of the statistical model.

To summarize, the statistical model employed in the study to analyze the data was a split-plot analysis of variance with repeated measures. The analyses were conducted through the use

of BMPD (Dixon and Brown, 1979). The level of significance was selected at .05 to evaluate the relevant F-ratios.

Restatement of Null Hypotheses with Statistical Analyses

The purpose of the study was to compare the effects of a cooperative instructional context with a competitive instructional context on the verbal and nonverbal behaviors of same-sex student pairs within a microcomputer environment. This purpose generated three research questions and an ancillary question, stated previously in Chapters I and III. In this section, the null hypotheses with accompanying statistical analyses are presented. Also, the results of the exploration for the ancillary question are given.

The three research questions generated fifteen null hypotheses; each question generated five hypotheses. The three sets of null hypotheses related to these questions are presented in the following manner: (a) the first five null hypotheses were related to the question of the main effect of instructional context on student interaction, verbal and nonverbal; (b) the second five null hypotheses were related to the question of the main effect of pairing by sex on student interaction, verbal and nonverbal; (c) the third five hypotheses were related to the question of the interaction effect of instructional context and pairing by sex on student interaction, verbal and nonverbal.

It should be noted that the same statistical model was utilized in testing these fifteen hypotheses; therefore, the summary tables of results presented with the first five hypotheses are inclusive of the results for the second and third set of hypotheses (Refer to those tables for discussion of the second and third set of hypotheses). In addition, separate tables are presented that indicate the means and standard deviations related to each hypothesis.

Statistical Testing of Null Hypotheses/Set A

The null hypotheses in Set A were related to the repeated measures factor, instructional context. The first hypothesis in Set A stated in the null form was:

Hypothesis 1.1 There will be no significant differences between the means of self-oriented verbal and nonverbal behaviors of student pairs in a cooperative instructional context and the means of self-oriented verbal and nonverbal behaviors of student pairs in a competitive instructional context within a micro-computer environment.

The purpose of this hypothesis was to determine whether or not student pairs participated equally in self-oriented verbal and nonverbal behaviors in a cooperative and competitive instructional context. This was to be accomplished by determining the mean score for all pairs for both instructional contexts on verbal and nonverbal dimensions of self-oriented behavior.

The results for the means and standard deviations and the split-plot analysis of variance are shown in Tables 4.5 through 4.7. An examination of the means in Table 4.5 indicated that the means of self-oriented verbal behaviors in a cooperative instructional context ($\bar{X}$=41.90) differed substantially from the

Table 4.5

Means and Standard Deviations of Self-Oriented Verbal and Nonverbal Behaviors of Student Pairs in Cooperative and Competitive Instructional Contexts within a Microcomputer Environment

Behaviors	Cooperative		Competitive		Marginal
	Mean	SD	Mean	SD	
Verbal	41.90	14.93	71.05	39.85	56.47
Nonverbal	118.80	38.13	186.05	79.01	152.42
Marginal	80.35		128.55		

mean of self-oriented verbal behaviors in a competitive instructional context ($\bar{X}$=71.05). Also, the indications were that the mean of self-oriented nonverbal behaviors in a cooperative instructional context ($\bar{X}$=118.80) differed substantially from the mean of self-oriented nonverbal behaviors in a competitive

Table 4.6

Split-plot Analysis of Variance of Self-oriented Verbal Behaviors for Student Pairs Within a Microcomputer Environment

Source	SS	df	F	$\hat{h}^2$
Between Ss				
Sex	15.62	1	.01	
Error	21128.85	18		
Within Ss				
Context	8497.22	1	11.54*	.39
Interaction	15.62	1	.02	
Error	13256.65	18		

P<.05

Table 4.7

Split-plot Analysis of Variance of Self-oriented Nonverbal Behaviors for Student Pairs Within a Microcomputer Environment

Source	SS	df	F	$\hat{h}^2$
Between Ss				
Sex	3861.22	1	.74	
Error	93380.05	18		
Within Ss				
Context	45225.62	1	17.07*	.48
Interaction	1311.02	1	.49	
Error	47697.85	18		

P<.05

instructional context ($\bar{X}$=186.05).

When these means were subjected to a split-plot analysis of variance with repeated measures, the results in Tables 4.6 and 4.7 were ascertained. An inspection of these tables indicated that there was a significant main effect of instructional context on self-oriented verbal ($F=11.54$, $df=1/18$, $p<.05$) and self-oriented nonverbal ($F=17.07$, $df=1/18$, $p<.05$) behaviors.

Therefore, the null hypothesis of no significant differences was rejected.

The second hypothesis of Set A stated in the null form was:

Hypothesis 1.2 There will be no significant differences between the means of besting verbal and nonverbal behaviors of student pairs in a cooperative instructional context and the means of besting verbal and nonverbal behaviors of student pairs in a competitive instructional context within a microcomputer environment.

The purpose of this hypothesis was to determine whether or not student pairs participated equally in besting verbal and nonverbal behaviors in a cooperative and competitive instructional context. To accomplish this, the mean score for all pairs for both instructional contexts on verbal and nonverbal dimensions was computed.

The results for the means and standard deviations and the split-plot analysis of variance with repeated measures are

exhibited in Tables 4.8 through 4.10. An examination of the means in Table 4.8 indicated that the mean of besting verbal behavior in a cooperative instructional context ($\bar{X}$=1.75) differed from the mean of besting verbal behaviors in a competitive instructional context ($\bar{X}$=4.85). In relationship to the nonverbal dimension, the results in the Table indicated that the mean of besting nonverbal behaviors in a cooperative instructional context ($\bar{X}$=.15) differed from the mean of besting nonverbal behaviors in a competitive instructional context ($\bar{X}$=.25) within a microcomputer environment.

Table 4.8

Means and Standard Deviations of Besting Verbal and Nonverbal Behaviors of Student Pairs for Cooperative and Competitive Instructional Contexts within a Microcomputer Environment

Behaviors	Cooperative		Comptetitive		Marginal
	Mean	SD	Mean	SD	
Verbal	1.75	2.40	4.85	4.64	3.30
Nonverbal	.15	.67	.25	.63	.20
Marginal	.95		2.55		

Table 4.9

Split-plot Analysis of Variance of Besting Verbal Behaviors for Student Pairs Within a Microcomputer Environment

Source	SS	df	F	$\hat{h}^2$
Between S_s				
Sex	.40	1	.03	
Error	257.00	18		
Within S_s				
Context	96.10	1	6.90*	.26
Interaction	12.10	1	.87	
Error	250.80	18		

*p < .05

Table 4.10

Split-plot Analysis of Variance of Besting Nonverbal Behaviors for Student Pairs Within a Microcomputer Environment

Source	SS	df	F	$\hat{h}^2$
Between S_s				
Sex	.10	1	.25	
Error	7.30	18		
Within S_s				
Context	.10	1	.21	
Interaction	.40	1	.85	
Error	8.50	18		

*p < .05

When these means were subjected to a split-plot analysis of variance with repeated measures, the results in Tables 4.9 and 4.10 were revealed. An examination of these summary Tables indicated a significant main effect of instructional context on besting verbal behaviors ($F=6.90$, $df=1/18$, $p<.05$), yet no significant main effect of instructional context on besting nonverbal behaviors ($F=.21$, $df=1/18$, $p=.65$).

Therefore, the null hypothesis of no significant differences was rejected.

The third hypothesis in Set A stated in the null form was:

Hypothesis 1.3 There will be no significant differences between the means of other-oriented verbal and nonverbal behaviors of student pairs in a cooperative instructional context and the means of other-oriented verbal and nonverbal behaviors of student pairs in a competitive instructional context within a micro-computer environment.

The purpose of this hypothesis was to determine whether or not student pairs participated equally in other-oriented verbal and nonverbal behaviors in cooperative and competitive instructional contexts. This was to be accomplished by determining the mean score of student pairs on verbal and nonverbal behaviors in both instructional contexts.

The results for the means and standard deviations and split-plot analysis of variance are shown in Tables 4.11 through 4.13. An examination of the results in Table 4.11 revealed that the

Table 4.11

Means and Standard Deviations of Other-Oriented Verbal and Nonverbal Behaviors of Student Pairs for Cooperative and Competitive Instructional Contexts within a Microcomputer Environment

Behaviors	Cooperative		Competitive		Marginal
	Mean	SD	Mean	SD	
Verbal	119.25	45.40	40.29	33.08	79.72
Nonverbal	.60	.68	.20	.41	.40
Marginal	59.62		20.20		

mean of other-oriented verbal behaviors in a cooperative instructional context ($\bar{X}$=119.25) differed from the mean of other-oriented verbal behaviors in a competitive instructional context ($\bar{X}$=40.29). In regard to the nonverbal dimension, the mean of other-oriented nonverbal behaviors in a cooperative instructional context ($\bar{X}$=.60) differed slightly from the mean of other-oriented nonverbal behaviors in a competitive instructional context ($\bar{X}$=.20).

To determine if these mean differences were a function of instructional context, the mean scores were subjected to a split-plot analysis of variance with repeated measures. The results of this statistical analysis are presented in Table 4.12 and 4.13. An examination of these summary tables indicated that there was a significant main effect of instructional

Table 4.12

Split-Plot Analysis of Variance of Other-Oriented Verbal Behaviors for Student Pairs Within a Microcomputer Environment

Source	SS	df	F	$\hat{h}^2$
Between S_s				
Sex	1.22	1	.00	
Error	36456.25	18		
Within S_s				
Context	62489.02	1	48.84*	.72
Interaction	483.02	1	.38	
Error	23028.45	18		

*p < .05

Table 4.13

Split-Plot Analysis of Variance of Other-Oriented Nonverbal Behaviors for Student Pairs Within a Microcomputer Environment

Source	SS	df	F	$\hat{h}^2$
Between S_s				
Sex	.90	1	2.84	
Error	5.70	18		
Within S_s				
Context	1.60	1	5.43*	.23
Interaction	.10	1	.34	
Error	5.30	18		

*p < .05

context on other-oriented verbal behaviors ($F=48.84$, $df=1/18$, $p<.05$) and there was a significant main effect of instructional context on other-oriented nonverbal behaviors ($F=5.43$, $df=1/18$, $p<.05$) within a microcomputer environment.

Therefore, the null hypothesis of no significant differences was rejected.

The fourth hypothesis of Set A stated in the null form was:

Hypothesis 1.4 There will be no significant differences between the means of negative verbal and nonverbal behaviors of student pairs in a cooperative instructional context and means of negative verbal and nonverbal behaviors of student pairs in a competitive instructional context within a microcomputer environment.

The purpose of this hypothesis was to determine whether or not student pairs participated equally in negative verbal and nonverbal behaviors in cooperative and competitive instructional contexts. To accomplish this, the mean scores of student pairs on verbal and nonverbal behaviors in both instructional contexts were calculated.

The results of the means and standard deviations and split-plot analysis of variance are reported in Tables 4.14 through 4.16. An examination of Table 4.14 revealed that the mean of negative verbal behaviors in a cooperative instructional context ($\bar{X}=.35$) differed from the mean of negative verbal behaviors in a competitive instructional context ($\bar{X}=1.15$).

Table 4.14

Means and Standard Deviations of Negative Verbal and Nonverbal Behaviors of Student Pairs for Cooperative and Competitive Instructional Contexts within a Microcomputer Environment

Behaviors	Cooperative		Competitive		Marginal
	Mean	SD	Mean	SD	
Verbal	.35	.74	1.15	1.66	
Nonverbal	.45	.99	.05	.22	
Marginal	.40		.60		

Also, the mean of negative nonverbal behaviors in a cooperative instructional context ($\bar{X}$=.45) differed from the mean of negative nonverbal behaviors in a competitive instructional context ($\bar{X}$=.05).

The mean scores of the student pairs were subjected to a split-plot analysis of variance with repeated measures. The results of these analyses are presented in Tables 4.15 and 4.16. An examination of the summary tables indicated that there was no significant main effect of instructional context on negative verbal behaviors (F=3.47, df=1/18, p=.07) nor a significant main effect of instructional context on negative nonverbal behaviors (F=3.27, df=1/18, p=.08).

Therefore the null hypothesis of no significant differences failed to be rejected.

Table 4.15

Split-Plot Analysis of Variance of Negative Verbal Behaviors for Student Pairs Within a Microcomputer Environment

Source	SS	df	F	$\hat{h}^2$
Between S_s				
Sex	.90	1	.57	
Error	28.60	18		
Within S_s				
Context	6.40	1	3.47	
Interaction	.40	1	.22	
Error	33.20	18		

*p < .05

Table 4.16

Split-Plot Analysis of Variance of Negative Nonverbal Behaviors for Student Pairs Within a Microcomputer Environment

Source	SS	df	F	$\hat{h}^2$
Between S_s				
Sex	.90	1	1.88	
Error	8.60	18		
Within S_s				
Context	1.60	1	3.27	
Interaction	1.60	1	3.27	
Error	8.80	18		

*p < .05

The final hypothesis of Set A stated in the null form was:

Hypothesis 1.5 There will be no signficant differences between the mean of positive verbal and nonverbal behaviors of student pairs in a cooperative instructional context and the means of positive verbal and nonverbal behaviors of student pairs in a competitive instructional context within a microcomputer environment.

The purpose of this hypothesis was to determine whether or not student pairs participated equally in positive verbal and nonverbal behaviors in cooperative and competitive instructional contexts. To accomplish this, the mean scores of student pairs were determined and subjected to analysis.

The results of the means and standard deviations and the split-plot analysis of variance are presented in Tables 4.17 through 4.19. An examination of the results in Table 4.17

Table 4.17

Means and Standard Deviations of Positive Verbal and Nonverbal Behaviors of Student Pairs for Cooperative and Competitive Instructional Contexts within a Microcomputer Environment

Behaviors				
	Mean	SD	Mean	SD
Verbal	7.70	6.63	1.50	3.63
Nonverbal	1.85	3.32	.55	1.05
Marginal	4.77		1.02	

Table 4.18

Split-Plot Analysis of Variance of Positive Verbal Behaviors for Student Pairs Within a Microcomputer Environment

Source	SS	df	F	$\hat{h}^2$
Between Ss				
Sex	2.50	1	.06	
Error	777.10	18		
Within Ss				
Context	384.40	1	23.80*	.56
Interaction	16.90	1	1.05	
Error	290.70	18		

*p < .05

Table 4.19

Split-Plot Analysis of Variance of Positive Nonverbal Behaviors for Student Pairs Within a Microcomputer Environment

Source	SS	df	F	$\hat{h}^2$
Between Ss				
Sex	19.60	1	4.53*	.20
Error	77.80	18		
Within Ss				
Context	16.90	1	2.60	
Interaction	4.90	1	.75	
Error	117.20	18		

*p < .05

through 4.19. An examination of the results in Table 4.17 indicated that the mean of positive verbal behaviors in a cooperative instructional context ($\bar{X}$=7.70) differed from the mean of positive verbal behaviors in a competitive instructional context ($\bar{X}$=1.50). Also, the mean of positive nonverbal behaviors in a cooperative instructional context ($\bar{X}$=1.85) differed from the means of positive nonverbal behaviors in a competitive instructional context ($\bar{X}$=.55).

When the mean scores were subjected to a split-plot analysis of variance with repeated measures, the results in Tables 4.18 and 4.19 were revealed. An examination of these summary tables indicated that there was a significant main effect of instructional context on positive verbal behaviors ($F=23.80$, $df=1/18$, $p<.05$). There was no significant main effect of instructional context on positive nonverbal behaviors ($F=2.60$, $df=1/18$, $p=.12$).

Therefore, the null hypothesis of no significant difference was rejected.

Summary of Results for Hypotheses (Set A)

The results of the statistical analyses for hypotheses 1.1 through 1.5 provided answers to the question pertaining to the effect of instructional contexts, cooperative and competitive, on student interaction variables. Specifically, the results indicated that: (1) a competitive instructional context within a microcomputer environment generated more self-oriented verbal and nonverbal behaviors of students than a cooperative instructional context, (2) a competitive instructional context within a

microcomputer environment generated more besting verbal behaviors of students than a cooperative instructional context, (3) a cooperative instructional context generated more other-oriented verbal and nonverbal behaviors between students than a competitive instructional context, (4) neither a cooperative nor a competitive instructional context made a difference in the exhibition of negative verbal and nonverbal behaviors between students, and (5) a cooperative instructional context generated more positive verbal behaviors between students than a competitive instructional context.

Of these five hypotheses, four hypotheses were rejected and one hypothesis failed to be rejected, on the basis of the results evidenced by the statistical analyses.

Statistical Testing of Null Hypotheses/Set B

The null hypotheses in Set B were related to the main effect of pairing by sex, the between-subjects factor. The first hypothesis of Set B stated in the null form was:

Hypothesis 2.1 There will be no significant differences between the means of self-oriented verbal and nonverbal behaviors of female pairs and male pairs within a microcomputer environment.

The purpose of this hypothesis was to determine whether or not female pairs and male pairs participated equally in self-oriented verbal and nonverbal behaviors within a microcomputer

environment. To accomplish this, the mean scores of female pairs and male pairs on these behaviors were ascertained.

The results of the marginal means are presented in Table 4.20. The researcher refers the reader to Tables 4.6 and 4.7 for the summary tables for the results of the split-plot analysis of variance test. An examination of Table 4.20 indicated that the marginal mean of self-oriented verbal behaviors of female pairs ($\bar{X}$=55.85) differed from the marginal self-oriented verbal behaviors of male pairs ($\bar{X}$=57.10) within a microcomputer environment (across instructional contexts). Also, the results displayed indicated that the marginal mean of self-oriented nonverbal behaviors of female pairs ($\bar{X}$=162.25) differed from the mean of self-oriented nonverbal behaviors of male pairs ($\bar{X}$=142.60) within a microcomputer environment.

Table 4.20

Marginal Means of Self-Oriented Verbal and Nonverbal Behaviors for Male Pairs and Female Pairs within a Microcomputer Environment

Behaviors	Male	Female
	Marginal Mean	Marginal Mean
Verbal	57.10	55.85
Nonverbal	142.60	162.25

When these means were subjected to a split-plot analysis of variance with repeated measures, the results (see Table 4.6 and 4.7) indicated that there was no significant main effect of pairing by sex on self-oriented verbal behaviors (F=.01, df=1/18, p=.90). Also, there was no significant main effect of pairing by sex on self-oriented nonverbal behaviors (F=.74, df=1/18, p=.39).

Therefore, the null hypothesis of no significant differences failed to be rejected.

The second hypothesis of Set B stated in the null form was:

Hypothesis 2.2. There will be no significant differences between the means of besting verbal and nonverbal behaviors of female pairs and male pairs within a microcomputer environment.

The purpose of this hypothesis was to determine whether or not female pairs and male pairs participated equally in besting verbal and nonverbal behaviors. To accomplish this, the marginal means (across instructional contexts) were ascertained.

The results of the marginal means are presented in Table 4.21. An examination of these results indicated that the marginal mean of besting verbal behaviors of male pairs ($\bar{X}$=4.20) differed slightly from the marginal mean of besting verbal behaviors of female pairs ($\bar{X}$=3.40) within a microcomputer environment. Also, it was indicated that the marginal mean of besting nonverbal behaviors ($\bar{X}$=.15) differed slightly from the marginal mean of

Table 4.21

Marginal Means of Besting Verbal and Nonverbal Behaviors for Male Pairs and Female Pairs within a Microcomputer Environment

Behaviors	Male	Female
	Marginal Mean	Marginal Mean
Verbal	4.20	3.40
Nonverbal	.15	.25

besting nonverbal behaviors of female ($\bar{X}$=.25) pairs.

When these marginal means were subjected to a split-plot analysis of variance, the results presented in Tables 4.9 and 4.10 indicated that there was no significant main effect of pairing by sex on either verbal behaviors (F=.03, df=1/18, p=.86) or besting nonverbal behaviors (F=.25, df=1/18, p=.62).

Therefore, the null hypothesis failed to be rejected, based on the statistical analysis.

The third hypothesis of Set B stated in the null form was:

Hypothesis 2.3. There will be no significant differences between means of other-oriented verbal and nonverbal behaviors of female pairs and male pairs within a microcomputer environment.

The purpose of this hypothesis was to determine whether or not female pairs and male pairs participated equally in other-oriented behaviors within a microcomputer environment. To

accomplish this, marginal means (across instructional contexts) were determined.

The results of the calculated marginal means are presented in Table 4.22. An examination of this Table revealed that the marginal means of other-oriented verbal behaviors of male pairs (X=79.90) slightly exceeded the marginal mean of other-oriented

Table 4.22

Marginal Means of Other-Oriented Verbal and Nonverbal Behaviors for Female Pairs and Male Pairs within a Microcomputer Environment

Behaviors	Male	Female
	Marginal Mean	Marginal Mean
Verbal	79.90	79.55
Nonverbal	.25	.55

verbal behaviors of female pairs ($\bar{X}$=79.55). The marginal mean of other-oriented nonverbal behaviors of female pairs ($\bar{X}$=.55), however, slightly exceeded the marginal mean of other-oriented nonverbal behaviors of male pairs ($\bar{X}$=.25).

These means were subjected to a split-plot analysis of variance with repeated measures. The results of the summary tables (See Table 4.12 and 4.13) indicated that there was no

significant main effect of pairing on either other-oriented verbal behaviors (F=.00, df=1/18, p=.98) or other-oriented nonverbal behaviors (F=2.84, df=1/18, p=.10).

Therefore, the null hypothesis of no significant differences failed to be rejected.

The fourth hypothesis of Set B stated in the null form was:

Hypothesis 2.4. There will be no significant differences between the means of negative verbal and nonverbal behaviors of female pairs and male pairs within a microcomputer environment.

The purpose of this hypothesis was to determine whether or not female pairs and male pairs participated equally in negative behaviors within a microcomputer environment. To accomplish this, marginal means were calculated.

The results of the calculated means are presented in Table 4.23. An examination of Table 4.23 indicated that the

Table 4.23

Marginal Means of Negative Verbal and Nonverbal Behaviors of Female Pairs and Male Pairs within a Microcomputer Environment

Behaviors	Male	Female
	Marginal Mean	Marginal Mean
Verbal	.90	.60
Nonverbal	.40	.10

marginal mean of negative verbal behavior of male pairs ($\bar{X}$=.90) was slightly larger than the marginal mean of negative verbal behaviors of female pairs ($\bar{X}$=.60). Similarly, the marginal mean of negative nonverbal behaviors of male pairs ($\bar{X}$=.40) was slightly larger than the marginal mean of negative nonverbal behavior of female pairs ($\bar{X}$=.10).

These marginal means were subjected to a split-plot analysis of variance (See Table 4.15 and 4.16) which upon examination yielded the results that there was no signficant main effect of pairing by sex on either negative verbal behaviors (F=.57, df=1/18, p=.46) or negative nonverbal behaviors (F=1.88, df=1.18, p=.18) within a microcomputer environment.

Therefore, the null hypothesis of no significant differences failed to be rejected.

The final hypothesis in Set B stated in the null form was:

Hypothesis 2.5 There will be no significant differences between the means of positive verbal and nonverbal behaviors of female pairs and male pairs within a microcomputer environment.

The purpose of this hypothesis was to determine whether or not female pairs and male pairs participated equally in positive verbal and nonverbal behaviors within a microcomputer environment. To accomplish this, marginal means were calculated for these behaviors and subjected to statistical analysis.

The results of the marginal means are presented in Table 4.24. An examination of Table 4.24 indicated that the marginal mean of positive verbal behaviors for male pairs ($\bar{X}$=4.85) slightly exceeded the mean of positive verbal behaviors of female pairs ($\bar{X}$=4.35). Also, indicated in this Table was the marginal mean of

Table 4.24

Marginal Means of Positive Verbal and Nonverbal Behaviors of Female Pairs and Male Pairs within a Microcomputer Environment

Behavior	Male	Female
	Marginal Mean	Marginal Mean
Verbal	4.85	4.35
Nonverbal	.50	1.90

positive nonverbal behaviors of female pairs ($\bar{X}$=1.90) exceeded that of male pairs ($\bar{X}$=.50).

These means were subjected to a split-plot analysis of variance which yielded these results (See Tables 4.18 and 4.19): that there was no signficant main effect of pairing by sex on positive verbal behavior (F=.06, df=1/18, p=.81), but there was a significant main effect of pairing by sex on positive nonverbal behaviors (F=4.53, df=1/18, p<.05).

Therefore, the null hypothesis of no significant differences was rejected.

Summary of Results for Hypotheses (Set B)

The results of the statistical analyses for hypotheses 2.1 through 2.5 provided answers to the question pertaining to the main effect of pairing by sex on student interaction variables. Specifically, these results indicated the following: (1) female pairs and male pairs did not differ in the generation of self-oriented verbal and nonverbal behaviors within a microcomputer environment; (2) female pairs did not differ from male pairs in the exhibition of besting verbal and nonverbal behaviors; (3) female pairs and male pairs did not differ in demonstrating other-oriented verbal and nonverbal behaviors; (4) female pairs and male pairs did not differ in participating in negative verbal and nonverbal behaviors; (5) female pairs and male pairs did not differ in demonstrating positive verbal behaviors, but female pairs did differ in demonstrating more positive nonverbal behaviors than male pairs did.

Of these five hypotheses, four of the hypotheses failed to be rejected; one of the hypotheses was rejected, based on the results of the statistical analyses.

Statistical Testing of Null Hypotheses/Set C

The null hypotheses tested in Set C were related to the third research question pertaining to the interaction effect of the

between-subjects factor (pairing by sex) and the within-subjects factor (cooperative and competitive instructional contexts) on student interaction variables under study. The purpose of these five hypotheses was to determine whether or not the combination of the two factors accounted for the amount of variance in the student interaction variables.

The first hypothesis of Set C stated in the null form was:

Hypothesis 3.1. There will be no significant interaction between instructional context, cooperative and competitive, and pairing by sex on the means of self-oriented verbal and nonverbal behaviors of female pairs and the means of self-oriented verbal and nonverbal behaviors of male pairs.

The results of the statistical analysis, a split-plot analysis of variance with repeated measures, were based on the mean scores of female pairs and male pairs in the cooperative and competitive instructional contexts. In Table 4.25, these mean scores are presented. An examination of Table 4.25 indicated that the means of verbal ($\bar{X}$=41.90) and nonverbal ($\bar{X}$=114.70) behaviors of males in a cooperative instructional context were not unlike the means of verbal ($\bar{X}$=41.90) and nonverbal ($\bar{X}$=122.90) behaviors of female pairs in a cooperative instructional context. Also indicated in this Table were that the means of verbal ($\bar{X}$=72.30) and nonverbal ($\bar{X}$=170.50) of male pairs were not unlike, to any great extent, the means of verbal ($\bar{X}$=69.80) and nonverbal ($\bar{X}$=201.60) behaviors of female pairs in the competitive instructional context.

Table 4.25

Means and Standard Deviations of Self-Oriented Verbal and Nonverbal Behaviors of Same Sex-Pairs in Cooperative and Competitive Instructional Contexts within a Microcomputer Environment

Context	Mean	SD	Mean	SD
Cooperative				
Verbal	41.90	9.38	41.90	19.55
Nonverbal	114.70	26.41	122.90	48.31
Competitive				
Verbal	72.30	36.11	69.80	45.22
Nonverbal	170.50	78.66	201.60	80.34

These mean scores were subjected to a split-plot analysis of variance. Results are presented in Tables 4.6 and 4.7. An examination of these results indicated no significant interaction effect ($F=.02$, $df=1/18$, $p=.88$) on self-oriented verbal behaviors and no significant effect on self-oriented nonverbal behaviors ($F=.49$, $df=1/18$, $p=.49$).

Therefore, the null hypothesis of 3.1 failed to be rejected as a result of the statistical analysis.

The second hypothesis is Set C stated in null form was:

Hypothesis 3.2 There will be no significant interaction between instructional context, cooperative and competitive, and pairing by sex on the means of besting verbal and nonverbal

behaviors of female pairs and the means of besting verbal and nonverbal behaviors of male pairs within a microcomputer environment.

The results of the statistical analysis were based on the mean scores of female pairs and mean scores of male pairs in the cooperative and competitive instructional contexts. The mean scores are presented in Table 4.26. An examination of the results in the Table indicated that means of besting verbal

Table 4.26

Means and Standard Deviations of Besting Verbal and Nonverbal Behaviors of Same-Sex Pairs in Cooperative and Competitive Instructional Contexts within a Microcomputer Environment

Context	Male		Female	
	Mean	SD	Mean	SD
Cooperative				
Verbal	2.20	2.57	1.30	2.26
Nonverbal	.00	.00	.30	.94
Competitive	4.20	4.15	5.50	5.23
	.30	.67	.20	.63

($\bar{X}$=2.20) and nonverbal ($\bar{X}$=.00) behaviors of male pairs in a cooperative instructional context differed slightly from the means of besting verbal ($\bar{X}$=1.30) and nonverbal ($\bar{X}$=.30) behaviors of

female pairs in the same context. Also, the means of besting verbal ($\bar{X}$=4.20) and nonverbal ($\bar{X}$=.30) behaviors of male pairs differed slightly from the means of besting verbal ($\bar{X}$=5.50) and nonverbal ($\bar{X}$=.20) behaviors of female pairs in the competitive instructional context.

When these mean scores were subjected to split-plot analysis of variance (See Tables 4.9 and 4.10), an examination of the results in the summary Tables indicated no significant interaction on besting verbal behaviors (F=.87, df=1/18, p=.36) or on besting nonverbal behaviors (F=.85, df=1/18, p=.39).

Therefore, the null hypothesis of no significant interaction failed to be rejected.

The third hypothesis of Set C stated in the null form was:

Hypothesis 3.3 There will be no significant interaction between instructional context, cooperative and competitive, and pairing by sex on the means of other-oriented verbal and nonverbal behaviors of female pairs and on the means of other-oriented verbal and nonverbal behaviors of male pairs within a microcomputer environment.

The results of the statistical analysis were based on the mean scores of female pairs and male pairs on other-oriented verbal and nonverbal behaviors. These means are presented in Table 4.27. An examination of Table 4.27 indicated that the means of other-oriented verbal ($\bar{X}$=122.90) and nonverbal ($\bar{X}$=.40) behaviors of male pairs differed slightly from the means of

Table 4.27

Means and Standard Deviations of Other-Oriented Verbal and Nonverbal Behaviors of Same-Sex Pairs in Cooperative and Competitive Instructional Contexts within a Microcomputer Environment

Context	Male		Female	
	Mean	SD	Mean	SD
Cooperative				
Verbal	122.90	38.29	115.60	53.43
Nonverbal	.40	.51	.80	.78
Competitive				
Verbal	36.90	31.76	43.50	35.74
Nonverbal	.10	.31	.30	.48

other-oriented verbal ($\bar{X}$=115.60) and nonverbal ($\bar{X}$=.80) behaviors of female pairs in a cooperative instructional context. Also shown, the means of other-oriented verbal ($\bar{X}$=36.90) and nonverbal ($\bar{X}$=.10) behaviors of male pairs differed slightly from the means of other-oriented verbal ($\bar{X}$=43.50) and nonverbal ($\bar{X}$=.30) behaviors of female pairs.

These mean scores were subjected to a split-plot analysis of variance. The results of this statistical analysis are presented in Tables 4.12 and 4.13. An examination of these tables indicated that there was no significant interaction on either other-oriented verbal (F=.38, df=1/18, p=.54) or other-oriented nonverbal (F=.34, df=1/18, p=.56) behaviors.

Therefore, the null hypothesis of no significant interaction failed to be rejected.

The fourth hypothesis of Set C stated in the null form was:

Hypothesis 3.4. There will be no significant interaction between instructional context, cooperative and competitive, and pairing by sex on the means of negative verbal and nonverbal behaviors of female pairs and on the means of negative verbal and nonverbal behaviors of male pairs within a microcomputer environment.

The results of the statistical analysis were based on the mean scores of female pairs and male pairs. In Table 4.28, these means are presented. An examination of Table 4.28 indicated that the means of negative verbal ($\bar{X}$=.60) and nonverbal ($\bar{X}$=.80) behaviors of male pairs were slightly greater than the means of negative verbal ($\bar{X}$=.10) and nonverbal ($\bar{X}$=.10) behaviors

Table 4.28

Means and Standard Deviations of Negative Verbal and Nonverbal Behaviors of Same-Sex Pairs in Cooperative and Competitive Instructional Contexts within a Microcomputer Environment

Context	Male		Female	
	Mean	SD	Mean	SD
Cooperative				
Verbal	.60	.966	.10	.316
Nonverbal	.80	1.316	.10	.316
Competitive				
Verbal	1.20	1.686	1.10	1.728
Nonverbal	.00	.000	.10	.316

of female pairs in the cooperative instructional context. The means of negative verbal ($\bar{X}$=1.20) and nonverbal ($\bar{X}$=.00) behaviors of male pairs were not unlike the means of negative verbal ($\bar{X}$=1.10) and nonverbal ($\bar{X}$=.10) behavior of female pairs in a competitive instructional context.

When these means were subjected to a split-plot analysis of variance with repeated measures, the results summarized in Tables 4.15 and 4.16 indicated that there was no significant interaction on either negative verbal behaviors (F=.22, df=1/18, p=.64) or negative nonverbal behaviors (F=3.27, df=1/18, p=.08) within a microcomputer environment.

Therefore, the null hypothesis of no significant interaction failed to be rejected.

The final hypothesis in Set C stated in the null form was:

Hypothesis 3.5. There will be no significant interaction between instructional context, cooperative and competitive, and pairing by sex on the means of positive verbal and nonverbal behaviors of female pairs and the means of positive verbal and nonverbal behaviors of male pairs within a microcomputer environment.

The results of the statistical analysis were based on the mean scores of female pairs and male pairs. These means are presented in Table 4.29. An examination of Table 4.29 indicated that the means of positive verbal ($\bar{X}$=8.60) and nonverbal ($\bar{X}$=.80)

Table 4.29

Means and Standard Deviations of Positive Verbal and Nonverbal Behaviors of Same-Sex Pairs in Cooperative and Competitive Instructional Contexts within a Microcomputer Environment

Context	Male		Female	
	Mean	SD	Mean	SD
Cooperative				
Verbal	8.60	8.289	6.80	4.732
Nonverbal	.80	.918	2.90	4.332
Competitive				
Verbal	1.10	3.142	1.90	4.201
Nonverbal	.20	.421	.90	1.370

behaviors of male pairs differed slightly from the means of positive verbal ($\bar{X}$=6.80) and nonverbal ($\bar{X}$=2.90) behaviors of female pairs in a cooperative instructional context. Also shown were the means of positive verbal ($\bar{X}$=1.10) and nonverbal ($\bar{X}$=.20) behaviors of male pairs which were not unlike, to any great extent, the means of positive verbal ($\bar{X}$=1.90) and nonverbal ($\bar{X}$=.90) behaviors of female pairs in a competitive instructional context.

These mean scores were subjected to a split-plot analysis of variance. The results summarized in Tables 4.18 and 4.19 indicated that there was no significant interaction on either positive verbal behaviors (F=1.05, df=1/18, p=.31) or positive nonverbal behaviors (F=.75, df=1/18, p=.39).

Therefore, the null hypothesis of no significant interaction failed to be rejected.

Summary of Results of Hypotheses (Set C)

The results of testing hypotheses 3.1 through 3.5 provided answers to the question pertaining to the interaction of instructional context and pairing by sex on the student interaction variables. To summarize, the results of these hypotheses suggested that the relationship of instructional context to pairing by sex on the variance in the student interaction variables was negligible. No interaction of these two factors was evidenced.

Exploration of the Ancillary Question

The ancillary question posited by the researcher was: How do students perceive their microcomputer experiences? This question was explored through statistical analyses and anecdotal comments from the data gathered on The Student Self-Evaluative Questionnaire.

This instrument consisted of 25 Likert-type questions and four open-ended questions. Of the 25 questionnaire items, using Likert-response categories, 18 items comprised five subscales within the instrument. These discriminating items were related to the following subscales: self-oriented - items 7, 10, and 18; besting - items 6, 9, and 13; other-oriented - items 1, 3, and 19;

negative - items 4, 5, and 20; positive - items 14, 15, and 17.

The five subscales were scored and the scores analyzed through conducting a split-plot analysis of variance on each subscale. The results of the statistical analyses are presented in Tables 4.30 through 4.34 (See Appendix E for Tables). An examination of the results from these summary tables revealed: (1) for the self-oriented subscale, there was no main effect of the sex factor ($F=.97$, $df=1/18$, $p=.33$) of students' perceptions of their microcomputer experience, no main effect of the instructional context ($F=1.61$, $df=1/18$, $p=.22$) on students' perceptions, and no significant interaction ($F=.03$, $df=1/18$, $p=.87$) of these two factors on students' perceptions; (2) for the besting subscale, there was no main effect of the sex factor ($F=.49$, $df=1/18$, $p=.49$) on students' perceptions, no main effect of instructional context ($F=.44$, $df=1/18$, $p=.51$) on students' perceptions, and no significant interaction ($F=.25$, $df=1/18$, $p=.62$) of these two factors on students' perceptions; (3) for the other-oriented subscale, there was no significant main effect of the sex factor ($F=.45$, $df=1/18$, $p=.50$) on students' perceptions, a significant main effect on instructional condition ($F=11.01$, $df=1/18$, $p<.05$) on student perceptions, and no significant interaction ($F=.40$, $df=1/18$, $p=.53$) of these two factors on students' perceptions of their microcomputer experiences; (4) for the negative subscale there was no significant main effect of the sex factor

(F=.86, df=1/18, p=.36) on students' perceptions, no significant main effect of instructional context (F=.08, df=1/18, p=.88), and no significant interaction of these two factors (F=.08, df=1/18, p=.77) on students' perceptions; (5) for the positive subscale, there was no significant main effect of the sex factor (F=2.88, df=1/18, p=.10) on students perceptions, no significant main effect of the instructional condition (F=.09, df=1/18, p=.76) on students' perceptions, and no significant interaction of these two factors (F=.00, df=1/18, p=.96) on students' perceptions within a microcomputer environment.

In examining anecdotal comments made by students r[illegible]ng to their microcomputer experiences, the researcher chose t[illegible] examine comments relating to question 26 and 29. Students responded to question 26 and 29 in the following manner:

Question 26: Would you like to work in pairs with microcomputers in your classroom?

Responses (after cooperative condition): "Yes, you can talk to them and learn from them, too."
"Yes, you get to ask them questions."
"It might depend on who the partner is."

Responses (after competitive condition):
"Yes, you get to ask questions."
"No, it's always noisy."

Question 29: Which activity did you like better?

The students responded to this question by circling (A) working together or (B) working against each other. By simply counting the number of responses, 9 out of 20 females

(45%) preferred working together while the remaining 11 females (55%) preferred working against one another. Similarly, 7 out of 20 males (35%) preferred working together while the remaining 13 (65%) preferred working against one another.

The responses to question 26 indicated that students' feelings about working in pairs were ambivalent. A clearer distinction was made in the responses to question 29, favoring slightly "working against one another" within a microcomputer environment.

Summary of Exploration into Ancillary Question

The results of the statistical analyses conducted on the five subscales provided information on students' perceptions of their microcomputer experiences. Specifically, students perceived their self-oriented behaviors in a cooperative instructional just as they perceived their behaviors in the competitive instructional context; students' perceptions were not dependent on the students' sex or interaction of the instructional context and sex. Second, students rated their besting behaviors in a cooperative and competitive instructional context in a similar manner; again, the sex of students did not play a part in rating these behaviors and neither did interaction of sex and instructional context. Another result was related to students' perceptions of the other-oriented behaviors. In this, students'

perceptions were affected by the instructional context, but they were not affected by the sex of students or interaction of these two factors. Finally, students' perceptions of their negative and positive behavior were not affected by the instructional context, the sex of students, or an interaction of those two factors.

Overall, students' perceptions of their behaviors in a microcomputer environment were not influenced by the variables under study. Only one analysis revealed a statistically significant effect, instructional context, upon students' perceptions. This observation, further, added complementary information to the anecdotal comments made by the students and their preferences of instructional contexts. It was indicated that similar numbers of males (N=13) and females (N=11) preferred the competitive instructional context while the number of males (N=7) and females (N=9) preferred the cooperative one. What emerged was that some females as well as some males preferred competition and some females as well as some males preferred cooperation. Thus, these results indicated additional support for the results of the statistical analyses.

Summary and Discussion

The summary and discussion of the analysis of data are presented in this section. In the summary, the results are

recounted according to the research questions. The discussion was derived from these results and was arranged according to the independent variables under study.

Summary

The results of the statistical analyses provided answers to three research questions and ancillary question of the study.

Questions 1. Will student interaction occuring in a cooperative instructional context differ from student interaction occuring in a competitive instructional context?

Results: (a) self-oriented verbal and nonverbal behaviors of student pairs were exhibited more in a competitive instructional context than in a cooperative instructional context.

(b) besting verbal behaviors of student pairs were exhibited more in a competitive instructional context than a cooperative, yet, besting nonverbal behaviors were exhibited similarly in both instructional contexts.

(c) other-oriented verbal and nonverbal behaviors of student pairs were exhibited more in a cooperative instructional context than in a competitive instructional context.

(d) negative verbal and nonverbal behaviors of student pairs were exhibited in both instructional contexts.

(e) positive verbal behaviors of student pairs were exhibited more in a cooperative instructional context than in a competitive one, yet positive nonverbal behaviors were exhibited similarly in both contexts.

Question 2: Will student interaction occuring in female pairs and male pairs differ within a microcomputer environment?

Results: (a) Female pairs and male pairs did not differ in self-oriented verbal and nonverbal behaviors, besting verbal and nonverbal behaviors, other-oriented verbal and nonverbal behaviors, negative verbal and nonverbal behaviors, or positive verbal behaviors within a microcomputer environment.

(b) Female pairs exhibited more positive nonverbal behaviors than male pairs within a microcomputer environment.

Question 3: Will there be an interaction of cooperative and competitive instructional contexts and pairing by sex which affects student interaction occuring within a microcomputer environment?

Results: No significant interaction of these variables was found to affect the student interaction variables under study.

Discussion

Based on these results, the independent variable, cooperative and competitive instructional contexts and pairing by sex had differential effects on student interaction within a microcomputer environment.

Instructional Context

Other researchers (Pepitone, 1980; Slavin, 1981) have stated that cooperative and competitive instructional contexts generate various student behaviors. The general findings have indicated that competitive instructional environments promote more work related behaviors, besting and attentional behaviors (Pepitone, 1980) whereas cooperative instructional environments promote more pro-social behaviors (Johnson and Johnson, 1975; Johnson, 1980; Schmuck, 1977). Similarly, in the present study, the findings indicated that competitive instructional contexts did promote more self-oriented and besting behaviors than a cooperative one and the cooperative instructional context did promote more other-oriented and positive behaviors. In addition to these findings in the present study, it was indicated that negative behaviors occurred in both instructional contexts.

Pairing by Sex

The psychological research on sex differences indicated that findings varied from study to study (Maccoby and Jacklin, 1974). In some cases, there were clear distinctions between behaviors of males and females. In the present study, the results indicated that within a microcomputer environment the sex of students was not a contributing factor to the majority of the behaviors exhibited. In only one out of ten behaviors, positive nonverbal behaviors, was it found that females differed significantly from males. Overall, it appeared that the pairing of students by sex in a microcomputer environment was not a basic determinant of variance in student interaction.

To conclude, the cooperative and competitive instructional contexts have been shown to affect student interaction more so than pairing of students by sex. These instructional contexts influenced the student interaction variables referred to as self-oriented, besting, other-oriented, negative, and positive behaviors. In addition, the cooperative and competitive instructional contexts affected the verbal and nonverbal dimensions of those student interaction variables with the verbal dimension being more clearly defined. For this reason, Table 4.35 has been constructed to summarize the verbal dimensions of the five major categories of behaviors occuring in both the instructional contexts. In Table 4.35, the means of the verbal dimensions are

Table 4.35

Summary of Verbal Dimensions for Five Major Behavioral Categories In the Cooperative and Competitive Instructional Contexts

Behaviors	Cooperative	Competitive
Self-Oriented	41.90	71.05
Besting	1.75	4.85
Other-Oriented	119.25	40.29
Negative	.35	1.15
Positive	7.70	1.50
	N=20 (Pairs)	N=20 (Pairs)

presented. Statistical analyses using those means have been conducted, yet in Table 4.35, the means are interpreted from a different perspective. An examination of this Table indicated that self-oriented verbal behaviors in a competitive instructional context were exhibited almost twice as much as self-oriented behaviors in a cooperative instructional context; besting verbal behaviors in a competitive instructional context were exhibited four times as much as besting behavior in a cooperative instruction context; other-oriented verbal behaviors in a cooperative instructional context were exhibited four times as much as other-oriented verbal behaviors in a competitive instructional context; negative verbal behaviors in a competitive instructional

context were exhibited three times as much as negative verbal behaviors in a cooperative instructional context; positive verbal behaviors in a cooperative instructional context were exhibited seven times as much as positive verbal behaviors in a competitive instructional context.

From this interpretation, the cooperative instructional context generated less self-oriented, less besting and less negative verbal behaviors than the competitive instructional context and more other-oriented and more positive verbal behaviors than the competitive instructional context. Therefore, more pro-social interaction occurred in the cooperative instructional context. On the other hand, the competitive instructional context generated more self-oriented, besting, and negative verbal behaviors than the cooperative instructional context. Therefore, more self evaluation and self-assertive interaction occurred in the competitive instructional context.

Both instructional contexts affected verbal student interaction. Both contexts served as contributors to the social development of students within a microcomputer environment.

Ancillary Question

Overall, student's perceptions of their behaviors after a competitive instructional context were no different from their perceptions after a cooperative instructional context. After the cooperative instructional context, however, students perceived

that they participated qualitatively different in regard to other-oriented behaviors than they had in the competitive instructional context. Also, student's perceptions of working within pairs were generally favorable. Some students preferred "working against one another" to "working together", yet, both of these conditions required the presence of another person, promoting the notion that pairs of students or small groups of students working within a microcomputer environment does generate social interconnectedness in a cooperative and competitive instructional context. Finally, students' perceptions of their behaviors within the microcomputer environment were not affected by sex or interaction of sex and instructional context. This indicated that students, irrespective of sex or sex by condition, were motivated by the microcomputer environment as a force within itself.

CHAPTER V

SUMMARY, LIMITATIONS, CONCLUSIONS AND IMPLICATIONS

This chapter is divided into four sections. In the first section, the study is summarized with major findings. Limitations of the study are delineated in the second section. The third section is based on conclusions drawn from the results of the study. The final section is provided to suggest the implications of the study to practitioners, courseware developers, and future research efforts.

Summary of the Study

Purpose

The purpose of the study was to compare the effects of a cooperative instructional context with a competitive instructional context on the verbal and nonverbal behaviors of same-sex pairs of students within a microcomputer environment. This purpose was derived from the concern of educators and the researcher that: a) student-student interaction has been an underutilized and often neglected variable in the learning process and social development of students; b) the advent of microcomputer technology in the classroom may either facilitate or hinder the potential for constructive use of student-student dyadic relationships; c) the blending of machine technology with the social context of instruction may

require decisions related to classroom management and the social organization of instruction to be viewed in different contexts.

Research Questions

There were three research questions posed in this study to investigate the social contexts of instruction when microcomputers were present. These questions were as follows:

(1) Will student interaction occurring in a cooperative instructional context differ from student interaction occurring in a competitive instructional context within a microcomputer environment?

(2) Will student interaction occurring in female pairs and male pairs differ within a microcomputer environment?

(3) Will there be an interaction of cooperative and competitive instructional contexts and pairing by sex which affects student interaciton occurring within a microcomputer environment?

In addition to these research questions, an ancillary question was also explored: How do students perceive their microcomputer experiences?

The three major research questions were the basis for formulating fifteen research hypotheses which were statistically tested. The exploration of the ancillary question also involved statistical analysis as well as subjective analysis.

Theoretical Framework and Conceptual Lens

The theoretical framework on which the study was based came from the tradition of social psychology. This tradition advocated by McMillan (1981), Slavin (1981) and others focused on the identification and interpretation of social and psychological aspects of environment, individual characteristics, and group characteristics which predict patterns of interaction between the person and his/her environment. An integral part of a social-psychological perspective has been the understanding of group processes.

The conceptual model of group process advanced by McGrath (1964), Johnson (1980), and others provided the lens for viewing the processes of student-student interaction within a microcompuer environment. With the guidance of the inputs-process model, research studies were sought which built upon the foundations of this concept. Thus, related and relevant literature tied to the social, psychological and phenomenological underpinnings of group process was reviewed. The review of this literature provided: a) a way of relating input factors to student interaction variables, b) the diverse methodologies which could be used to study the interaction process, and c) the basis of subsequent data analysis. Specifically, the literature that dealt with the input-process-outcome paradigm assisted the researcher in identifying and describing student interactions. The literature from investigations into cooperative and competitive reward or goal structures in the classroom assisted in the design and structure of experimental

conditions. From the literature on sex differences, the impact of social and psychological factors provided insights into efforts to discriminate behaviors based on the sociological attributes of students. Finally, the literature from student-computer interactions led to assumptions about the uniqueness of the microcomputer environment which required further examination, related to the impact of this technology on the social environment within the classroom.

Methodology

Experimental research methodology was utilized to conduct the study. Ten female pairs and ten male pairs drawn from three sixth-grade mathematics classes participated in the study. These subjects were all Anglo-American and were from middle-class economic backgrounds. Prior to actual participation in the study, the subjects were introduced to the research efforts through an oral presentation and videotaped presentation. After permission request forms were returned by subjects, the subjects were stratified (by sex) in a random sampling procedure into same-sex pairs and, then, randomly assigned to the initial experimental condition and the second experimental condition.

All subjects participated in two conditions: a cooperative, same-sex pair condition and a competitive, same-sex pair condition. This constituted a repeated measures design for the study--Sex X

Condition with repeated measures on the second factor. The dependent variable under study was student interaction inclusive of verbal and nonverbal dimensions of specified behavioral categories inherent in cooperation and competition between students.

Data were collected by videotaping student pairs during both experimental conditions and by two administrations of a Student Self-Evaluative Questionnaire, each administered post hoc. The data collected were subsequently coded and scored. Data collected by videotapes were coded by two trained "blind" coders using the Student Interaction Observation Record, based on Pepitone's (1980) categories and modified by the researcher. Questionnaire data were scored by assigning numerical values ranging from 0 to 4 on Likert response categories and open-ended questionnaire data were subjectively evaluated by the researcher.

Data analysis was conducted through the use of BMPD (Dixon and Brown, 1979) and SPSS (Nie et al., 1975) statistical programs. Specifically, statistical analyses used to analyze data were: (1) split-plot analysis of variance, (2) Cronbach alpha test of reliability, and (3) descriptive statistics such as means, standard deviations, and ranges.

Summary of Major Findings

The results of statistical analyses and descriptive analyses of the data collected in this study yielded the following findings:

(1) Within a microcomputer environment, the competitive instructional context generated more self-oriented verbal and nonverbal behaviors of student pairs than a cooperative instructional context.

(2) Within a microcomputer environment, a competitive instructional context generated more besting verbal behaviors of student pairs than a cooperative instructional context. Yet, both cooperative and competitive instructional contexts have the potential to generate, in a similar manner, besting nonverbal behaviors of student pairs.

(3) A cooperative instructional context generated more other-oriented verbal and nonverbal behaviors of student pairs than a competitive instructional context within a microcomputer environment.

(4) The negative verbal and nonverbal behaviors of student pairs occurred in both a cooperative and competitive instructional context within a microcomputer environment, in a similar fashion.

(5) Within a microcomputer environment, positive verbal behaviors of student pairs occurred more in a cooperative instructional context than in a competitive instructional context. Yet, positive nonverbal behaviors of student pairs occurred in both instructional contexts, not

favoring either context as a more powerful generator of student behaviors.

(6) Female pairs and male pairs did not differ in self-oriented, besting, other-oriented, negative and positive behaviors. In only one instance, positive non-verbal behaviors did female pairs exhibit more of those behaviors than male pairs within a microcomputer environment.

(7) There was no relationship between instructional contexts and pairing by sex on student interaction occurring within a microcomputer environment.

(8) Students' perceptions of their behaviors within a microcomputer environment did not differ after participation in a cooperative or competitive instructional context. In one instance, the cooperative instructional context did influence students' perceptions of their other-oriented behaviors more than the competitive instructional context.

(9) Students' perceptions of working in pairs was favorable with students slightly more favorable to working against one another within the grouping situation.

Limitations of the Study

In this section, the limitations of the study are delineated which qualify subsequent conclusions drawn from the findings.

Instrumentation

The instruments used to assess student interaction (The Student Interaction Observation Record) and to evaluate students' perceptions about their microcomputer experiences (The Student Self-Evaluative Questionnaire) may have been sources of limitations. First, the Student Interaction Observation Record has been shown to possess content validity but no argument has been proffered for other validity measures. The Student Self-Evaluative Questionnaire, although piloted and revised, had reliability that was moderate. Therefore, the results of the questionnaire analyses may need to be viewed with caution.

Laboratory Setting

In the study, students who participated were taken out of the classroom environment and placed within a laboratory context. By manipulating the environment, the laboratory setting may have set up a context for student interaction that may not normally occur within the naturalistic confines of the classroom.

Software Design

In the study, "Dueling Digits" was the software used. This program was not specifically designed for educational settings nor was the program designed to be used in the way that it was in the study. Though the program had some design problems, it should

be noted that through appropriate management strategies the desired outcomes can still be achieved. Moreover, if there existed more software without the design problems, the impact on the social environment may be far greater than what was ascertained in this study.

Conclusions of the Study

The following conclusions were drawn from this study:

1. The range of verbal and nonverbal behaviors comprising student interaction was generated, to some degree, by both cooperative and competitive instructional contexts. Yet the cooperative instructional context seemed more conducive to generating other-oriented behaviors on both the verbal and nonverbal dimensions and positive behaviors on the verbal dimensions. In comparison, the competitive instructional context seemed more promotive of self-oriented behaviors on the verbal and nonverbal dimensions and besting behaviors on the verbal dimension. These factors led to the broader conclusion that different instructional contexts within a microcomputer environment allow different types of social interaction between students which in turn may facilitate accomplishment of different educational goals within the classroom.

2. Female students exhibited pro-social and anti-social behaviors similar to those behaviors of male students within a microcomputer environment. It has been indicated in the study

that males and females were just as competitive or just as cooperative within pairs working in a microcomputer environment. This would seem to indicate that the microcomputer environment offered opportunities for female and male students to exhibit behaviors that were generally not attributed to them through research and practice.

3. There was no significant relationship of instructional context and pairing by sex on student interaction occurring within a microcomputer environment. This would indicate that the uniqueness of the microcomputer environment as an entity unto itself had immeasurable impact on the range of behaviors occurring within student pairs, without the proposed influences posited through an interaction of instructional context and pairing by sex.

4. Though the present study did not investigate the question of ability levels and effects on student interaction, the sample in the study ranged in ability levels. Yet, no evidence in the data indicated any marked discrepancies in student interaction which would suggest ability levels may have been a confounding variable.

5. Students' perceptions of their microcomputer experiences, whether participating in a cooperative or competitive instructional context, were fairly consistent. Students in each of the contexts exhibited a full range of behaviors within the various contexts

within the microcomputer environment. This led to a broader conclusion that students' perceptions of their microcomputer experiences encompassed participation in such a way that permitted social interconnectedness.

Implications of the Study

This research study has shown that the microcomputer environment can be considered a facilitator of student-student interaction within various instructional contexts. In the research process, diverse student interactions were analyzed and the results of these analyses have implications for practitioners, courseware developers, and future research efforts. In this section, the implications of the study are presented to the various audiences specified in an effort to suggest ways to unitize their efforts for improving educational practices and study.

Implications for Practitioners

1. The use of microcomputer technology in the organization of diverse instructional contexts represents a unique exploitation of the technology. That is, practitioners' awareness of what educational goals can be accomplished through the blending of this technology with educational aims should be heightened. This can be accomplished through providing practitioners with opportunities (i.e., staff development, pre-service training, etc.) to investigate

the flexibility and capabilities of microcomputer technology.

2. With the advent of microcomputers into the classroom, practitioners are confronted with issues relating to management of this technology. Small groups of students assigned to one microcomputer provide benefits: a) effective management and scheduling of computer use for students, when the number of students exceeds available microcomputers; b) student-student interaction in this environment may loosen some constraints on teachers' time.

3. Practitioners may be placed in the role of curriculum specialists within a microcomputer environment. This implies that practitioners must be knowledgeable of the role(s) that the computer has in the teaching/learning process and be able to match these roles to educational goals of the curriculum.

4. Practitioners' participation in the design and selection of courseware is a necessity in order to be aware of the limitations associated with courseware design and its effect on use in the classroom. Design of courseware and its use in the classroom should address the specified educational goals and the diverse student population for whom goals are determined.

5. Issues may arise in the classroom when microcomputers are present. In this study, the pairing by sex factor addressed implicitly the issue concerning opportunities for males and females to participate equitably within a microcomputer environment. Practitioners should pay attention to the characteristics of the

students (i.e., sex, age, race, socio-economic status, ability level) in order to ensure that these characteristics will not become a source of separation or inequity within the classroom.

Implications for Courseware Developers

1. The courseware developed for educational purposes should be designed so that social interaction in the classroom does not become an anomaly due to instructional programs that limit use to one student user at a time. Courseware should be facilitative of interactions between students and of interactions between students and computer.

2. Courseware developers should consider design of courseware packages which may be utilized in the classroom as well as in laboratory settings. This will provide a clearer picture and better evaluation of how student users will interact with the material.

Implications for Future Research

1. All-male and all-female pairs were used in this study. The interactions recorded and analyzed reflect only one distinction between the two groups. Consideration should be given to a study of mixed-sex pairs to investigate the effects of the microcomputer phenomenon.

2. The experimental approach used in this study had "no

control group." Consideration should be given to observing student interaction in competitive and cooperative instructional contexts within a microcomputer environment and without a microcomputer environment. This need not be an experimental approach rather a qualitative approach to understanding and identifying processes within the environment.

3. The ancillary question in the present study explored students' perceptions of their microcomputer environment. Future research should consider a more in-depth look at student perceptions and also how these perceptions affect life in the classroom.

REFERENCES

Ahlgren, A., and Johnson, D. Sex differences in cooperation and competitive attitudes from the 2nd through the 12th grades. Developmental Psychology, 1979, 15 (1), 45-49.

Allen, V. (Ed.) Children as tutors. New York: Academic Press, 1976.

Anderson, L.W. Assessing affective characteristics in schools. Boston, Mass: Allyn and Bacon Inc., 1981.

Asay, C.S. and Schneider, E.W. Student acceptance of the TICCIT systems: A preliminary study. Brigham Young University, 1973.

Bales, R.F. Interaction process analysis. Cambridge, Mass: Addison-Wesley, 1956.

Bandura, A. Social learning theory. Englewood Cliffs, N.J.: Prentice-Hall, 1977.

Bloom, B., Englehart, M., Furst, E., Hill, W., and Krathwohl, D., Taxonomy of educational objectives. In N. Gage and I. Berliner, Educational Psychology. Chicago, Ill: Rand McNally, 1974.

Borgatta, E. and Stimson, J. Sex differences in interaction characteristics. Journal of Social Psychology, 1963, 60, 89-100.

Bork, A. Interactive learning. In Taylor, R. (Ed.). The computer in the schools: Tutor, tool, tutee. New York: Teachers' College Press, 1980.

Bossert, S.T. Tasks and social relationships in classrooms. Cambridge, Mass: Cambridge University Press, 1979.

Brookover, W.B. and Erickson, E.L. Society, schools, and learning. Boston, Mass: Allyn and Bacon, 1969.

Charp, Sylvia. Trends-time-sharing, microcomputers-networking. Technological Horizons in Education Journal, 1983, 1, 82-83.

Cook, H. and Stingle, S. Cooperative behavior in children. Psychological Bulletin, 1974, 81 (2), 918-933.

Cox, D. Early adolescent use of selected problem-solving skills using microcomputers. Michigan: University of Michigan, 1980. (ERIC Document Reproduction Service No. ED 200449).

Crockenburg, S., Bryant, B., and Wiles, L. The effects of cooperatively and competitively structured learning environments on intra- and interpersonal behavior. Child Development, 1976, 47, 386-396.

DeVault, M. Chapter VIII. Computers. In E. Fennema (Ed.) Mathematics education research: Implications for the 80's. Alexandria, Va.: Association for Supervision and Curriculum Development, 1981.

Dixon, W. and Brown, M. (Ed.) Biomedical computer programs P-series. Berkeley, Calif: University of California Press, 1979.

Edwards, J. How effective is CAI? A review of the research. Educational Leadership, 1975, 33, 147-153.

Frederickson, J., Warren B., Gillote, H. and Weaver, P. The name of the game is literacy. Classroom Computer News, 1982, May/June, 23-27.

Fox, D. The research process in education. New York: Holt, Rinehart and Winson, 1969.

Gagne, R. The condition of learning. New York: Holt, Rinehart, and Winston, Inc., 1977.

Getzels, J. and Thelen, H. The classroom as a unique social system. In N.B. Henry (Ed.) Yearbook National Society for the Study of Education. Chicago, Ill: University of Chicago Press, 1959.

Golton, R., The effects of student interaction of computer-assisted instruction in mathematics at the sixth grade level. Unpublished doctoral dissertation. Berkeley, Calif.: University of California-Berkeley, 1975.

Hawkins, J., Sheingold, K., Gearhart, M., and Berger, C. Microcomputers in schools: Impact on the social life of elementary classrooms. Technical Report. New York: Center for Children and Technology, 1982.

Hartup, W., Glazer, J. and Charlesworth, R. Peer reinforcement and sociomentric status. Child Development, 1967, 38, 1017-1024.

Hoban, C., Educational technology and human values. AV Communication Review, 1977, 25 (3), 221-242.

Hunter, B., Seidel, R. and Hargun, F. Assessing the impact, benefits, limitations, and costs on computer innocations in education. (ERIC Document Reproduction Service No. ED 208 852, 1979).

Jamison, D., Suppes, P. and Wells, S. The effectiveness of alternative instructional media: A survey. Review of Educational Research, 1974, 44, 1-67.

Johnson, D.W. Group process: Influences of student-student interaction on school outcomes. In L. Macmillan (Ed.) The social psychology of school learning. New York: Academic Press, 1980.

Johnson, D.W. Student-student interaction: The neglected variable in education. Educational Researcher, 37, 1981.

Johnson, D.W. and Johnson, R. Learning together and alone. Englewood Cliffs, N.J.: Prentice-Hall, 1975.

Johnson, D., Johnson, R., Johnson, J. and Anderson, D. Effects of cooperative versus individualized instruction on student pro-social behavior, attitude toward learning and achievement. Journal of Educational Psychology, 1976, 68 (4), 446-452.

Johnson, D., Johnson R., and Bryant, B. Cooperation and Competition in the classroom. Elementary School Journal, 1973, 74, 172-80.

Johnson, D., Johnson, R. and Skon, L. Student achievement on different types of tasks under cooperative, competitive, and individualistic condition. Contemporary Educational Psychology, 1979, 4, 99-106.

Kearsley, G., Hunter, B. and Seidel, R. Two Decades of Computer-based instruction projects: What have we learned. T.H.E. Journal, 1983, 90-94.

Kulik, J., Bangert, R. and Williams, G. Effects of Computer-based teaching on secondary school students. Journal of Educational Psychology, 1983, 75 (1), 19-26.

Kulik, J., Kulik, C., and Cohen, P. Effectiveness of computer-based college teaching: A meta-analysis of findings. Review of Educational Research, 1980, 50, 525-544.

Lazarowitz, R., Sharan, S. and Steinberg, R. Classroom learning style and cooperative behavior of elementary school children. Journal of Educational Psychology, 1980, 72, 97-104.

Lewis, M. and Rosenblum, L. (Eds.) Friendship and peer relations. New York: John Wiley and Sons, 1975.

Lipkins, J.P. Equity and microcomputer use in education. Washington, D.C.: NIE, 1983.

Lipson, J. Multiple-vision for school improvement. In Pitts, M. (Ed.) A bright promise, but a dim future. Council for Educational Development and Research, Washington, D.C., 1981.

Lockheed, M., & Hall, P. Conceptualizing sex as a status characteristic: Applications to leadership training strategies. Journal of Social Issues, 1976, 32 (3), 111-124.

Lockheed, M. The modification of female leadership behavior in the presence of males. Research in Education, 1975 (Abstract).

Loop, L. and Christensen, P. Exploring the microcomputer learning environment. Report No. 5. San Francisco, Calif.: Far West Laboratory, 1980.

Maccoby, E., and Jacklin, C. The psychology of sex differences. Stanford: Stanford University Press, 1974.

Magidson, E.M. Student assessment of PLATO: What students like and dislike about CAI. Educational Technology, 11, 1978.

Malone, T. What makes things fun to learn? A study of intrinsically motivating computer games. Palo Alto, Calif: Palo Alto Research Center, 1980.

McGrath, J. and Altman, I. Small group research: A synthesis and critique of the field. New York: Holt, Rinehart, and Winston, Inc., 1968.

McIsaac, D. Impact of personal computing on education. Association for Educational Data Systems Journal, 13 (1), 1979, 7-16.

McMillan, L. The social psychology of learning. New York: Academic Press, 1980.

Medley, D., and Mitzel, H. Measuring classroom behavior by systematic observation. In N.L. Gage (Ed.), Handbook of research on teaching. Chicago: Rand McNally, 1963.

Murphy, R., and Appel, L. Evaluation of the PLATO IV computer-based educational system in the community college. Educational Testing Service, Princeton, N.J., June, 1977.

Nie, N., Hall, C., Jenkins, J., Steinbrenner, K., and Bent, D., Statistical packages for the social sciences (2nd ed.). New York: McGraw-Hill, 1975.

Nilles, J. A technical assessment of personal computers Volume I: Summary. (ERIC Document Reproduction Service No. ED 202452).

Okey, J. and Majer, K. Individual and small group learning with computer-assisted instruction. Audiovisual Communication Review, 1976, 24, 79-86.

Pitts, M. and Schneider, E. (Eds.) A bright promise, but a dim future. Council for Educational Development and Research, Washington, D.C., 1981.

Pepitone, E.A. Children in cooperation and competition. Lexington, Mass.: D.C. Heath and Co., 1980.

Reid, J., Palmer, R., Whitlock, J. and Jones J. Computer-assisted instruction performance of student pairs as related to individual differences. Journal of Educational Psychology, 1972, 65, 65-73.

Sagan, M., and Pickert, S. Cross-sex and same-sex dominance in a cooperative group task. ERIC 186090, 1979, 14.

Schmuck, R. Peer groups as settings for learning. Theory into Practice, 16 (4), 1977.

Scott, W.A. Reliability of content analysis: The case of nominal coding. The Public Opinion Quarterly, 1955, 19 (3), 321-325.

Sharan, Shlomo. Cooperative learning in small groups: Recent methods and effects on achievement, attitudes, and ethnic relations. Review of Educational Research, 1980, 50, 241-272.

Sharin, K. and Moely, B. Sex differences in competition-cooperation behaviors of eight year-old children. (ERIC Document Reproduction Service No. ED 096015, 19[illegible].

Simon, A., and Boyer, E. Mirrors for behavior. An anthology of observation instruments continued, Vol. B. Philadelphia, PA: Research for Better Schools, Inc., 1970.

Slavin, R. Cooperative learning. Review of Educational Research, 1980, 50, 315-342.

Slavin, R. Classroom reward structure: An analytic and practical review. Review of Educational Research, 1977, 47, (4), 633-650.

Smith, I. Impact of computer-assisted instruction on student attitudes. Journal of Educational Psychology, 1973, 64 (3), 366-372.

Sowell, E. and Casey, R. Research methods in education. Belmont, Calif.: Wadsworth Publishing Co., 1982.

Sutter, E. and Reid, J. Learner variables and interpersonal conditions in computer-assisted instruction. Journal of Educational Psychology, 1967, 60, 153-157.

Swing, S. and Peterson, P. The relationship of student ability and small group interaction to student achievement. American Educational Research Journal, 1982, 19 (2), 259-274.

Tennyson, R. Interactive effect of cognitive learning theory with computer attributes in the design of computer assisted instruction. Journal of Educational Technology Systems, 1981-82, 10, (2), 175-185.

Thomas, D. and McClain, D. Selecting microcomputers for the classroom. Association for Educational Data Systems Journal, 1979, 13 (1) 55-68.

Wager, W. Design considerations for instructional computing programs. Journal of Educational Technology Systems, 1981-82, 10 (3) 261-269.

Watts, D. Educat[illegible]r citizenship in a computer-based society. In Seidel, R., Anderson, R., Hunter, B. (Eds.). Computer literacy. New York: Academic Press, 1982.

Webb, N. A process-outcome analysis of learning in group an individual settings. Educational Psychologist, 1980, 15 (2), 69-83.

Webb, N. Student interaction and learning in small groups. Review of Educational Research, 1982, 52 (3), 421-445.

Winer, B. Statistical principles in experimental design. New York: McGraw-Hill, 1974.

APPENDICES

APPENDIX A

SUN PRAIRIE PUBLIC SCHOOLS
SUN PRAIRIE, WISCONSIN 53590 PHONE (608) 837-2541

February 9, 1983

Dear Parents,

Our sixth grade math classes have been invited to participate in a student interaction-activities while working with microcomputers. The cooperative learning activities will be conducted under the direction of Mary A. Vereen, a doctoral student at the UW-Madison in conjunction with , our sixth grade math teacher.

The microcomputer-support activities will have two settings each requiring 15 minutes of students time. The educational games will have the children balancing mathematical equations with an accumulation of points awarded. Students that have participated in the activities have enjoyed them. They have indicated their small group work has been fun and challenging.

The outcomes we wish to accomplish are that the mathematical skill can be learned and reinforced by the enrichment activities. The student small group activities will provide constructive interaction which will help teacher select and structure related learning patterns in future programming.

In order for your child to participate in this study, you must sign and return the permission request form to Mr. at Elementary School by February 15, 1983. If you have any questions, please contact Mr. at .

Sincerely,

Mary A. Vereen

Mary A. Vereen

6th grade math teacher

EC:djw

Principal

I grant permission for my child _____ to participate in the microcomputer-supported activities discussed in your letter.

_____

Parent's Signature

PLEASE RETURN BY TUESDAY, FEBRUARY 15, 1983.

APPENDIX B

STUDENT INTERACTION OBSERVATION RECORD

Categories	Verbal	Nonverbal
1 - 11	1 Self-oriented: gives facts, evaluates one's work, rhetorical questions Examples: Mine stinks. I can't decide. . . What can I do? Definition: these are work oriented comments	11 Self-oriented: gazing intently at screen, pointing at screen, leaning toward computer
2 - 12	2 Besting: comparative statements that clearly raise one's own value at the expense of the other Examples: I'm winning. Mine is better than your. Can't you build a better equation? Look at mine. Definition: these are behaviors that move the child closer to his goal at the expense of the other child.	12 Besting: looking at other triumphantly when finished, moving away from partner, clapping hands when finished first, patting other on head
3 - 13	3 Other oriented: offers suggestions, gives directions, gives information, asks other child for his decision Examples: Let's start the game here. What do you want to do? What did you get? Put it over here.	13 Other oriented: manually helps other child operate equipment, shows other how to do something, eye contact with other

Definition: any behavior that can be said to facilitate work and/or aid the other; these behaviors must be judged to require a consideration of the other's expectations, demands, feelings, or opinions.

Categories		Verbal		Nonverbal
4 - 14	4	Negative behavior: refusal to give help or provide information, insult other Examples: You are stupid. No, I won't. Definition: these are anti-social acts toward other child which might hurt the child psychologically or physically.	14	Negative behavior: rolls eyes at other, snatches controls from other, looks away angrily
5 - 15	5	Positive behavior: encourages other child, praises other child, jokes with other child Example: I know we can do it. I know you can do it. Come on! That's it. Definition: these behaviors please or reward the other child.	15	Positive behavior: smiles at other child, nods head in agreement with other child
9		Nonspecific behavior: this is behavior that is not coded under any of the other categories.		
10		Silence or Confusion: this is self explanatory. When coding from the videotapes, always begin with 10 and end with 10. Use 10 whenever there is, of course, silence or confusion.		

Summary of Conventions for Coding

Self-oriented	1 GF = gives facts	11 GI = gazing intently
	1 EV = evaluates one's own work	11 PS = pointing at screen
	1 TC = talking to computer	
Besting	2 CS = comparing oneself to other	
	2 CO = criticizing other's work	
	12 LT = looking at other triumphantly when finished	
	12 PO = patting other on back or head	
Other-oriented	3 OS = offering suggestions	
	3 GD = giving directions	
	3 GI = giving information	
	3 AD = asking other child to help make decision	
	13 MH = manually helps other child operate computer	
	13 DS = demonstrates to other how to do something	
	13 EC = making eye contact with other, nonthreatening	
Negative Beh.	4 RG = refusal to giver help to other	
	4 RI = refusal to provide information	
	4 IO = insulting other	
	14 EM = eye movement that is threatening such as rolling the eyes	
	14 SC = snatches controls from other or takes turn away from other	
	14 LF = looking away from other angrily or with frustration with other	
Positive Beh.	5 EO = encourages other child	
	5 PO = praises other child	
	[illegible] 0 = joking with other child	
	[illegible] 50 = smiling at other child	
	15 NH = nods head in agreement with other child	
Nonspecfic Beh.	9 (placing hand under chin, or any behavior not specified)	
Silence or Confusion	10	

Names _____

Activity _____

TALLY SHEET

Matrix of Student Interaction

Pair : M or F

Activity : Comp or Coop

	1	11	2	12	3	13	4	14	5	15	9	10	Total	%	
1															
11															
2															
12															
3															
13															
4															
14															
5															
15															
9															
10															
2															
6															

APPENDIX C

Name _____ Activity _____

Circle One: Boy Girl Date _____

The statements below give you a chance to say how you feel about working in small groups with microcomputer-supported activities and what you did when you were working in small groups. There are no right or wrong answers. The only answer is the one that is right for you. Read each statement carefully before choosing an answer.

Directions: Circle the words beneath each sentence that best describes your microcomputer experience.

1. I asked my partner for help.

   Never Hardly ever Sometimes Always Don't know

2. I disliked working with a partner.

   Never Hardly ever Sometimes Always Don't know.

3. I helped my partner operate the computer and paddles.

   Never Hardly ever Sometimes Always Don't know.

4. I said things that hurt my partner's feelings.

   Never Hardly ever Sometimes Always Don't know

5. I refused to give ideas and suggestions to my partner.

   Never Hardly ever Sometimes Always Don't know

6. I had better ideas than my partner.

   Never Hardly ever Sometimes Always Don't know

7. I wanted my partner and me to do a good job.

   Never Hardly ever Sometimes Always Don't know

8. I liked working with a partner.

   Never Hardly ever Sometimes Always Don't know

9. I wanted to be better than my partner.

   Never Hardly ever Sometimes Always Don't know

10. I had just as many good ideas as my partner had.

    Never Hardly ever Sometimes Always Don't know

11. I tried to keep my partner from doing a good job.

    Never Hardly ever Sometimes Always Don't know

12. I ignored my partner's ideas and suggestions.

Never Hardly ever Sometimes Always Don't know

13. I worked harder than my partner.

Never Hardly ever Sometimes Always Don't know

14. I told my partner when he/she was doing a good job.

Never Hardly ever Sometimes Always Don't know

15. I made sure that I didn't hurt my partner's feelings.

Never Hardly ever Sometimes Always Don't know

16. I agreed with my partner's decisions.

Never Hardly ever Sometimes Always Don't know

17. I praised my partner for doing a good job.

Never Hardly ever Sometimes Always Don't know

18. I worked just as hard as my partner worked.

Never Hardly ever Sometimes Always Don't know

19. I gave my partner help in any way I could.

Never Hardly ever Sometimes Always Don't know

20. I made fun of my partner's mistakes.

Never Hardly ever Sometimes Alwa Don't know

21. I disagreed with my partner's decisions.

Never Hardly ever Sometimes Always Don't know

22. I kept my partner from operating the microcomputer.

Never Hardly ever Sometimes Always Don't know

23. I would describe this experience with a partner as

Very good Good Not so good Bad Don't know

24. The game that was played was:

Very easy Easy Hard Very Hard Don't know

25. I would say that being videotaped bothered me:

A whole lot, most of the time | A lot, some of the time | At first, but not later | Forgot about it, most of the time

PART II

Directions: Answer each question as completely as you can.

26. Would you like to work in pairs with microcomputers in your classroom? If your answer is yes, tell why.

27. What would you say was the best thing that happened when you worked along side of a partner?

28. What would you say was the worst thing that happened when you worked along side of a partner?

PART II

Directions: Answer each question as completely as you can.

26. Would you like to work in pairs with microcomputers in your classroom? If your answer is yes, tell why.

27. What would you say was the best thing that happened when you worked along side of a partner?

28. What would you say was the worst thing that happened when you worked along side of a partner?

29. Which activity did you like better? Circle only one.

A. Working together

B. Working against each other

APPENDIX D

TABLE 4.1
Observed Behavioral Acts of Male and Female Pairs in a Cooperative Instructional Contexts within a Microcomputer Environment

Pairs	Self-Oriented		Besting		Other-Oriented		Negative		Positive		NS	S	Total
	* V	** NV	V	NV	V	NV	V	NV	V	NV			
Male													
1	22	155	0	0	114	0	0	0	4	0	29	1	325
2	40	60	0	0	194	0	1	4	14	2	4	1	320
3	39	108	6	0	165	0	3	2	6	2	9	1	341
4	38	142	0	0	105	1	0	0	7	0	11	0	304
5	54	94	6	0	126	1	0	0	29	1	6	2	319
6	49	110	1	0	97	0	0	0	13	1	3	1	275
7	45	104	3	0	65	0	0	1	1	0	28	0	247
8	49	122	5	0	123	1	1	0	4	0	8	1	314
9	49	127	1	0	151	1	1	0	3	2	5	0	340
10	34	125	0	0	89	0	0	1	5	0	1	2	257
Total	419	1147	22	0	1229	4	6	8	86	8	104	9	3042
Female													
1	29	199	0	0	78	0	0	0	6	0	12	1	325
2	11	165	0	0	106	0	0	0	3	1	5	1	292
3	26	110	1	0	126	0	0	0	9	0	35	1	308
4	52	122	0	3	41	2	0	1	10	0	18	1	250
5	45	146	1	0	159	1	0	0	12	8	7	1	380
6	33	61	0	0	179	1	0	0	9	3	0	1	287
7	66	112	5	0	168	1	0	0	14	3	5	1	375
8	67	78	0	0	100	1	0	0	0	13	1	1	261
9	63	60	6	0	167	0	1	0	4	1	1	1	304
10	27	176	0	0	32	2	0	0	1	0	16	1	255
Total	419	1229	13	3	1156	8	1	1	68	29	100	10	3037

* Verbal behavior
** Nonverbal behavior

TABLE 4.2
Observed Behavioral Acts of Male and Female Pairs in a Cooperative Instructional Contexts within a Micrcomputer Environment

Pairs	Self-Oriented		Besting		Other-Oriented		Negative		Positive		NS	S	Total
	* V	** NV	V	NV	V	NV	V	NV	V	NV			
Male													
1	141	76	1	0	30	0	0	0	10	0	4	1	263
2	75	95	7	0	113	0	4	0	0	0	5	1	300
3	47	215	6	1	31	0	0	0	0	0	7	3	310
4	93	94	2	0	25	0	2	0	0	0	6	1	223
5	18	272	2	2	9	0	2	0	0	1	6	0	312
6	73	181	0	0	18	0	0	0	0	0	5	1	278
7	27	312	1	0	10	0	0	0	0	0	1	1	352
8	93	162	8	0	40	0	0	0	0	0	2	1	306
9	93	119	13	0	69	1	4	0	0	1	5	1	306
10	63	179	2	0	24	0	0	0	1	0	3	1	273
Total	723	1705	42	3	369	1	12	0	11	2	44	11	2923
Female													
1	60	280	8	2	30	1	1	0	0	4	7	1	394
2	160	138	7	0	37	0	0	0	5	1	3	1	352
3	74	107	7	0	39	0	0	0	1	0	1	1	230
4	37	228	1	0	28	0	0	0	0	0	10	1	305
5	35	279	2	0	27	0	0	0	0	0	11	2	356
6	13	288	0	0	23	1	0	0	0	2	5	1	333
7	43	218	1	0	22	1	0	0	0	2	4	1	292
8	107	67	16	0	67	0	2	0	0	0	1	1	261
9	117	149	11	0	24	0	3	0	0	0	7	1	312
10	52	262	2	0	138	0	5	1	13	0	54	1	528
Total	698	2016	55	2	435	3	11	1	19	9	103	11	3363

*Verbal behaviors
**Nonverbal behaviors

Appendix D

TABLE 4.4

Means and Standard Deviations of Two Administrations of Student Self-Evaluative Questionnaire By Sex and Context

Item	Cooperative				Competitive			
	Male		Female		Male		Female	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
1	2.05	.79	2.05	.49	2.20	.48	1.70	.78
2	3.10	.99	3.35	.85	3.00	.52	3.60	.65
3	1.95	.98	2.10	.73	1.30	.71	1.60	.56
4	3.45	.72	3.35	1.05	3.50	.47	3.50	.81
5	3.15	.88	3.15	1.02	2.95	.98	3.15	1.10
6	1.65	.81	1.80	.67	1.90	.61	2.05	.89
7	3.90	.21	3.85	.337	3.45	.89	3.80	.35
8	3.30	.71	3.65	.24	3.15	.85	3.85	.33
9	2.20	1.08	2.30	.88	2.20	1.05	2.40	.90
10	2.75	1.25	2.85	.78	2.60	1.04	2.40	.73
11	3.25	1.29	3.35	.94	2.70	.63	3.40	.69
12	2.50	.94	3.55	.36	2.80	.78	3.25	1.00
13	1.45	1.23	1.90	1.02	1.90	.77	1.65	.94
14	3.05	1.03	2.95	.86	2.75	.79	2.60	.94
15	2.85	.97	3.40	.77	3.00	.85	3.75	.63
16	3.00	.57	3.25	.35	2.75	.67	2.85	.70
17	1.95	1.14	2.55	.79	2.25	.58	2.75	.97
18	2.45	1.27	3.00	.78	2.40	.93	3.00	.88
19	3.45	.64	3.10	.99	3.00	.66	2.55	1.23
20	3.20	1.11	3.75	.35	3.20	.91	3.65	.41
21	2.65	.53	3.10	.65	2.55	.86	2.90	.87
22	3.60	.65	3.90	.21	3.45	.83	3.40	.87
23	2.95	.83	3.35	.62	3.20	.53	3.35	.66
24	2.60	.56	2.20	.78	2.10	.87	2.70	.67
25	3.55	.49	3.40	.56	3.60	.45	3.66	.50

APPENDIX E

Table 4.30

Split-Plot Analysis of Variance of Self-oriented Subscale For Students' Perceptions of Their Microcomputer Experiences

Source	SS	df	F	h^2
Between Ss	18.22	1	.97	
Sex	18.22	1	.97	
Error	339.25	18		
Within Ss				
Context	13.22	1	1.61	
Interaction	.22	1	.03	
Error	148.05	18		

$p < .05$

Table 4.31

Split-Plot Analysis of Variance of Besting Subscale for Students' Perceptions of Their Microcomputer Experiences

Source	SS	df	F	h^2
Between Ss				
Sex	6.40	1	.49	
Error	235.00	18		
Within Ss				
Context	6.40	1	.44	
Interaction	3.60	1	.25	
Error	259.00	18		

$p < .05$

Table 4.32

Split-Plot Analysis of Variance of Other-Oriented Subscale For Students' Perceptions of Their Microcomputer Experiences

Source	SS	df	F	h^2
Between Ss				
Sex	7.22	1	.45	
Error	287.25	18		
Within Ss				
Context	55.22	1	11.01*	.45
Interaction	2.02	1	2.20	
Error	90.25	18		

*p < .05

Table 4.33

Split-Plot Analysis of Variance of Negative Subscale For Students' Perceptions of Their Microcomputer Experiences

Source	SS	df	F	h^2
Between Ss				
Sex	12.10	1	.86	
Error	251.90	18		
Within Ss				
Context	.10	1	.02	
Interaction	.40	1	.08	
Error	87.50	18		

*p < .05

Table 4.34

Split-Plot Analysis of Variance of Positive Subscale for Students' Perceptions of Their Microcomputer Experiences

Source	SS	df	F	h^2
Between Ss				
Sex	46.22	1	2.88	
Error	289.05	18		
Within Ss				
Context	1.22	1	.09	
Interaction	.02	1	.00	
Error	236.25	18		

*p < .05

APPENDIX F

DUELING DIGITS

Here are your instructions:

To control your scarab number-collection machine you must use the paddles or a joystick. Your object is to shoot the floating numbers and mathematical operands and place them down below in a balanced mathematical expression such as 234 + 14 = 248. The computer is not particular about where you leave blank spaces, so it would also accept 2 34+1 4=2 48. Operands may be on either side of the "=" sign and the result may equal zero.

Here are some examples of legal equations:

2 + 36 = 38 45 = 15 x 3

36 + 10 = 40 + 6 0 = 45 + 4 - 49

To begin an equation, press the paddle button to shoot a number, then move your scarab down below the main screen and drop your number in one of the slots available. If you accidentally pick up a number or operand you do not want, you must position yourself above the "garbage" hole toward the bottom center of the screen, then press the paddle button to drop the unwanted digit. If at any time you accidentally drop a number or operand in the wrong place so that your expression shows little chance of balancing, move your scarab as close to the bottom center of the screen as possible and press the paddle button. This will release all of your numbers and allow you to start over.

The scarabs to the side indicate how many machines you have

left. In the one player version each side starts with ten machines. A direct hit to your opponent will give you 5 points and cause the side that's hit to lose one machine. In the two player version each side starts with five machines. A hit will score 5 points. If the side hit is holding a number or an operand, it will be lost. Each time you complete an equation you will gain an additional machine and your opponent will lose one. It pays to work fast!

The scoring is as follows:

The four operands are "+", "-", "x", and "/", representing addition, subtraction, multiplication, and division. These are worth 1, 2, 3, & 4 points respectively. The computer goes through a completed equation, adds the value of the operands, and multiplies the total by 10. Higher scores are gained by using many operands in each equation.

Pressing CTRL S will turn the sound effects off and on.

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APPENDIX G

Context: Cooperative
Pairing: Male

R - There's a six. Oooh! There's a times.

(R - turning controls, smiling, L - gazing intently at screen.)

(L - taking game very seriously)

[L - moves head and shoulders when handling controls.]

R - Got it!

(R - a small smile)

[Both gazing at screen]

R - Let's see - seven - seven - seven hit! aw there's a six.

(Both gazing at screen. R - smiling some)

(L - draws in quick breath. Both gazing intently)

[Both gazing at screen.]

R - Get him back. he - he aw.

(L - moves head and shoulders when moving controls)

(R - big smile)

[R & L laugh]

L - How about 7 x 7.

(Both smiling)

R - aw. Got a zero.

(L - shakes head) (B - gazing at screen)

L - whoop can't - - -

(L - moves head and shoulders again while moving controls)

L - 7 x 1 five what a shot.

[Both are laughing]

R - oo the seven - get the seven.

(Both smiling while L puts umph into moving controls)

R - oops alright. R & L - aw!! L - Killed us.

(R - lifts shoulders wrinkles noses)

(L - squirms in chair) [Both gazing at screen]

R - he he - killed him

(R - smiling. L - still using a lot of force with controls)

L - Hey, we beat him.

(L - scratches shin. R - press keyboard)

[Both are gazing at screen. L - reaching over to controls]

R - Minus - it's 20 points that's still not good.

(R - looks away from screen.)

(Both gazing intently at screen)

L - shoot.

(Both gazing intently at screen)

L - Oh - seven - seven.

(L - licks lips and swallows)

R - three

They don't do too much of anything.

L - Let's make like one.

R - Okay.

(Both gazing at screen)

[R - scratches back.] [R - touches head]

L - six. R - Yeah, we just lost a six.

(R - scratches chin with finger)

L - There's one. R - Oh.

(Both gazing intently at screen) (R - puts a little umph into pressing

controls).

L - a ten. R - Oh.

(R - resting finger on chin, licks lips)

L - Hey. R - you got a times.

(L - gazing at screen intently)

[R - smiling some]

(R - rubs ear and back of head]

R - Oh let's times it - seven minus one times six.

(R - looks at L to see if he agrees) (R - also points to screen)

L - Seven minus one - six times six. R - Is.

(L - gazing intently at screen, blinks eyes)

L - It'll end upd being six times six.

(R - puts hand close to head)

R - Gotta gotta - there - there.

(R - wants to show L how to do it)

L - So equals.

(Both gazing at screen)

[R - smiling some]

L - Good shot.

(R - blinks eyes)

L - What we get? Oh good for 36.

(R - licks lips. L - blinks eyes) (R - wrinkles nose)

R - No - move it more over there.

(R - points to screen)

R - Yeah, right that's ---- pretty good.

(R - squirms a little in chair--smiles)

L - three.

(R - lifts right shoulder.)

[Both gazing intently at screen]

L - Now all we need is a equals.

(L - gazing at screen turning controls)

(R - smiling slightly.)

(L - there it is too. You've got it.

(L - smiling just a little)

L - sixty points ---- what you get?

(Both slightly smiling)

(L moves head and shoulders forward a little)

L & R - Nine.

[R - smiling] [L - moves head and shoulders back]

R - Oh. L - times. R - No, nothing

(R - wrinkles nose a little) (R - smiling a little.)

(L - moves in chair)

L - nine again nine times nine. R - Yeah eighty-one.

(Both gazing at screen)

L - There's our times.

(R - smiling a little, swallows)

[R - brings head forward laughing]

L - There's our equals.

(Both gazing at screen)

(L - blinks eyes, R - smiling)

R - Man we're getting almost everything right away!

(Both smiling)

[Both gazing at screen] [R - squinting eyes some and smiling some]

L - There's our eight - there's our one. R - Oh.

(L - blinks eyes)

(R - brings head back a bit)

L - There's our eight. R - Whew.

(R - draws in a quick breath, smiles. L - moves head)

[Both gazing intently at screen]

R - Good.

L - There's our one.

(Both gazing intently at screen)

R - That was. L - That was our fastest one I've ever got.

R - Yeah, really)

(Both smiling slightly) (L - rubs his hands together.) (Both still smiling)

L - 105 we got. L - Five - - - - - - - - -

(R - rubs nose with finger)

R - Excuse me. L - Four you see it four.

(R - turns from screens and sneezes) (R - smiling)

L - You were going for the four and you hit him.

R - Eight's not bad.

(Both smiling) (R - turns head just a bit)

L - Equals. You might as well as get an equals.

(R - blinks eyes and smiles)

R - Yeah, I know right away. You see three spaces. It goes 3-yeah - Well - who cares, really.

(L - scratches nose)

(R - smiling) (L - still scratching nose)

(R points to the screen)

L - eight times what do you get.

R - eight plus

(R - shakes head some and shrugs shoulder)

(R - blinks eyes)

R - eight plus.

L - eight plus - okay. Try again.

R - eight plus five would be hurry!

(R - smiling)

(Both gazing at screen) (R - smiling)

R - Oh well.

L - What's that?

(R - shakes head)

R - Let's see another plus, we could do that.

(Both gazing intently at screen)

L - We don't have enough room.

R - Yes, we do.

L - No we don't.

R - Oh, I guess not.

(R - smiling some) (R - blinks eyes) (R - sorta makes a frowning face)

L - Might as well get the three or the two or something.

(Both gazing at screen. R - blinks eyes)

L - Hit it. R - two, well who cares.

(R - smiles some - shakes head a little)

L - There's our one.

R - Hey we could get 27 or something like that.

(R - puts hand of hair and forehead)

(R - smiling, L - gazing intently at screen).

L - 7.

R - Put a 7 there - that would be 35.

(R - points to screen.)

L - Oh, okay, I see what you mean.

(L - rubs hands together)

L - Who's that horse?

(Both gazing at screen. R - smiling some)

L - Three. R - There's a three. Oh.

(Both gazing intently at screen) (R smiling)

[Both gazing intently at screen)

[R - moves shoulder]

R - Get the five aw! Alright!

(R - smiles licks lips)

(R - big smile)

[R - laughs rubs cheek]

[L - looks down at control]

L - I got a six. R - Oh, I didn't even see you had it.

(Both gazing at screen) (R - smiling)

[R - laughing]

[Both have hands on controls]

[L - smiling]

[Both gazing intently at screen]

[R - blinks eyes]

[L - moves head and shoulders while pushing controls]

(Both gazing at screen)

L - Hey - six?

[Both gazing at screen]

R - Aw . . . . . six well. L - Now

(R - licks lips, smiling blinks eyes).

R - Now. Well, no that would be 12.

(R - looks at L) (L - gazing at screen intently)

R - there's a one.

[L - moves head and shoulders when pushing controls]

[R - smiles]

R - Two well that's twelve.

(Both gazing at screen) (R - smiles)

L - Hit it same thing. R - Did we get a two wait - there.

(Both gazing at screen)

(Both gazing at screen) (R - blinks eyes)

L - Oh. Got 15. R - Fifteen.

(Both move a little in their chairs)

L - Might as well get an equals. Oops. What's that

(R - has big grin on face) (L - presses keys)

R - Lucky shot. I just tried to get the equals.

(Both gazing at screen) (R - smiling) (Both smiling a little)

L - Oh, twelve. R. No ------- we're right next to the equals.

(R - points to screen, moves head)

[R - laughs puts a little umph into pushing controls]

R - Oh, we got a one. Put twelve equals don't need that.

(L gazing intently at screen) (R - turns head a little and blinks eyes)

[R - reaches down and scratches leg]

L - Oh ---------

(R - laughs, looks at L) (L - blinks eyes.)

[R - smiling]

R - Get a plus sign.

(Both gazing at screen)

L - times can always take it times.

(Both have serious looks on face)

[Both have serious looks on face]

R - Got a plus. L - Good job.

(R - moves head and shoulders when pushing controls)

R - Now let's see 17. L - Good shot.

(R - moves around in chair)

(Both gazing at screen)

[L - smiles while R uses a little umph to press controls]

L - there's only one. R - Aw nine two less than.

(R - disappointing look on face, blinks eyes) (R - now smiling)

[Both gazing at screen.]

L - There's our one.

(Both gazing at screen.)

R - Oh good. Now all we need is a 7.

(R - smiling some)

R - Oh, there's a six. L - ooo

(R - blinks eyes) (Both gazing at screen while R points to screen)

R - there it is, there is it. L - aw, I see it.

R - A got a five.

L - Right when we come out--shoot him. Okay?

(R - moves in chair sorta frowning face)

(R - smiling. L - gazing at screen)

R - That was good.

L - Hey, let's do from now on.

(Both laughing)

(Both smiling while R looks at keyboard and then out at somebody else)

R - That was pretty fun. Just comes out.

L - Okay. R - Okay from now on let's do that as soon as he comes out let's shoot at him.

(L - rubs cheek, R makes motion with hands)

(Both smiling - having fun)

R - No, we can't though.

(Both smiling - L - looks away from screen)

L - Gee, got him anyway!

R - Yeah.

L - That's a good technique.

(Both smiling)

(Both gazing at screen)

R - Really - just waitstay down and

L - Oh, times 2.

(Both gazing at screen)

R - Oh, six -- we'll put six

(Both gazing at screen)

L - times

[R - rubs nose, touches cheek with hand]

R - Oh, eleven times six.

(R - looks at L)

R - No-right there. L - I can't. R - There.

(R points to screen) (L - gazing at screen)

L - Oh yeah.

[R - rubs nose] [blinks eyes]

L - shoot equals. R - Got it.

(Both gazing at screen, R's little finger rub chin) [R rubs nose]

L - Different turn. R. _ _ _ two sixes.

(Both gazing at screen)

[Both gazing at screen]

R - Oh man.

L - There we got two sixes.

(R - smiling)

R - Aw, turned a four right before I shot.

L - I know.

(R - moves in chair, smiles some)

(L - smiling some and shakes head)

[Both gazing at screen]

L - times oops

(Both gazing at screen)

[Both have serious look on face]

L - This is times hey - - - - changing.

[L - eyes blink. Both serious looks)

R - Aw, you just missed a six.

(R - rubs cheek)

L - There. R - Just missed another one.

(Both gazing at screen intently

L - There .

L & R. Got it.

R - Whew!

(Both move in chair; R - smiling)

L - 3 4

(gazing at screen)

R - Get a equal sign, get a 3--equal sign!!

(gazing at screen looking excited)

R - There's one guy out. Let me have one.

(L - snaps fingers in disgust)

L - Well, I got 70 points - didn't get any others.

(L - playing with necklace and hair)

R - Shoot!

L - Need a nine. Okqy! Don't get that division sign in there.

(Both gazing at screen)

R - Shoot! times 8

(L - playing with necklace again)

L 72 agaion, you're having problems with that before. 7! Aw, missed it!

(L - is laughing a little and playing with necklace)

R - Darn it!

(gazing at screen)

L - Should have the 2.

(gazing at screen)

R - that's what I was trying for.

(gazing at screen)

L - Oh, put it there

(L is showing R by pointing to screen)

R. Why?

R - times again?

L - Yea and then get a 1.

both gazing at screen and L is pointing at)

[L has hand under chin]

R. (ikes!)

[R sorta twisting her neck]

L - No, then go to the equal sign.

(L still hand under chin and points to screen)

R - Darn it!

(Both gazing at screen-- L hand under chin)

R - O! got minus sign! 7, where should I put it?

[Between talking R gasps, takes in a breath]

[L hand under chin]

L - No! Throw it away!

(L hand under chin, points to screen)

R - No cause 72, 72 x 9.

(R makes eye contact with L questioning L's remark)

L - Okay, 1, equal sign over there. Put it right there. Oh, that's good.

(L demonstrates to R how to do something)

(L puts hand under chin praising R)

R - Oh, do I need a two?

(Both gazing at screen. L has hand under chin)

L - Au gee's.

R - Come on, there's an equal sign. Go up to get it! Oh!

(R moves whole body in her chair)

L - Ohhh! Come on!

(L gets excited, claps hands and makes a slurping noise)

R - Darn, what did I get? The three

(Both smiling)

L - One, one too many, should had it before. No the other ones.

(L wringing hands)

R - Where's the equal sign? There it is! Okay, come on.

(R twisting head, L hands in chin)

L - Shoot the two, aw you missed it!

(Both gazing at screen)

R - Yes, one!

(R rolling eyes in disgust)

L - Ok one, that something

(L smiling while gazing at screen, agreeing)

R - equal sign get it get it.

(R eyes looking excited, L hand on chin)

(L pointing finger at screen)

L - Shoot it.

(Both gazing intently at screen)

R - Darn it, I got a 3 instead. I don't like threes. Come on what can I get let's see. equal sign good idea another one.

(R pushes up her glasses, turns upper part of body a bit)

(L looks away from screen laughing a bit)

L - oo! missed it, now what shall we do? Shoot Shoot! Aw change.

(L points at screen, acting a little nervous puy finger on mouth and then puts hands in front of her)

(L excitingly moves hands about--end up around her face)

R - Oh my god.

(R draws in breath, both gazing at screen while L still has hands around face)

L - This is his last guy, shoot him.

R - 0! I won!

(R draws back head, lifts eyebrows, makes sputtering noise with tongue. R manipulated computer and hands control over to L. L begins to play game. R turns head and looks at clock behind her.

L - I got 0.

(Both gazing at screen. R points at screen)

R - Take it like times, times, times.

(Both gazing at screen. R drops head on shoulders)

R - 1 drop it, get a times!

L - 0!!!

R - Minus oh! Drop it!

(L opens mouth in fright while R smiles from her friend's reaction)

(Both gazing at screen)

L - I think I got I got to play it.

(R sticks out her tongue. L's eyes looking excited)

R - Put the 4 in fron of the 1. 41 - 5.

(R getting anxious tells L what to do)

L: Naw! I got me.

(Both gazing at screen)

R. Two ah 41 - 2 is 39 so a 3 and a 9, there's 9.

(R puts head on top and behind head.

(L points at screen)

L - oo! o 1.

(L gets a surprised look on face. R smiles at computer)

R - Right there. Yea, you got get an equal sign and a 3.

(L and R gazing at screen while R points at screen)

[R wiping brow.]

L - I got a 6.

(L disgusting look on her face).

[Both gazing at screen]

R - Oh good. Try to jump right in front of the line. O! Good--get equals sign equal signs are hard to come by. You got it!

(L gazing at screen and manipulating control. R points at screen, gets a bit excited and points at screen again. R happy for her friend and sticks out tongue.

(L has both surprised and happy look on her face. R smiles and clears throat)

L & 4 - 40 points!

(L - is gazing intently at screen)

(L - has controls right close in front of her).

(L - very serious looking--doesn't hardly move except for hands on control) (eyes blink once in a while but does not take them off screen)

(R - also gazing at screen bites tongue and lip--draws in quick breaths)

R - Just can't wait for the no. 10.

(Both gazing at screen intently.)

(" " " " " .)

R - Ah--Oh, I got shot.

(R - smiles a bit) (R - bites lip)

(L - serious--looking)

(Both gazing intently at screen. R - biting lip)

R - uuuu

(R - squirms in chair)

L - Oh-oh--somebody got a four right on the blue pants? So I can't get rid of my screen.

(L - moves head forward a bit)

(R - gazing at screen)

(R - widens her eyes)

R - Move over--get down Karrie!

(R - surprised look on face)

(R - bites tongue--looking intently at screen)

(L - still real serious look on face)

R - Oh gees Oh!

(R - gets a big smile on face)

(R - looks away from screen for a moment, shakes her head no.)

(R - bites lip)

(L - gazing intently at screen)

R - What happened?

(R - smiles a little--L - moves head from side to side)

(Both gazing at screen, and maniplating controls. R - bites lip.)

R - Oh - Okay

(Both have eyes on screen--look serious)

(R - shakes head once in a while, makes odd movements with her mouth--bites lip--more expressions on face than L.)

(R - draws in quick breaths--licks her lips with tongue yet keeping eyes on screen)

(L's expressions do not change) (Only movement is her hands on the control--eyes fixed on screen.)

(R - sighs--moves lip a lot)

R - Ah - ha

(Both gazing intently at screen.)

(R - moves shoulders forward a bit. Licks lips with tongue)

(Both have eyes fixed on computer. L very intent)

R - What am I doing--I'm going over to your side.

(R - smiles a little while L doesn't move)

(Moves tongue and lips some)

R - Gee's

(R - moves her body some)

(R - continues to bite lip. Draws in quick breaths, makes little grunt and sighing noises, moves head forward, squirms in chair.)

[L - twitches her lip some.]

[Both gazing at screen and manipulating controls.]

R - oooh

(R - smiles some and shakes head No)

[L - moves lips, moves her shoulder very little and blinks eyes]

[R - continues to move lips and tongue a lot, put umph into the controls--a determined look in eyes]

(L - turns her attention and hands to keyboard)

R - Okay!

(R - scratches her arm.)

[L - returns her attention to screen and looks very seriious]

[L - moves lips some]

[L - bites lip a little and blinks eyes.]

[R - jerks head and shoulders some when manipulating controls. continues to lick lips with tongue--shakes her head No--opens mouth in O shape.]

(Both gazing intently at screen--also both nervously bite or twitch their lips.]

L. That's 3 points when I shoot those little things there.

(Both are gazing intently at screen)

(L - has controls close to herself)

(R - jerking head and shoulders some when manipulating controls.)

R - Really!

[R - drops R shoulder]

[Both gazing at screen]

R - I wanted that!

(R - smiles--turns into a little laugh)

[R - bites lip and makes other lip contortions.]

[R - responds with sighing noises]

[R - stretches her neck.]

[L - no--changes--blinks eyes once in a while.]

[R - makes slurping noise with mouth]

[R - shows a little excitement]

[R - sticks out tongue]

R - Oh, there's no equal signs.

(R - moves shoulders some and slightly smiles)

L - How come it didn't give me points.

(L - looking a little disgusted--also questioning look)

R - Oh, there's an equal sign--I just missed it.

(Both gazing intently at screen)

[R - makes a quick move on controls and draws in a breath.]

[L - biting lip a little.]

(R - lets a couple of disappointing sounds)

(L - still biting lip a little)

R - Oh - Ah!

[R - biting lip, nods head a couple of times, licks lip with tongue]

L - I got the whole thing but it's not

(L - blinks eyes some)

[R - makes sudden move.]

R - Oh gee's chaaange

(R - gazing intently, manipulates the control and bites lip)

[Both gazing at screen while R puts more effort into handling her control.]

R - It's not going to work.

(Both gazing intently at screen. R - smiles slightly)

[R - bites lip, licks lip with tongue, shakes head, and moves some in the chair.]

[L - bites lip a little.]

R - I don't even know what I got.

(Both gazing at screen while R smiles slightly.)

[R - continues to bit lips. R - also looks away from screen.]

[L - gazing intently at screen.]

L - Stupids guys are showing up.

(L - does not change her expression whatsoever)

[R - drops right shoulder some and snickers some.]

[Both gazing at screen intently.]

R - Hardest thing is to get the equal signs.

(Both gazing at screen)

[R - gets excited--lips go into an O shape.]

L - I always get them when I don't need them.

(R - lets out a laugh.)

(L - bites lip)

R - Great!

(R - smiling some--moves head back.)

(L - biting lip)

[R - looking excited, moves tongue and lips.]

L - You got it, didn't you?

(L - looks half-disgusting and very slightly smiles)

R - uh um!

(R - smile, shakes head, yes!.)

R - There's my no. 2

(R - draws in quick breath--gives some effort in pushing down controls)

R - Aw - okay - good.

(Both biting lips)

(R - jerks head when pressing controls)

[L - biting lip, R - counts to herself]

[R - biting lip a lot]

L - Oh! (disgustingly)

(L - wrinkles nose and frowns)

[R - licking lips with tongue)

[L - looks away from screen.]

[R - jerks head a lit, bites lip.]

R - Oh, my god! Look at all the guys.

(R - looks surprised.)

(L - moves hand from control to keyboard and back to control)

[L - looks away twice from screen]

[R - moves lip and tongue a lot and smiles]

[L - bites lip some]

[R - put shoulder and body movement into handling controls]

[R - makes O form with mouth]

[R - pushes check out with tongue, sniffle and sighs]

[R - bites lips]

L - Dumb zero!

(L - looks disgusted)

R - take it away?

(Both gazing intently at screen.)

[R - draws shoulders back]

[R - brings head forward for a closer look.]

[R - shakes her ead No and then rubs nose.]

[Both gazing intently at screen while R bites lip]

R - I don't know what I got.

[R - looks away from screen]

[R - uses little jerking motions to press control.]

R - 0-0- what did I get? I got a three can't get it over the garbage dumpthmm ooo I was going to go for it.

(both gazing at screen and Good-bye. L. squinting his eyes)

L. You need a one!

(both gazing intently at screen. L has smile on face.) R - Nooo. L. I don't understand.

(both gazing intently at screen)

R - 70 take 78

(R - lets out a snicker)

L - Hit ya.

(Lifts up eyebrows and smiles)

R - You did? L. I think so. R. No cause. I was down to my last one--I would have been gone now. L. Yea!

(R - questionable look on face; both are gazing and smiling at green)

L - What happened?

(L - has a puzzled look on face)

R - I can't shoot. Oh yea, now I can.

(R - rolls eyes trying to figure out what happened) (looks down at control

L - I don't even know hat I'm getting.

(Both are looking and concentrating on screen)

R - I'm going to get it, I'm going to win this time.

R - What are those little round circles. I shot one of them and all of a sudden it went r-r-r.. That's why I died!

(R - rolls his eyes and smiles)

L - 2 x . . . .

[Both gazing intently at screen]

(Both are concentrating very hard--eyes on screen)

R - How do you drop your - oo I got a nine.

Nine (R - draws in a tiny breath)

R - Nine.

L - Times.

R - Times

(R - laughed and L smiled while gazing at screen)

R - I almost shot ya.

L - You got close.

(R - laughing a little harder, L - gazing intently)

L - What did I get?

R - 9 + 4

L - Yea! I did.

(L - brings head in closer to get a better look and smiles)

R - Four.

L - Can't get rid of it now. Can't get rid of it!

(Both gazing at the screen intently and both have slight smiles.

L - bites lip for a bit; looks serious)

R - You get 9 + 1.

L - Yea, I know.

(L - draws head back--looks a little disappointed)

R - How do I drop it? L - There.

[R - gives a little extra push on the control]

R. 8, 9 _ 1 = Where's an equal - oh what did I get now? I got another one. Get rid of it. How come it won't drop?

(Both gazing intently at screen while R rolls his eyes looking for an equal sign)

(R - looking disgusted, opoens mouth some frowning. L looking at screen, smiling slightly)

L - You got to get right over.

(Both looking at screen while R makes a nose with mouth)

R. I did!

L - That was Close.

R - Fire.

Both gazing at screen.

(R - eyes widen, smile some, draws in small breath)

R - Aw you, I'm going to try to get you next time for that because I needed my equals

R - talking to computer makes mouth-moving noises

L - I got an equals Oh?

(Both gazing intently at computer)

R - Oh there's an equals. Aw! It turned into a five.

(R - frowns--looking disappointed)

L - Year five.

R - You want a five? Hit the little round things and you get a 100 point.

(Both gazing at screen while R rolls his eyes and gets big smile on face.)

L - I h[illegible]

R - You [illegible].

L - Not from what she said you don't. She said if you did, you could get killed, Kobi, remeber.

(Both gazing intently at screen and both have slith smiles--turns into a laugh)

R - No, I forgot.

(Both smiling - R - sticks out tongue some and draws in a breath. Both gazing and smiling)

R - equal - aw - I screwed the whole thing up. I got another one of them ones.

(R - widens eyes, disgusted look on face- turns fore a little)

(R - wrinkles his nose)

L - Aw - you almost had an equal sign.

(Both gazing at screen. R - very intent)

R - Yea, you take them all away

L - I'm trying to get them.

(Both gazing at screen - slight smiles. R - widens eyes)

L - Who got it?

R - I don't know -- I got it -- I got it -- you got a nine.

(Both looking at screen)

(R - starting off with a slight smile, smiling a lot more now)

[Gazing at screen intently]

R - Alright -- 9 + 1 -= 10 -- oo hey! Man you know that was too close for comfort.

(R - lifts eyes and makes noise with mouth)

L - Get you!

(L - moves head back)

R - Nope you missed, I still got as many men as you--ooo-eee-ooo 0 dang it; you're gettin close.

(R - seems more itent than L. R - making mouth noise.)

(R - rolls eyes; L - looking at screen)

L - Oh, that three's guarding it.

(L - surpised look on face. R -smiles)

R - Let's see, where is it--I need a 1 or 0?! 0 - 0 - 1 or a 0! Oh no, now I'm not getting any of them.

(R - questioning look on face-squints eyes)

(R - moves faces sorta chanting--lifts eyes.)

(Both gazing at screen)

R - There's a 0. Oh man, it's going up!

(L - looking at screen, R's shoulder seems to lift up.)

L - Yea! R. ooo L. equals

(Both gazing at screen; R - seeming more intent)

R. oop 0! Oh nuts! I got a times!

(R - lifts shoulder and then shrugs them; L - smiling)

R - ooo L - 0! What was that thing?

(R - lifts shoulders, L - moves head - Both smiling a lot)

R - You shot one! You shout the little guy. What I go? Aw a plus.

(L - looking at screen. R - squirms in chair looking very disgusted; frowning, turned up lip)

L - Take it easy, Kob! A one.

(L - smiling. R. shrugs shoulders, wrinkles nose)

R - It's gone. Well. Drop now. I want to get you this time. I got rid of it.

(R - manipulating control with a little umph; L - brings head forward; R - looking pleased)

R - I want a one too so you better watch out. Need a zero first. This one's zero 0 - 0 - 0. Got get it. He's going down. Now I got a two. L - Aw.

(L - draws head back. R - disappointed--brings down shoulders)

R - 0! My whole things destroyed. All I got to do is get anything. Ooh. Not anything? I got something though.

(R - has unbelieving look on face--disappointment eyes get big)

(Both smiling a bit. R - has determined look on face; R - takes hand and covers face--looks back at screen and smiles--lifts eyes)

R - I got a 1. Got a one. 1 - 1 - 1.

(Both gazing at screen R getting excited--lifts shoulders and eyes)

R. Okay, I got another 1. 1 + 1. Well!

(R - looks away from screen)

L - You didn't, no + sign.

(Both gazing at screen)

R - I could have a take away. L - Yea!

(R - looking intently) [R lifts shoulders]

R - I got 0 -0. 1 - 1. 1 - 1 = 0. 1 - 1 = 0. Those are equal zero zero mean take away. Take away the 0. Dang it.

(Both gazing at screen)

(L - draws head back) (R - puzzled look on face) (R - lifts eyes and shoulders--getting excited) [Both ggzing at screen. R - lifts shoulders]

R - ooo - aw - ooo e - equal. I got another one. No! Oh no.

(R - groans - frowns. L - gazing. R - brings hand up to cover face)

L - Not going to take anything. R - not even the one.

(Both gazing at screen. R - smiles)

[R - lifts shoulders. L - mumbling]

L - Do it once, the fours good enough.

R - 11 take away.

(Both gazing at screen)