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ABSTRACT

The availability of inexpensive microcomputers has made it practical for almost all classrooms to have one or more computers for student and teacher use. During the past 10 years, elementary and secondary schools have experienced a growing investment in microcomputer technology for instructional uses. However, the impact of microcomputers on the classroom environment as well as on the teaching and learning processes has not yet been fully documented. Promises of improved teaching and learning conditions and educational advantages, such as increased student motivation, individualized learning, tutoring, and freeing teachers to devote more time to direct instruction, have accompanied the installation of microcomputers in classrooms, but have not been proven effective. Instructional uses of microcomputers vary sharply by grade level and also according to where computers are located in the school buildings. A large percent of computers are placed in laboratory settings rather than classrooms. A survey of teacher and student attitudes in both a sixth grade computer lab and a classroom setting reveals that technology has an impact upon the organization of the classroom by reorganizing classroom interaction. Teachers give assistance to noncomputing students, allowing computing students to work independently. Laboratory settings had more interactions at a higher level than classrooms. and lab teachers displayed more types of interactions at higher percentages of frequency. Teacher and student perceptions of the usefulness of a computer as an instructional tool were similar. (33 references) (Author/DB)

Student-Teacher Interactions in Computer Settings: A Naturalistic Inquiry

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Running head: Microcomputer Interactions

Abstract

The availability of inexpensive microcomputers has made it practical for almost all classrooms to have one or more computers. During the past ten years, elementary and secondary schools have experienced a growing investment in microcomputer technology for instructional use. However, few studies have examined the types of teacher-student interactions while students are actively engaged with microcomputers in different settings. This naturalistic study investigated the types of interactions between teachers and sixth grade students using microcomputers in lab settings and classroom settings. The results indicated the differences of teacher-student patterns of classroom interactions.

Introduction

Computers not only have become a facet in American life, but also a facet of instruction in schools. During the past ten years, elementary and secondary schools have experienced a growing investment in microcomputer technology for instructional use. Microcomputers existed in more than half of the schools in the United States as early as 1983 (Becker, 1983). Since then, the Office of Technology Assessment (1988) reports the number of computers in American public schools from 1985 to 1988 rose from 800,000 to 1.7 million. Currently, there are over two million computers in American schools, about one computer for every 25 students.

As computers are acquired in greater numbers in schools, the infusion of technology raises many questions regarding the impact, if any, that computers have on the educational process. Promises of improved teaching and learning conditions and education advantages, such as increased student motivation, increased student self-concepts, individualized learning, tutoring, and freeing teachers to devote more time to direct instruction and remediation, have accompanied the installation of microcomputers in classrooms.

Inquiries related to computer utilization in educational settings are diverse. In the early 1980's, studies focused on the effectiveness of computer-assisted instruction and computer managed instruction (Burns & Bozeman, 1981; Edwards, Norton, Taylor, Van Dusseldorp & Weiss, 1974; Smith, 1973; Thomas, 1979) as well as reactions to software utilization in classrooms (Edwards, 1982; Hunter, 1983).

Several studies indicate that students learn as well or better when material is presented via a computer (Kulik, Kulik, & Bangert-Drowns, 1985; White, 1986; Niemiec & Walberg, 1987; U. S. Congress, Office of Technology Assessment, 1988; Swan, Mitrani, Guerrero & Schoener, 1991). Yet, with all the computer related research, studies focusing on student-teacher interactions while students are using computers are lacking in the research literature. Thus, the focus of this study was the examination of interactions between teachers and sixth grade students using computers in two settings: a computer lab (IMPAC) setting and students in a typical classroom setting with less than five microcomputers.

Some advocates for educational computing envision the computer as having a powerful effect on the teaching and learning process (Bork, 1985; Walker, 1986; Weir, 1989; Laboratory for Comparative Human Cognition, 1989). They claim that computer usage will result in schools which are student-centered, cooperative, and individualized, rather than teacher-centered, competitive, and group instruction oriented. According to Schulz (1991) the success of technology in learning depends on a number of factors, including subject area, the type of students in class, the teacher's training and role in the use of technology, and the design of the software.

Using microcomputers effectively is not just locating good software, but one of designing a social and instructional system that maximizes the benefits that computers bring to the different types of students facing different educational challenges. A major consideration for educators is what are teachers doing with the computers they have acquired and what has made some teachers more successful in using microcomputers.

Instructional uses of microcomputers vary sharply by grade level. Becker (1986) reported that more than half of the elementary school students' utilization focuses on drill-and-practice and tutorial programs, whereas, secondary school students spend more time programming. Furthermore, Becker (1986) reported that "across all school levels, about one-third of student instructional time on school computers is for CAI, one-third is for programming, and one-third is for all other academic work" (p. 8). Wolk (1991) reported that of the teachers who use computers, nine out of ten use them to teach language arts, while four of ten said they also use computers for enrichment, remediation, and demonstration of ideas.

Schools have made different decisions concerning where to locate computers in the building. Placing computers in classrooms, in labs, and in libraries were the three most common location settings for computer usage. Becker (1986) found a larger percentage of computers were placed in a laboratory setting than in classrooms. A typical elementary school lab had eight computers, whereas the typical secondary schools lab had 13-14 computers. Furthermore, Becker found that computer-using teachers are more likely to use computers in their own classroom than in a laboratory setting.

If computers have been implemented extensively and are being used by schools, then what are the types of interactions taking place in settings in which students are using computers? Research on technology and the social life of classrooms is in its infancy. "Classrooms are well-established cultures with social organizations and work-related agendas embodied in long-standing curricula" (Sheingold, Hawkins, & Char, 1984, p.4). The presence of computers in classrooms may have an impact on the social organization of students in the class. However, not only do computers directly affect students, they also have an impact on the teacher.

The influx of microcomputers into schools led to a national concern about social isolation for students. Research findings do not support the contention that computers cause isolation; rather there is evidence that computer contexts promote more interaction than other classroom activities (Papert, 1980; Margolies, 1991; Swigger & Swigger, 1984; Fein, 1984). Hawkins, Sheingold, Gearhart, and Berger (1982) and Clements and Nastasi (1985) found that children socialize and ask questions while working with computers.

Becker (1983) reported that the use of microcomputers will modify teacher-student patterns of classroom interaction. In several studies, verbal behavior in microcomputer contexts have been examined (Fish & Feldman, 1988; Hawkins, Sheingold, Gearhart, & Berger, 1982; Webb, Ender, & Lewis, 1986). Fish and Feldman (1988) found that student-teacher behavior varied across grade level as well as by activity structure. Chernik and White (1982) examined the patterns of teacher and pupil interaction in a setting replicating a microcomputer classroom. Results indicated that pupils in a computer setting questioned more and participated more than those in a classroom setting.

Webb, Ender, and Lewis (1986) reported the most frequent interchanges between students learning BASIC were specific questions and answers. Swan, Mitrani, Cheung, Guerrero, and Schoener (1991) compared the interactions occurring between high school students and teachers involved in computer-based and traditional classroom instruction. They found that teaching and learning in computer-based classrooms were dramatically more student-centered and individualized than teaching and learning in traditional classroom settings.

Although several student-teacher interaction studies have been conducted on microcomputer usage, no studies have compared teacher-student interactions of elementary students using microcomputers in a computer lab setting and in a classroom setting. The main purpose of this research was to compare teacher-student interactions of sixth grade learners in computer labs to the interactions in classroom settings with five or less computers. Specifically, we were interested in how microcomputers are being utilized in a regular classroom setting and in a computer lab, what the student-teacher interactions are when students are using microcomputers in a regular classroom setting, what the noncomputing students are doing when the teacher is interacting with a student at a microcomputer, what the student-teacher interactions are in a computer lab setting, how computer ulitization and student-teacher interaction in a class with five or less microcomputers differ from a computer lab, and what makes for an effective computer environment.

Method

Subjects

Subjects were sixth grade students in ten different classrooms from schools in Northeast Arkansas. Of the ten classrooms, five were elementary classrooms which had less than five computers in each room and the other five classrooms were computer (IMPAC) labs with one student per computer. Five sixth grade teachers from elementary classroom settings and five teachers in computer lab settings answered a questionnaire concerning computer utilization. Students in all ten classrooms completed a survey concerning microcomputer usage. Eighty-seven lab students and eighty-two students in classroom settings completed the student survey.

Instrumentation

A naturalistic approach was used in the research study. Several studies (Barr, 1986; Fish & Feldman, 1988; Rieth, Bahr, Okolo, Polsgrove, & Eckert, 1988;

Dillon, 1989) have used naturalistic inquiry because it yields detailed context-bound information about interaction during typical education experiences. In educational settings, a complex social institution, naturalistic inquiry "Offers a contextual relevance and richness unmatched by any other paradigm" (Guba & Lincoln, 1982, p.235).

As suggested by Guba (1981), overlapping data was collected with three different techniques. An observation instrument, a teacher attitude survey, and a student attitude survey were utilized for collection of data.

An observation instrument was developed to gather teacher-student interactions in both settings. The instrument consisted of two major observational parts, teacher and student, alternating from teacher to student three different times for five minutes observation intervals. The teacher portion included two subparts with one focusing on the computing student and one focusing on the non-computing student. The teacher observation portion included 16 types of interactions which could take place for computing or non-computing students. Student actions were coded for 17 possible interactions on the student observation portion of the instrument. Demographic information and commentary/anecdotal information was also incorporated into the instrument.

A teacher questionnaire consisting of 35 open- and closed-ended items was developed for the study. Thirty-three questions were included in the teacher survey to gain information focusing on six topical areas of attitude toward the computer, how computers were used for instruction, how computer training/experience was gained, availability of computers and software, scheduling and time available for microcomputer usage, and general information. The teachers responded to 33 Likert-type items on a five-point scale ranging from "strongly agree" to "strongly disagree" or numbers varying in range. The final section consisted of two open-ended questions asking teachers to express their feelings toward the best aspects about using a microcomputer and the aspects which make it difficult to use a microcomputer.

A student questionnaire consisting of 14 open- and 2 closed-ended items was also developed for the study. Fourteen questions were included in the student survey to gain information focusing on the following three areas: students' attitudes toward using the microcomputer, help from the teacher or other students, and time available for computer usage. Students used a Likert-type five-point scale ranging from "strongly agree" to "strongly disagree" or numbers varying in range to respond to these 14 items. The last section of the survey consisted of two open-ended questions about students' likes and dislikes about computers.

Instrument Validation

The observation instrument was pilot tested by having two graduate and six undergraduate students code student-teacher interaction during a fifteen minute video taping of sixth graders using computers. Appropriate changes were then made in the specific interactions and coding approach.

To field test the student questionnaire, three sixth grade students completed the student survey. Problem areas were noted and appropriate changes were made in the questions and layout. The teacher survey was pilot tested on three sixth grade teachers and one computer lab teacher. Appropriate changes were made in the questions and layout.

Procedures

With the completion of the field testing of the observation instrument and questionnaires, nine schools (one school had both a computer lab setting and a sixth grade classroom with computers) agreed to participate in the study. Five schools with computer labs (IMPAC) and five schools with computers in sixth grade settings were observed during a three month period. During each observation session, the teacher and students were observed 6 five-minute time periods, alternating between the teacher and student observation. The teacher was observed three times and a randomly selected computer using student was selected for each of the three observed time periods. Of the 3 five-minute time periods, the observer recorded all interactions during two five-minute episodes. During 1 five-minute time period randomly chosen either at the beginning, middle or end of the thirty minute observation session, the observer recorded observations every thirty seconds.

During the ten classroom observations, approximately eight hours were spent in classrooms. Of the eight hours, five hours were student-teacher interaction observation coding time and two hours were spent on the completion of teacher and student surveys.

After each observation session, students were instructed to complete the student survey and teachers completed the teacher survey. The on-site surveys were submitted to the observer before leaving the school. Anecdotal information was obtained during the observation sessions and questionnaire completion time.

Results

The results are presented in four separate parts. First, the percentages of the various student-teacher interactions in computer and classroom settings are presented. Second, the results describing the teachers attitudes toward computer utilization are presented. Third, the results of student surveys exhibiting students attitudes toward the use of microcomputers as instructional tools are presented. Last, the anecdotal information is described.

Student-Teacher Interactions

The following sections report the frequencies for the observed interactions.

Teacher interactions in lab settings. During the five-minute coding periods of every occurrence, the two teacher interactions which had the highest frequencies in lab settings were academic monitoring and individual explanation with 26% and 18%

respectively of the total observations. For ease of interpretation, Table 1 shows the teacher interactions with computing and non-computing students in lab and classroom settings. Similarly, during the every thirty second coding period, academic monitoring

Insert Table 1 about here

was one of the highest interaction frequencies. In contrast to every occurrence interaction time period, non-attending was the second highest behavior observed during the every thirty second coding period. The teacher interactions which did not occur for both every occurrence and every thirty second coding time periods were booting or interacting with the program, introducing software, and demonstrating or using students to demonstrate. Additionally, during the five minute sessions of coding interactions every thirty seconds, there were no teacher interactions in the areas of group explanation and reading or explaining directions.

Teacher interactions in classroom settings. According to the data gathered in this study, teachers in regular classrooms spend more time with non-computing students than computing students. During the five minute time sessions coding every occurrence, teachers spent 79% of their time interacting with non-computing students and 21% with computing students. When coding every thirty seconds, teachers interacted with non-computing students 70% of the time and with computing students 30%of the time. Teacher interactions with non-computing students during both every occurrence and thirty second occurrence coding times were highest for individual explanation spending 32% and 40% of the time respectively. In contrast, the area with the highest percentage of teacher interactions for computing students during both the every occurrence and thirty second occurrence sessions was nonattending at 10% every occurrence and 16% every thirty second occurrence.

Teacher interactions with computing students. The two major differences in the types of teacher interactions for computing students in lab settings and classroom settings during every occurrence coding sessions were academic monitoring and individual explanation. The percentage of time teachers academically monitored students in lab setting was 26%, whereas in the classroom setting the percentage was 1%. Teachers provided individual explanation to computing students in the lab setting 18% of the time compared to teachers in the classroom interacting with students by providing individual explanation 2% of the time. Other areas in which teachers in lab settings interacted more than those in classroom settings were teacher interactions of group explanation, providing feedback, pointing to screen, and questioning students.

Furthermore, differences were found for teacher interactions of computing students in lab settings and classroom setting during every thirty second occurrence sessions. Again, academic monitoring was higher in lab settings (24%) than the classroom settings (2%). Questioning students was the other major area of difference in teacher interactions for computing students during the every thirty second coding session. Teachers in a lab setting were engaged in questioning students 10% of the time, but in the classroom setting, teachers questioned students 2% of the time.

Student interactions. In both the lab and classroom settings, the areas which had the highest percentages of interactions were actively engaged and passively engaged with the program. During the five minute every occurrence in the lab setting, students were actively engaged with the program 44% of the time and were passively engaged 22% of the time. During the thirty second occurrence in the lab setting,

Insert Table 2 about here

students were actively engaged with the program 40% and were passively engaged 34% of the time. During the five minute every occurrence in the classroom setting, students were actively engaged with the program 41% and passively engaged 19%. During the thirty second occurrence in the classroom setting, students were actively engaged with the program 38% and passively engaged 18%.

For both every occurrence and thirty second occurrence sessions in the lab setting, no student interactions occurred in the following five areas: reading directions aloud, explaining directions, waiting disruptive, demonstrating, and engaged with visitors. Whereas, for students in classroom settings the only interactions which were not observed were waiting disruptive and demonstrating. Unlike students in lab settings, however, students in regular sixth grade classrooms engaged in 17% student-student interaction time rather than 6% interaction time in lab settings (every occurrence) and 12% student-student interaction time in classroom settings rather than 8% interactions time in lab settings (every thirty second).

Teacher Attitudes

From the teacher attitude surveys, data indicated that classroom teachers and computer lab teachers believe that a computer is useful as an instructional tool and that a computer is helpful to students of all abilities. Classroom teachers and computer lab teachers attitudes differed significantly in several areas. Classroom teachers indicated that they could spend more time for non-student-focused activities

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Insert Table 3 about here

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while students were using computers in the classroom. Lab teacher indicated that they received adequate training and guidance for implementation of computers with computer work being coordinated with curriculum objectives. Another difference was that classroom teachers, unlike computer lab teachers, reported a lack of an adequate number of computers and computer using time for students.

From the open-ended questions on the teacher survey, lab teachers reported that they learned to use computers through inservice training, whereas classroom teachers learned to use computers through college courses, inservice training, and by colleagues and friends. Both lab teachers and classroom teachers reported that the best things about computers were that they provided reinforcement of skills, were fun for students, and provided immediate feedback for students. Overall, classroom teachers reported that the barriers to using a microcomputer were not enough computers, not enough software, and difficulty in scheduling. Like classroom teachers, lab teachers reported difficulty scheduling for lab and lack of specific software as difficulties in using a computer. Lab teachers, however, indicated slower students not having time to finish, a few students getting bored, and a low percentage for passing were other difficulties in using computers.

Student Attitudes

To present information concerning students' attitudes toward computers, the four areas of students' attitudes toward computer usage, help students obtain from teacher or other students, time available for computer usage, and open-ended questions centered on students' likes and dislikes about computers will be addressed.

Students' attitudes toward computer usage. One hundred sixty-nine students responded to four questions on the student survey addressing this issue. The results are summarized in Table 4.

Insert Table 4 about here

Help students obtain while using the computer. Six items on the questionnaire were used to obtain data in this area. The results are summarized in Table 5.

Insert Table 5 about here

Time available for computer usage. Three items from the questionnaire focused on available time (See Table 6). Overall, only 27% of the students could use the computer as often as they needed. Approximately 70% of the students used the computer less than 6 times a week for 25 minutes or less.

Insert Table 6 about here

Responses to open-ended questions. Two open-ended questions were asked at the end of the questionnaire to obtain students likes and dislikes concerning the use of computers. Three responses indicating students' likes of computers occurred most frequently. Of the respondents, 53% indicated that computers were fun to use, 44.8% indicated that computers helped them learn, and 41.5% indicated liking the use of games on computers.

Two student dislikes occurred frequently. First, 32.8% of the students stated that lack of computer usage time was a dislike concerning computers. Second, 31.9% of the students reported computer system malfunctioning as a dislike concerning computers.

Anecdotal Information

Anecdotal information was obtained by the observer during both lab and classroom observations and during survey completion. Lab teachers wanted students to work individually on the computer, whereas students in classrooms cooperatively worked on the computers because of the lack of computers. Instruction in lab settings had the tendency to be more student-centered and individualized than in regular classrooms. Classroom teachers voiced concern about the lack of coordination of objectives with the regular curriculum. Lab teachers expressed an importance in academic monitoring and individual explanation while students were working at a computer, whereas classroom teachers expressed an importance of working with non-computing students while others were on the computer. Furthermore, classroom teachers voiced concern about whether they were using the computers effectively.

Overall, in both the lab and classroom settings, students worked diligently without teacher assistance most of the time. Students appeared to be enjoying instruction via a computer.

Discussion

Based on the infusion of microcomputers into classrooms for instruction and the consensus of more computers being placed in lab settings (Becker, 1986), we expected to find differences in the interactions between teachers and computing students in lab settings and classroom settings. The results indicated that of the sixteen different interactions, lab teachers displayed 13 different types of interactions with students, while classroom teachers displayed 8 types of interactions. Lab teachers did not interact with students by booting/interacting with the program, introducing software, or demonstrating. One rationale for the lack of these interactions in a lab setting was the time of the year the observation took place. Less of these types of interactions are likely to occur at the end of the year when the observations were conducted, than at the beginning of the school year. Lab teachers had spent ample time at the beginning of the school year teaching students how to perform these functions.

In a regular classroom setting, teachers spent more time with non-computing students (79% every occurrence and 70% every thirty second occurrence) than with computing students (21% every occurrence and 30% every thirty second occurrence).

A possible explanation for this lack of interaction is that teachers use computers in the classroom for individualized, enrichment work to have time for other students needing more help from the teacher. For the most part, students interacted with the computers in a classroom setting without intervention from the teacher.

The data of this study indicated that academic monitoring (26%) and individual explanation (18%) occurred more in the lab setting than in a classroom setting. Furthermore, lab teachers have more interaction in group explanation (6%), providing feedback (7%), pointing to the screen (10%) and questioning students (9%) than classroom teachers. This may occur because in a lab setting all students are engaged with computers rather than other classroom activities. In addition, the lab teachers monitored individual students and were able to offer assistance immediately and without explicit requests from the students.

In a classroom setting, the teacher-student interactions which did occur were individual explanation (2%), academic monitoring (1%), booting/interacting with the program (1%), pointing to the screen (1%), questioning students (2%), engaged with visitors (2%), non-attending (10%), and doing paperwork (2%).

The observation data from this study indicated that technology has an impact upon the organization of the classroom by reorganizing classroom interaction. With some students engaged in computer work, teachers give assistance to noncomputing students allowing computing students to work independently. Lab settings had more interactions at a higher level than the regular classroom setting. Lab teachers displayed more types of interactions at higher percentages of frequency.

Lab and classroom teachers' attitudes were similar regarding the usefulness of a computer as an instructional tool and the assistance computers provide to students of all abilities. Differences were found, however, in the training of teachers and guidance for implementation of computers into the curriculum. Unlike classroom teachers, lab teachers indicated adequate training for implementation of computers and guidance on how to integrate computers into the curriculum. Also, in the areas of available time for computer usage, numbers of computers, and availability of software, lab teachers and classroom teachers differed in their attitudes. More computer usage time, more numbers of computers, and more availability of software was reported by lab teachers than classroom teachers.

From the student surveys, sixth graders indicated that computers aid in learning information, computers make learning fun and computers make learning easier. Student respondents also indicated a lack of time available for computer usage in terms of minutes per session and times per week.

Interactions of actively engaged with program and passively engaged with program were the two interactions which were highest in both the lab and classroom settings. Active engagement has been espoused to be positively correlated with academic achievement (Denham & Lieberman, 1980; Fisher, Berliner, Filby, Marliave, Cahen, Dishaw, and Moore, 1978; Stallings & Kaskowitz, 1974). Therefore, if computers prove to maximize engagement time and subsequent achievement, the organizational impact of microcomputers upon classroom interactions need further examination. The study also raises other questions concerning computer usage in lab and classroom settings. In the classroom, if computers are used for individualized study and enrichment, does that mean that bright students gain more access to computer usage? Since classroom students must work independently, what behaviors does this foster? Are they better at solving computer problems? Do they work better independently?

An examination of the interactions between teachers and students in lab settings and classroom settings suggests that the use of microcomputers is beginning to change the structure of teaching and learning. Computer use could make it possible for students to receive the benefits of student-centered, individualized learning. The impact of microcomputers on teacher-student interactions could eventually result in more profound structural changes in schools.

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Table 1 Teacher Interactions

Percentages of Teacher Interactions with Computing and Non-Computing Students in Lab Settings and Classroom Settings

	Five Minutes/Every Occurrence								Five Minutes/Every 30-Second Occurrence							
Lab Settings	Computer Student				Non-Computing Student				Computer Student				Non-Computing Student			
	[illegible]	[illegible]	[illegible]	[illegible]	T	B	M	E	T	B	M	E	T	B	M	E
Group explanation	6	3	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Individual explanation	18	13	2	3	0	0	0	0	6	4	8	0	0	0	0	0
Read/explain directions	4	3	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Provide feedback	7	5	1	1	0	0	0	0	4	2	2	0	0	0	0	0
Academic monitoring	26	10	3	13	0	0	0	0	24	4	16	4	0	0	0	0
Boot/interact w/program	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Introduce software	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Direct students attention to approp stimuli or keys	4	1.5	1	1.5	0	0	0	0	6	4	2	0	0	0	0	0
Engaged w/disruptive pupil	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Point to screen	10	9	0	1	0	0	0	0	6	2	2	2	0	0	0	0
Demonstrate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Qing students	9	6	0	3	0	0	0	0	10	2	2	6	0	0	0	0
Use chalkboard/cha	1	1	0	0	0	0	0	0	2	0	0	2	0	0	0	0
Explain strategies	1	1	0	0	0	0	0	0	2	0	2	0	0	0	0	0
Engaged with visitors	2	0	0	2	0	0	0	0	10	0	6	4	0	0	0	0
Non-attending	11	3	2	6	0	0	0	0	24	2	20	2	0	0	0	0

	Five Minutes/Every Occurrence								Five Minutes/Every 30-Second Occurrence							
Classroom Settings	Computer Student				Non-Computing Student				Computer Student				Non-Computing Student			
	[illegible]	[illegible]	[illegible]	[illegible]	T	B	M	E	T	B	M	E	T	B	M	E
Group explanation	0	0	0	0	11	5	3	3	0	0	0	0	4	0	0	4
Individual explanation	2	1	0	1	32	8	8	16	4	0	2	2	40	12	14	14
Read/explain directions	0	0	0	0	6	2	4	0	0	0	0	0	2	2	0	0
Provide feedback	0	0	0	0	8	2	2	4	0	0	0	0	6	2	2	2
Academic monitoring	1	1	0	0	8	4	4	0	2	0	0	2	6	2	4	0
Boot/interact w/program	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Introduce software	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Direct students attention to approp stimuli or keys	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Engaged w/disruptive pupil	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Point to screen	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Demonstrate	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Qing students	2	1	0	1	10	1	2	7	2	0	2	0	8	2	2	4
Use chalkboard/charts	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	2
Explain strategies	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0
Engaged with visitors	2	1	0	1	0	0	0	0	6	0	4	2	0	0	0	0
Non-attending	10	2	0	8	2	0	1	1	16	0	6	10	2	0	0	2
Paperwork	2	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Table 2 Student Interactions

Percentages of Student Interactions in Lab Settings and in Classroom Settings

	Five Minutes/Every Occurrence								Five Minutes/Every 30-Second Occurrence							
Lab Settings	Computer Student				Non-Computing Student				Computer Student				Non-Computing Student			
	[illegible]	[illegible]	[illegible]	[illegible]	T	B	M	E	T	B	M	E	T	B	M	E
Actively engage w/program	44	14	14	16	0	0	0	0	40	22	6	12	0	0	0	0
Passively engaged with pgm	2[illegible]	5	10	7	0	0	0	0	34	12	4	18	0	0	0	0
Reading directions to self	5	1.3	1.3	1.3	0	0	0	0	2	2	0	0	0	0	0	0
Reading directions aloud	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Explaining directions	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0
Engaged with teacher	3	2	0	1	0	0	0	0	2	0	0	2	0	0	0	0
Engaged with other pupil(s)	6	1	4	1	0	0	0	0	8	0	4	4	0	0	0	0
Waiting nondisruptive	2	1.3	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Waiting disruptive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-task nondisruptive	3	0	2	1	0	0	0	0	2	2	0	0	0	0	0	0
Off-task disruptive	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Demonstrating	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non/attending	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Waiting on peripherals	3	1	1	1.3	0	0	0	0	0	0	0	0	0	0	0	0
Engaged with visitors	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Using other instructional resources with computer program	7	5	0	2	0	0	0	0	8	0	4	4	0	0	0	0
Receiving feedback	3	1	1	2	0	0	0	0	4	2	2	0	0	0	0	0

	Five Minutes/Every Occurrence								Five Minutes/Every 30-Second Occurrence							
Classroom Settings	Computer Student				Non-Computing Student				Computer Student				Non-Computing Student			
	[illegible]	[illegible]	[illegible]	[illegible]	T	B	M	E	T	B	M	E	T	B	M	E
Actively engage w/program	41	17	7	17	0	0	0	0	38	18	16	4	0	0	0	0
Passively engaged with pgm	19	7	4	8	0	0	0	0	18	6	10	2	0	0	0	0
Reading directions to self	5	1	1	3	0	0	0	0	4	0	2	2	0	0	0	0
Reading directions aloud	1	1	0	0	0	0	0	0	4	2	2	0	0	0	0	0
Explaining directions	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Engaged with teacher	1	0	.5	.5	0	0	0	0	4	4	0	0	0	0	0	0
Engaged with other pupil(s)	17	8	4	5	0	0	0	0	12	0	8	4	0	0	0	0
Waiting nondisruptive	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Waiting disruptive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Off-task nondisruptive	1	0	.5	.5	0	0	0	0	0	0	0	0	0	0	0	0
Off-task disruptive	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Demonstrating	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Non/attending	1	0	.5	.5	0	0	0	0	4	0	0	4	0	0	0	0
Waiting on peripherals	4	1	1	2	0	0	0	0	6	2	9	4	0	0	0	0
Engaged with visitors	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0
Using other instructional resources w/ computer pgm	6	0	0	6	0	0	0	0	6	0	0	0	0	0	0	0
Receiving feedback	1	0	0	1	0	0	0	0	2	2	0	0	0	0	0	0

Table 3
Computer Lab and Classroom Teachers' Attitudes Toward Computers Using Percentages

Item		Agree or Strongly Agree	
		Lab Teacher	Classroom Teacher
1.	Computer is useful	100%	100%
2.	Computer used to provide instruction	80	80
3.	Computer is helpful to students of all abilities	100	100
6.	By using computers can spend more time for non-student-focused activities	60	100
7.	Adequate training on how to implement computer into instructional program	100	20
8.	Adequate guidance to integrate computer into the curriculum	100	20
9.	Computer work is coordinated with curriculum objectives	100	40
10.	Adequate number of computers	80	20
11.	Child has adequate time for usage	100	40
15.	Adequate software	80	20

Table 4

Students' Attitudes toward Computer Usage using Percentages

Item		Agree or Strongly Agree
1.	Computer makes learning fun	98.8%
2.	Computer helps learning	91.1
3.	Like using computer	94.0
4.	Learning is easier when using a computer	74.6

Table 5

Students' Attitudes about Receiving Help When Using the Computer

Item		Agree or Strongly Agree
5.	Teacher helps students with computer work	62.7%
6.	Students help students do computer work	42.6
8.	Teacher helps students begin with new computer material	73.2
9.	Teachers help students only when asked	85.2
11a.	Students need help using the keyboard	14.5
11b.	Students need help using the software	16.9
11c.	Students need help using the disk	12.7
11d.	Students need help understanding the directions	38.1

Table 6

Students' Attitudes about Time Available for Computer Usage

Item				Agree or Strongly Agree	
7.	Use the computer as often as needed			27.2%	
		Times	0-5	6-10	11-15	16-20
12.	Number of times of computer use per week		69.8%	27.8%	1.8%	.6%
		Minutes	1-10	11-25	26-35	36-50
13.	Minutes of each time spent on the computer		21.9%	54.4%	21.3%	1.8%