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A COMPARATIVE ANALYSIS OF TEACHER-DIRECTED AND COMPUTER-ASSISTED INSTRUCTION IN TERMS OF STUDENTS' KEYBOARDING ACHIEVEMENT, ATTITUDES, AND COOPERATIVE LEARNING

presented by

Esther M. Crowell

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Robert Poland
Major professor

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By

Esther M. Crowell

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ABSTRACT

A COMPARATIVE ANALYSIS OF TEACHER-DIRECTED AND COMPUTER-ASSISTED INSTRUCTION IN TERMS OF STUDENTS' KEYBOARDING ACHIEVEMENT, ATTITUDES, AND COOPERATIVE LEARNING

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Modern technology has led many educational institutions to invest in microcomputers for instructional purposes. As a result of the increased use of computers, the effectiveness of typewriters and the method used to teach keyboarding skills are questioned. The major purpose of this study was to analyze keyboarding skills of students using the teacher-directed and computer-assisted modes of instruction. Specifically, this study was aimed at comparing the two modes of instruction by examining students' attitudes, collaborative learning, and achievement.

A quasi-experimental design was used for this study. The subjects consisted of 66 students enrolled in the Fundamentals of Typewriting and Keyboarding classes at an urban community college. The sample was divided into two groups. The experimental group was taught keyboarding skills with computer-assisted instruction on microcomputers. The control group was taught similar skills with teacher-directed instruction on electronic typewriters.

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Twenty-five keyboarding lessons were divided into five units. Three instruments were developed by the researcher to gather data on students' attitudes and cooperative learning. Two instruments were administered at the end of every fifth lesson; the third was given at the end of the study. A pretest and posttest were given to analyze keyboarding achievement in speed, accuracy, and skill development in vertical, horizontal, block, and spread centering.

The analysis of data included the use of analysis of variance and repeated-measures analysis of variance to determine whether a difference occurred between the two groups as specified in the seven hypotheses. The .05 level of significance was used in analyzing the results from the tests.

Findings from this study revealed no significant differences between the two methods with regard to students' attitudes, cooperative learning, and achievement, regardless of previous keyboarding experience. There was a significant difference in speed; the control group typed faster than the experimental group. Also, the experimental group made fewer errors than the control group, although this difference was not statistically significant. This study supports the findings of other research, namely, that both modes of instruction are equal in teaching keyboarding skills to students and that students prefer interacting with a teacher but enjoy using the computer.

Dissertation Advisor: Dr. Robert Poland

To my family, Joe, Kymberlyn, and Rodney, for their patience, love, and support.

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CHAPTER I

INTRODUCTION

Technological advancements have revolutionized education and the work force. The growing use of keyboards in business, industry, government, and education, along with the demand for increased office productivity, has made the efficient use of keyboarding skills of prime importance in American society today. Nathan (1983) summed up the need for keyboarding skills by saying, "Knowing how to build a house and ride a horse were basic skills 150 years ago. Looking to the future, keyboarding is a twenty-first century basic skill" (p. 10). According to LaBarre (1984), "The spectacular advancements in electronic technology, competition in the work place, and the flexibility provided by electronic keyboarding systems are presenting business educators with challenges and new frontiers to be pioneered" (p. 54).

Whereas the typewriter is still used in teaching keyboarding skills, microcomputer technology has had a growing influence on the future of the business education curriculum. Hofmeiser (1982) stated that the widespread application of microcomputers is a societal, not merely an educational, phenomenon. This new era of microcomputer technology is rapidly pushing the typewriter toward

obsolescence (Rhodes, 1987). Wallace (1981) agreed and predicted that microcomputers will replace conventional typewriters in the classroom as keyboarding becomes a universal skill.

Stocker (1988) emphasized that the proliferation of computers in business education classrooms has brought about many changes. These changes, and their intellectual and emotional consequences, have had a major influence on the way business education is now being taught in the classroom. Thus, Behymer and Schaefer (1990) challenged the role of business education and business educators by asking, "How will business education in the 1990s and beyond differ from the present? Why, who, what, when, where, and how will we teach as we head towards the year 2000?" (p. 10).

With so much emphasis on microcomputers, educators will face many questions and concerns as they develop curricula to include microcomputers. To date, research on the effect of microcomputer technology in the classroom has been geared primarily toward student achievement in various academic subjects. In this study, the researcher addressed unanswered questions regarding the use of microcomputers in teaching keyboarding skills by comparing the relationship of two modes of instruction to students' learning, students' attitudes, and students' interaction with each other while achieving keyboarding skills.

Statement of the Problem

The American workplace has become a highly technological environment, where every individual whose job depends on processing

information needs to have keyboarding skills. In its 1984 publication, "This We Believe About Keyboarding," the Policies Commission for Business and Economic Education asserted that whether an executive uses a keyboard as a means of communication or a student interacts with a computer for drill and practice, the skill of keyboarding shortens input time and increases productivity. Stainbrook (1984) supported the need for most business people to have keyboarding skills by commenting: "Individual professionals of all kinds as well as captains of industry are ever more likely to be sitting down in front of a keyboard whether it be on a word processor with electronic messages or the computer terminal with scientific notations" (p. 326).

Research on developing keyboarding skills using microcomputers versus typewriters was conducted by Lindsay (1982), D'Souza (1983), Culwell (1985), Richerson (1986), and Davidson (1988). However, the results of these studies were not conclusive as to which type of equipment was better to use in teaching keyboarding. These researchers recommended that further studies comparing use of the typewriter with use of the microcomputer in teaching keyboarding be undertaken. Such research is needed as the microcomputer is being incorporated into the business education curriculum and the future use of typewriters is being questioned.

Although some research has been done to compare the achievement of students who have been taught keyboarding skills with the computer-assisted and teacher-directed methods of instruction, little or no research has been undertaken on students' attitudes

toward these two methods of learning keyboarding skills in conjunction with the cooperative/collaborative learning of students using both methods, at the community college level. Thus, this study was undertaken to provide some of that needed information. Specifically, the researcher attempted to determine whether there were significant differences in achievement, speed, accuracy, attitudes, and cooperative learning between students who were taught keyboarding skills on electronic typewriters, using the teacher-directed method, and those taught keyboarding skills on microcomputers, using the computer-assisted method.

Purposes of the Study

One of the researcher's purposes in conducting this study was to compare the keyboarding achievement, speed, and accuracy of students who learn keyboarding skills on electronic typewriters, using the traditional teacher-directed method of instruction, with that of students who learn keyboarding skills on microcomputers, using the computer-assisted method of instruction. Additional purposes were to determine whether students taught by these two methods differed in terms of their attitudes and the frequency with which they engaged in collaborative learning in the keyboarding/typewriting class. Further purposes were to discover whether the attitudes and collaborative learning of students who had had previous keyboarding experience differed from those of students who had not had keyboarding experience.

Importance of the Study

Microcomputer technology has brought about the automation of many jobs in the work place; thus, it is important that all business people learn keyboarding techniques. Robinson and Johnson (1982) commented that individuals at every level of the business hierarchy --from clerks to executives--are required to use keyboards to enter and retrieve information that is essential to the successful completion of their work.

As educators develop curricula to meet individuals' keyboarding needs, they should take into consideration the mode of instruction used to teach these skills and how it might influence students' attitudes and levels of interaction with other students. Feldman (1984) concluded from his research that the accounts of students themselves are well worth considering because students' attitudes and perceptions play a large part in how willing they are to work.

Baer (1988) agreed with Feldman, noting that researchers have largely ignored the importance of students' attitudes. Johnson and Johnson (cited in Carrier & Sales, 1987) discussed the need to consider how students interact with each other, or engage in collaborative learning, while receiving computer-assisted instruction:

> How students interact with each other is a neglected aspect of computer-assisted instruction. Much training time is devoted to helping teachers arrange appropriate interactions between students and (a) the computer and (b) other curriculum materials. And some time is spent on how teachers should interact with students, but how students should interact with each other while working with a computer is relatively ignored. It should not be. (p. 3)

Therefore, in designing curricula to prepare individuals for the work force, business educators need to be aware of how students' achievement, attitudes, and collaborative learning are influenced by the method of instruction used in teaching them keyboarding skills. This study is intended to provide new and additional information about the use of computer-assisted instruction and traditional teacher-directed instruction in teaching keyboarding skills. This information can then be used in developing courses to improve students' keyboarding skills.

Research Questions

The following questions were posed to guide the collection of data for this study:

1. Does the keyboarding achievement of students who learn keyboarding skills on microcomputers, using computer-assisted instruction, differ from that of students who learn keyboarding skills on electronic typewriters, using teacher-directed instruction?

2. Do the attitudes of students who learn keyboarding skills using computer-assisted instruction differ from those of students who learn keyboarding skills using teacher-directed instruction?

3. Does the collaborative learning of students who learn keyboarding skills using computer-assisted instruction differ from that of students who learn keyboarding skills using teacher-directed instruction?

4. Do the attitudes of students who have had previous keyboarding experience differ from those of students who have had no keyboarding experience?

5. Does the collaborative learning of students who have had previous keyboarding experience differ from that of students who have had no keyboarding experience?

Because typewriters are still used in some schools to teach keyboarding skills, the following research questions also were posed:

6. Does the speed of students who learn keyboarding skills using electronic typewriters differ from that of students who learn keyboarding skills using microcomputers?

7. Does the accuracy of students who learn keyboarding skills using electronic typewriters differ from that of students who learn keyboarding skills using microcomputers?

Hypotheses

The following hypotheses, stated in the null form, were formulated to test the data collected in this study:

Ho 1: There is no significant difference in the keyboarding achievement of students who learn keyboarding skills on microcomputers, using computer-assisted instruction, and that of students who learn keyboarding skills on electronic typewriters, using teacher-directed instruction.

Ho 2: There is no significant difference in the attitudes of students who learn keyboarding skills using computer-assisted instruction and those of students who learn keyboarding skills using teacher-directed instruction.

Ho 3: There is no significant difference in the collaborative learning of students who learn keyboarding skills using computer-assisted instruction and that of students who learn keyboarding skills using teacher-directed instruction.

Ho 4: There is no significant difference in the attitudes of students who have had previous keyboarding experience and those of students who have had no keyboarding experience.

Ho 5: There is no significant difference in the collaborative learning of students who have had previous keyboarding experience and that of students who have had no keyboarding experience.

Ho 6: There is no significant difference in the speed of students who learn keyboarding skills using electronic typewriters and that of students who learn keyboarding skills using microcomputers.

Ho 7: There is no significant difference in the accuracy of students who learn keyboarding skills using electronic typewriters and that of students who learn keyboarding skills using microcomputers.

Setting for the Study

This study was conducted in an educational setting at the Eastern and Downtown campuses of Wayne County Community College in Detroit, Michigan. The college has an open-door policy; thus, all students who desire an educational experience have the opportunity to enroll, regardless of their educational preparation. In addition, the college serves all people without regard to age, gender, race, national origin, handicapping condition, religion, economic status, or social background (Wayne County Community College, 1989).

Limitations

Instructor Effects

The researcher taught one control group and one experimental group. The second control group and second experimental group were taught by two professional tenured business instructors on the community college faculty, each of whom taught one group. Thus, certain instructor effects might have influenced the results.

Nonrandom Groups

Because of the nature of the scheduling procedures at Wayne County Community College, random assignment of students to course offerings was not possible. However, based on past experience, students enrolled in various sections of both courses were expected to be representative of all students taking the courses.

Sample Size

The sample was limited to students enrolled in two sections of Keyboarding (OIS 100) and students enrolled in two sections of Fundamentals of Typewriting (OIS 101) at Wayne County Community College during fall semester 1990.

Generalizability of the Findings

The findings of this study can be generalized only to students who were enrolled in either the Keyboarding course (OIS 100) or the Fundamentals of Typewriting course (OIS 101) during fall semester 1990 at Wayne County Community College. Generalizing the findings from this study to students enrolled in other

keyboarding/typewriting courses at other community colleges is not suggested.

Definitions of Terms

To ensure an accurate interpretation of key terms used in this study, the following definitions are provided.

Accuracy. Measured by the total number of errors in straight-copy timed writings (West, 1983).

Achievement. How well the student learns how to keyboard, based on the score he or she receives on an achievement test consisting of four centering problems--vertical, horizontal, block, and spread. High scores indicate positive achievement results; low scores indicate less positive results.

Attitude. How students feel about a teaching method, the equipment used, the subject matter, and the textbook.

Collaborative learning. Instruction whereby students work interdependently to accomplish a mutual task or goal; also referred to as cooperative learning (Swartz, 1989).

Computer-assisted instruction. Instruction whereby the student interacts with a computer. The student progresses at his or her own individual pace. The term is used interchangeably with computer-aided instruction.

Electronic typewriter. A piece of electronic equipment that falls into a category between the electric typewriter and the more sophisticated text-editing machine.

Formatting skill. The student's ability to arrange typed material in a specified manner on a sheet of typing paper.

Gross words a minute (GWAM). Measured speed on a timed writing, calculated by dividing the total words typed by the number of minutes in the timed writing (West, 1983).

Keyboarding. The act of entering information into various types of equipment through the use of a typewriter-like keyboard. The focus of keyboarding is on input rather than output of data (Policies Commission for Business & Economic Education, 1984).

Lockout/lockout system. A feature of the keyboarding software package, which does not allow the student to continue until he or she touches the correct key.

Microcomputer. A machine that receives, sends, stores, and manipulates data according to a series of software instructions; used interchangeably with computer.

Skill development. The activity that follows learning the alphabetic keys by touch and further develops speed and accuracy in keyboarding (Erickson, 1983).

Software. A computer program that interacts with the computer and enables it to perform various functions.

Speed. The number of standard five-stroke words of 1.5 syllabic intensity typed in a specific period of time, measured in gross words a minute (West, 1983).

Teacher-directed instruction. Instruction whereby a teacher interacts with the entire group. All students in the class are expected to progress at the same pace and to take all major

examinations at the same time. The teacher is expected to cover a specific amount of material within a given period of time (West, 1983).

Typewriting. An activity involving the manipulation of keys and controls of a standard typewriter keyboard in such a manner that typed copy is produced on paper (Erickson, 1983).

Organization of the Dissertation

Chapter I contained an introduction to the study, a statement of the problem, purposes of the study, and need for the research. The research questions and null hypotheses were presented, as were limitations of the research and definitions of important terms.

Chapter II contains a review of the literature comparing computer-assisted instruction to traditional teacher-directed instruction in terms of students' keyboarding achievement, speed, and accuracy. Findings of research on students' attitudes and on collaborative learning using either microcomputers or typewriters also are presented.

The methodology used in conducting the study is described in Chapter III. Included is a discussion of the research design, the population and sample, treatment protocol, instrumentation, data-gathering methods, and procedures used in analyzing the data.

The results of the data analyses are presented in Chapter IV. Chapter V contains a summary of the study, conclusions drawn from the major findings, recommendations for future research, and reflections.

CHAPTER II

REVIEW OF THE LITERATURE

A review of the literature was undertaken to provide background for this study. This chapter includes a discussion of articles and reports of research pertinent to (a) keyboarding, (b) the use of microcomputers in classrooms, (c) research on speed and accuracy in keyboarding, (d) computer-assisted instruction versus teacher-directed instruction, (e) students' attitudes toward computer-assisted and teacher-directed instruction, and (f) cooperative learning. The vast majority of the research on these topics was conducted at the high school and post-high-school levels, although a few studies were concerned with pre-high-schoolers.

Introduction to Keyboarding

Nearly a decade ago, the United States Department of Education and the National Science Foundation emphasized that American students were rapidly falling behind their Russian, Japanese, and German counterparts in both science and math achievement (Stainbrook, 1984). Stainbrook commented that, according to a 1979 report by the Carnegie Council, "One-third of America's young people have been ill-prepared, lacking in employable skills to become productive members of modern society" (p. 325). Naisbitt (1982)

alluded to the types of skills people will need to be employed in the 1990s and beyond. He indicated that, although Americans may think they are still living in an industrial society, the economy has in reality become one based on the creation and distribution of information. Keyboarding is an essential skill in this dissemination of information.

The United States Department of Labor emphasized that, by the year 2000, more than 65% of the American work force will be using some type of keyboard to distribute information (New York Times, 1981). In fact, in The Third Wave, Toffler (1980) suggested that the day will come when advertisements for high-level positions in management will carry a new requisite: "typing required." Thus, keyboarding has acquired new importance and will continue to attract students from all academic majors. Goodrich (1979) stated:

> Gone are the days when the typewriting course was designed primarily to prepare women for secretarial jobs. Today's keyboarding course must prepare men and women for their careers, any one of which may have a typewriter-like keyboard in it. The growing use of keyboards in business, industry, government and education has made them the tools for many future careers. (p. 15)

Because keyboarding skills can be developed on microcomputers as well as on typewriters, educators themselves first need to understand how to use microcomputers effectively, to prepare their students to succeed in a rapidly changing job market. Erickson (1983) claimed that "if we do not learn to use and apply newly available electronic tools in a relatively short period of time, we risk obsolescence" (p. 5). As microcomputers come to be used in developing keyboarding skills, business educators will face a number

of challenges, including revising the present curriculum, developing a new curriculum, and designing strategies for teaching students to use microcomputers. Confronted with these challenges, educators need to consider their mode of instruction and the attitudes of their students toward the mode of instruction, as well as students' interactions with each other as they learn keyboarding skills.

The Use of Microcomputers in Classrooms

The use of microcomputers in classrooms continues to grow at a phenomenal rate. According to the Becker Report, in 1983 more than 53% of all schools in the United States had at least one microcomputer for use in instructing students. Lambrecht (1984) and Swanson (1986) emphasized that course objectives should be determined before deciding what equipment to purchase. Unfortunately, in many cases this does not occur, particularly in business education departments, whose use of microcomputers has increased rapidly. Harmon (1986) reported that microcomputers are more applicable to business education than to other areas of secondary education because students can view the microcomputer as a medium of instruction.

Traditional typewriting/keyboarding classes have become increasingly popular as the need for keyboarding skills has become more prevalent. McLean (1987) confirmed the popularity of keyboarding by stating:

> Almost everywhere we look today we find microcomputers--in the classroom, the playroom, the workroom. Certainly the schools have discovered the technology in a major way; microcomputers are also widely evident in offices, stores, factories, warehouses, at sporting events, on television, in the comic strips, in romance novels, and in our homes. With this explosive growth, a new "basic" has been added to the curriculum that all students need to learn--the ability to keyboard. (p. 10)

Much research has been done concerning the effects of computer-assisted instruction on students' academic achievement. Larrea-Peterson (1986) examined such effects on reading and math achievement, Chin (1986) on achievement in chemistry, Morgan (1987) in biology, Dyarmett (1987) in accounting, and Morris (1987) in spelling with learning-disabled students.

In comparison to other courses, keyboarding has been the subject of just a few studies. Those studies on keyboarding generally have focused on developing such skills on microcomputers and/or typewriters, or they have compared the traditional teacher-directed method, using typewriters, with the computer-assisted method, using microcomputers (Anderson, 1984; D'Souze, 1983; Lindsay, 1982; Perrault, 1984; Schulz, 1985; Sharron, 1985; Sormunen, 1987).

In the early 1970s, a few researchers examined the teaching of keyboarding skills with electronic devices other than microcomputers; these devices included an electronic wallchart (Wally, 1974) an audio-visual tutorial (Anderson, 1976), and a simulator (Shaffer, 1977). These early studies provided business teachers with information that was useful in developing curricula to teach keyboarding skills on the typewriter and the microcomputer--

with or without the use of computer-assisted instruction. Such research also made teachers aware of some of the differences between using the typewriter and the microcomputer, especially in developing speed and accuracy in keyboarding.

Research on Speed and Accuracy in Keyboarding

Numerous studies have been conducted on speed and accuracy using the typewriter (Clever, 1980; Russon & Wanous, 1973; Walthall, 1986; West, 1969). However, due to the increased use of microcomputers, researchers have begun to compare the effects of using a typewriter to the effects of using a microcomputer in developing students' speed and accuracy in keyboarding.

In one such study, Davidson (1988) compared the effects of using a microcomputer versus an electric typewriter in teaching a beginning keyboarding class at the secondary school level. Her subjects were 112 students in four keyboarding classes. The typewriter/microcomputer group was composed of two classes that were taught on electric typewriters for the first two weeks and then switched to microcomputers for the remaining six weeks. The microcomputer/typewriter group was composed of the other two classes, which were taught on microcomputers for the first two weeks and then switched to electric typewriters for the remaining six weeks. Students who transferred from the electric typewriter to the microcomputer showed little change in completion time and produced fewer errors on timed writings. In contrast, students who transferred from the microcomputer to the typewriter showed an

increase in both completion time and typographical errors. Finally, on straight-copy timed writings, there were no speed differences between groups, but students using the microcomputer made fewer errors. Conclusions from the study showed that the performance of students working on microcomputers was superior to that of students working on electric typewriters in terms of completion time and accuracy.

Frederickson (1988) analyzed the relationship between a student's touch-typing skills and the availability of a computer at home. Of the 84 students who enrolled in a beginning typewriting class, 39 had computers at home. In the study, all students were taught keyboarding on electronic typewriters. After eight weeks of instruction, no significant differences in speed and accuracy scores were found. However, at the conclusion of the study (18 weeks), significant differences were found between the two groups. Students who had computers at home achieved higher scores on speed and accuracy than those who did not have computers at home.

Richerson (1988) sought to determine whether there was a difference in students' production/formatting skill rate and accuracy, based on the type of equipment they used. The sample consisted of 60 students who were enrolled in an intermediate typing class and an office production class at Southern Illinois University at Carbondale. Using a matched-pairs approach, 30 students were assigned to work on microcomputers, and 30 were assigned to work on electronic typewriters. The study lasted eight weeks. Final

evaluation was done with an instrument designed to measure production/formatting speed and accuracy. The Wilcoxon Signed-Range Test was the statistical procedure used in analyzing the data. The findings indicated that the microcomputer and the electronic typewriter were equally effective when used to develop students' speed and accuracy in production/formatting skills.

Glades (1986) examined the speed and accuracy scores of students using microcomputers to determine the effects of computer use on keyboarding techniques and skills. Five experienced teachers were involved in the research; they taught seven sections of keyboarding. Three study groups were formed, based on their keyboarding experience. Group 1 consisted of those students who had had no experience at the keyboard. Students in Group 2 had had no keyboarding experience but had completed a hands-on computer course. Group 3 consisted of those students who had completed at least one semester of keyboarding before taking the present class. In total, 103 students participated in the study; all were taught keyboarding skills on microcomputers in the same manner. Final testing covered keyboarding techniques, as well as speed and accuracy on two three-minute timed writings.

Glades (1986) used one-way analysis of variance and the Tukey Multiple-Range Test to determine whether differences existed among the three groups with regard to speed and accuracy. He found statistically significant differences among the three groups in keyboarding speed. Students with previous keyboarding experience had higher speeds than students with no keyboarding experience.

However, no significant differences were found among the three groups with regard to accuracy.

Only two studies were located that investigated students' speed and accuracy on microcomputers, as well as students' attitudes. One of these studies was designed by Williams (1990). Seventy seventh-grade students were divided into two groups; both groups keyed for 22 days on either a microcomputer or an electronic typewriter. At the end of 22 days, the students switched from computer to typewriter or vice versa. An attitude questionnaire was administered during the first session of the nine-week course and again during the last session. The data revealed that significant differences did occur between the two groups in terms of speed and accuracy; the computer group achieved greater speed and made fewer errors than the typewriter group. Also, both boys and girls indicated a preference for using computers as compared to typewriters; they also reported having less anxiety when using computers. Boys indicated that computer skills were more necessary for boys than for girls, whereas girls said that both boys and girls needed computer skills.

In a similar study, Liberatore (1986) explored the relationship of students' entry-level keyboarding skills to their input-speed scores, correcting/editing scores, and attitudes toward computers following a unit of instruction. Based on the study findings, Liberatore concluded that:

1. Students' grade point averages had a greater influence on the students' editing ability than did their keyboarding skill.

2. Students' level of performance while inputting data was directly related to their keyboarding ability.

3. Students' attitudes toward computers did not significantly change following the unit of instruction on word processing.

The purpose of Sharron's (1985) research was to analyze the systematic development and formative evaluation of a research-based model program for teaching alphabetic keyboarding skills on a microcomputer. The sample consisted of 66 community college students who were nontypists. Sharron developed her own microcomputer instructional program based on teaching strategies and psychological concepts that were considered appropriate during the early stages of teaching typing. She concluded that the microcomputer was an effective medium for teaching initial keyboarding skills and recommended that teachers of typewriting/ keyboarding should consider microcomputer instruction as a teaching method.

Using a sample of 103 students in grades three through six, Sormunen (1987) analyzed the relationship between students' keyboarding speed and the number of instructional hours they had on a microcomputer. Instruction was provided through a tutorial that used a traditional, research-based approach for teaching keyboarding on the microcomputer. Results from the study indicated there was no significant relationship between students' posttest keyboarding

speed and the number of instructional hours they had had on a computer.

Despite the growing popularity of teaching keyboarding on microcomputers, Robinson (1982) commented that the approach does have its limitations. Computer-assisted instruction cannot replace a well-prepared, interesting, and interested teacher (p. 228). Campbell and Campbell (1982) concurred with Robinson, adding that microcomputers should not be placed in business education classrooms merely to keep up with "trends" or because some administrator has decided they should be there. Yet, in assessing the attitudes of teachers toward using microcomputers in teaching keyboarding, Gladdis (1988) found that teachers preferred using the microcomputer over the typewriter when cost constraints did not exist.

Computer-Assisted Instruction

D'Souze (1983) defined computer-assisted instruction as "a method whereby the student is on-line to a microcomputer by means of a device such as an electronic keyboard" (p. 10). She stated that, through this mode of instruction, information is presented to the student, who then responds to and processes the information. In addition, D'Souze reported that computer-assisted instruction allows the student to become the direct recipient of the information presented by the microcomputer. In their studies, Lindsay (1982), Perreault (1988), D'Souze (1983), Culwell (1985), Schuls (1985), and Bartha (1988) found that computer-assisted instruction was one possible solution to many problems confronting business educators in

developing and presenting a keyboarding course that can meet the individual needs of students who want to develop basic keyboarding skills.

Perceptions of Computer-Assisted Instruction

D'Souze (1983) strongly advocated using computer-assisted instruction to teach keyboarding skills because:

> It addresses the individual differences in learning rate, motivation and learning style in basic keyboarding skill instruction by pacing students at goal rates, informing them line-by-line of their performance rate.
>
> Microcomputer assistance instruction attempts to improve the quality of instruction by providing individualization. Four important features of [computer-assisted instruction] in learning basic keyboarding skills are (a) immediate feedback, (b) lack of embarrassment, (c) lack of subjective evaluation, and (d) flexibility of scheduling. (p. 10)

Dalgaard and Lewis (1985) assessed the status of computer-assisted instruction to provide useful information on this approach for business educators. They made the following observations about the effectiveness of computer-assisted instruction, based on their review of general educational research literature:

1. Computer-assisted instruction can be effective in improving students' achievement.

2. Such instruction can reduce students' average training time.

3. Students' attitudes toward the subjects and their ratings of quality of instruction tend to be more favorable with computer-assisted instruction.

4. Students tend to have positive attitudes toward using computers.

5. Use of computer-assisted instruction enhances computer literacy.

6. Computer-assisted instruction may increase labor productivity.

In contrast to the aforementioned assertions regarding computer-assisted instruction, Robinson (1982) stressed that, although he found no significant differences in the keyboarding skills of students taught using computer-assisted instruction and those instructed with the traditional teacher-directed method, "the microcomputer cannot hear; therefore, it cannot answer the student's call for help" (p. 228). Thus, he asserted that using a combination of the two methods will result in better keyboarding skills.

Conversely, Sunkel and Cooper (1982) favored teaching keyboarding solely with microcomputers. They stated that students using microcomputers would spend more time than usual on the equipment and not complain about the amount of time used for practicing; as a result, they would develop better keyboarding skills.

Schmidt and Stewart (1983) recommended that, to achieve effective instruction in a computer-assisted keyboarding course, instructors should employ the following teaching and classroom-management procedures. These suggestions were based on Schmidt and Stewart's research findings regarding the effect of microcomputers on business education typewriting courses.

1. Select effective and appropriate software.

2. Familiarize students with operating the equipment and using the software.

3. Provide students with continuous reinforcement.

4. Monitor students' progress.

5. Help students establish appropriate goals.

6. Provide a variety of instructional activities.

Atkinson (1984) conducted a study on computer-assisted instruction and concluded that, during the last 20 years, computers have come to be used in classrooms in many different ways. She further stated that computer-assisted instruction is used in two basic ways: (a) to present supplementary material and (b) to substitute for other modes of instruction. Based on her extensive review of the literature, Atkinson concluded that computer-assisted instruction has been found to be effective in the following areas:

1. Student Achievement: This was the most commonly studied variable. Vinsonhaler and Bass (1972); Chambers and Sprecher (1980); and Kearsley, Hunter and Seidel (1983) concluded that computer-assisted instruction made instruction both more effective and efficient.

2. Learning Time. In a meta-analysis at the college level, Kulik et al. (1980) found that computer-assisted instruction took less time than traditional instruction.

3. Student Attitudes. Chambers and Sprecher (1980), McDougall (1975), and Kulik et al. (1980) reported that computer-assisted instruction improved students' attitudes toward computers in the learning situation.

4. Low-Ability Students. The findings from studies by Chambers and Sprecher (1980); Kulik et al. (1980); Hallworth and Brebner (1980); and Jamison, Suppes, and Wells (1974) indicated that computer-assisted instruction can be used successfully to improve the achievement of disadvantaged students at both the secondary school and college levels.

Although considerable research has supported the overall effectiveness of computer-assisted instruction as a teaching method, few studies have been undertaken to determine the effectiveness of the computer software for particular subject matter areas. Gray (1987) stressed that there has been an increasing focus on computer-assisted instruction in educational environments. However, most research efforts have centered on evaluating the effect of computer-assisted instruction on student achievement in particular subjects, but little research has been done on software packages designed for specific courses of study.

Patterson and Bloch (1987) found that little is done with regard to the formative evaluation of software packages used in computer-assisted instruction. They warned that such evaluation is highly important because much money is wasted each year on purchasing software that proves to be inappropriate or ineffective. "To prevent these negative effects and improve the educational products produced, CAI developers or design teams should engage largely in formative evaluation of courseware as part of the instructional development process" (p. 26).

Research on Computer-Assisted Instruction Versus Teacher-Directed Instruction

The findings from research comparing computer-assisted instruction with traditional teacher-directed instruction, like those of studies comparing the use of typewriters and microcomputers in teaching keyboarding skills, have not been conclusive with regard to whether one method or type of equipment is superior to the other.

Whereas no significant differences were found in four studies reviewed for the present research, in two similar studies differences were discovered when comparing the two modes of instruction.

In her study, D'Souze (1983) was interested in determining (a) whether the computer-assisted and traditional teacher-directed modes of instruction had different effects on student achievement, (b) whether there was a difference in mean instruction time between the two modes of instruction, and (c) whether attitudes toward keyboarding differed significantly between the two groups. At the end of the study, all students were tested for their achievement in keyboarding speed and accuracy.

Findings from D'Souze's study indicated that computer-assisted instruction was as effective as teacher-directed instruction and that the role of the teacher changed somewhat when computer-assisted instruction was employed. A questionnaire relative to students' attitudes and interests with regard to the course was administered at the end of the study. On this questionnaire, students expressed positive attitudes toward using the microcomputer as a teaching aid in developing their keyboarding skills. In addition, a t-test analysis indicated there were no significant differences between the two groups relative to their attitudes toward the keyboarding course. Finally, results of the t-tests comparing the two groups' mean speed and accuracy on straight-copy, two-minute timed writings

indicated no significant difference in keyboarding achievement at the .05 level of significance.

Lindsay (1982) compared the effectiveness of teaching typewriting skills on electric typewriters versus microcomputers. During a four-week period, 105 students were taught basic typewriting skills. The 32 students in the control group were taught these skills on electric typewriters; the 73 students in the experimental group were taught typewriting skills on Commodore computers, using a software package designed for that purpose. After being taught the alphabetic keys, both groups started a skill-building program to develop speed and accuracy. Findings from Lindsay's study suggested that the microcomputer was (a) as effective as the electric typewriter in increasing students' speed and accuracy when age and class attendance were controlled and (b) not as effective as the electric typewriter in increasing accuracy for males and females.

Using a sample of eight students enrolled in a keyboarding class at State Fair Community College in Sedalia, Missouri, Schuls (1985) compared computer-assisted keyboarding instruction to teacher-directed keyboarding instruction. The researcher's objectives were to identify the better instructional method and to produce instructor-assisted, individualized-instruction keyboarding materials for use with microcomputer keyboards. Schuls wanted to compare the success of students who received keyboarding instruction from microcomputers with the success of students who received such instruction from computers but also received individualized

attention, motivation, and instruction from a teacher. Half of the students in the study received feedback from the instructor at specified intervals; the other half did not have this interaction with the instructor. Students evaluated these procedures at the end of the study. The conclusions indicated that students favored instruction with the instructor but also believed that computer-assisted instruction was a valuable tool and should be used in conjunction with an instructor. Thus, according to Schuls, the best method for teaching keyboarding skills is a combination of computer-assisted and teacher-directed instruction.

In another study, Bartha (1988) involved students at the University of North Dakota in a study comparing teacher-directed instruction to computer-assisted instruction in keyboarding. Results from this study indicated no significant differences in speed and accuracy between students taught with these two modes of instruction.

Culwell (1985) undertook a comparative study of microcomputer and typewriter keyboarding skills to determine whether significant differences existed between microcomputer and typewriter keyboarding skills taught with computer-assisted and traditional teacher-directed methods, respectively. The study involved 29 students who were enrolled in a beginning typewriting class at the University of Arkansas. The experimental group received six weeks of keyboarding instruction on microcomputers, whereas the control group received keyboarding instruction on electric typewriters. Culwell

administered an attitude questionnaire to the students one week after the study.

To determine whether statistically significant differences existed between the two methods of instruction, Culwell used the t-test for independent samples to analyze the speed, accuracy, and proofreading scores of both groups. In addition, Pearson correlation coefficients were calculated to determine various relationships. Culwell found no significant differences between the two groups with regard to speed, accuracy, technique, proofreading, or attitude. However, significant relationships were found between speed and technique, speed and gender, speed and grade point average, technique and proofreading, technique and gender, and attitude and gender for the experimental group.

For the control group, Culwell found that significant relationships existed between speed and technique, speed and gender, and technique and proofreading. For both groups, significant differences were found in the relationship between speed and technique, speed and attitude, speed and gender, speed and grade point average, and accuracy and gender. The analyses also indicated that gender and technique were significant predictors of speed. No significant predictors were found for accuracy.

In a study by Perreault (1984), students' achievement in keyboarding was measured with regard to technique, straight-copy speed, and straight-copy errors. The sample consisted of 67 students who were taught keyboarding using the computer-assisted method or the teacher-directed method of instruction. Analysis of

variance and the student's t-test were the statistical techniques used to test the hypotheses at the .05 level of significance. The data analyses showed that there was a significant difference in overall achievement and in technique achievement between students taught with the computer-assisted method and those taught with the teacher-directed method. There was no significant difference in achievement in straight-copy speed or error scores. However, the computer-assisted group did make high average speed gains and made fewer errors per timed writing than the teacher-directed group.

Attitudes Toward Computer-Assisted Instruction

Garhart and Hannafin (1986) stated that individuals process information in different ways. The strategies preferred by one learner are likely to differ from those preferred by another individual. A number of researchers have established the overall effectiveness of computer-assisted instruction (Atkinson, 1984; Boettcher, Alerson, & Sauccucci, 1981; Gillingham, 1988).

Relatively few researchers have investigated the relationship between students' ability and their motivation to learn. Even less research has been reported concerning the effect that presenting information in alternative styles in computerized tutorials has on learning (MacLachian, 1986).

According to social psychologists, attitudes have three components: affective, cognitive, and conative or behavioral. These three components promote the supposition that the chief effect of an attitude should be on behavior toward the object of that

attitude (Greenwald, Pratkanis, & Breckler, 1989). Therefore, how well a student likes the subject or equipment could affect how much he or she will learn, which in turn could affect his or her behavior.

A number of investigators have explored the effectiveness of computer-assisted instruction and its influence on the learning process. The vast majority of these studies were done in non-business-education courses and concerned either students' achievement or their attitudes toward computers after using the computer-assisted method.

The attitudes of students toward computer-assisted instruction have been the focus for many researchers. According to Kern and Matta (1988), the effect of learner control on the effectiveness of computer-assisted instruction is influenced by individual traits of the learner. A student's personality may also have an influence on his or her ability to apply self-paced instruction. Students who exhibit a preference for alternative means of receiving and processing information may differ in their learning performance when applying various educational media. As Snow (cited in Kern & Matta, 1980) stated: "Individual characteristics not under the control of the students will determine, to a significant extent, what and how much that individual will learn in a given instructional setting" (p. 104). Kern and Matta further pointed out that identifying such patterns of receiving information would be helpful to educators who design or use computer-assisted instruction. Educators would then

have a better understanding of specific students' abilities to apply instructional packages.

Kern and Matta's study involved 90 students who were enrolled in an introductory computer class in a college of business. Using demographic information and data from the Myers-Briggs Type Indicator, a personality instrument, the researchers examined the influence of personality type on the performance of students taught using computer-assisted instruction. According to the developers of the Myers-Briggs Type Indicator, human behavior can be categorized into four areas: (a) extroversion versus introversion, (b) sensing versus intuition, (c) thinking versus feeling, and (d) judging versus perceiving. The results from Kern and Matta's study suggested that identifiable aspects of personality could be used to differentiate students' effectiveness when using computer-assisted instruction. The findings also showed that "sensing-thinking" students performed slightly better than "intuitive-feeling" students. Hence, Kern and Matta concluded that personality can contribute to students' relative success in employing computer-assisted instruction.

A similar study to that of Kern and Matta was undertaken by Howard (1987). The researcher's purpose was to examine the effect of personality characteristics, as measured by the Myers-Briggs Type Indicator and attitude, upon learning by computer-assisted instruction. The sample consisted of 79 upper-division students who were majoring in teacher education. Pretests and posttests on metric measurements were administered. The study findings indicated

that, at the end of the six-week study period, students could follow computer-assisted instruction and there was no significant difference among students in the four personality classifications with regard to retention.

Several researchers found no significant difference in students' attitudes toward computer-assisted instruction as compared to teacher-directed instruction (e.g., Agneberg, 1986, in record management; Labonty, 1988, in accounting, Leitman, 1987, in math; Tobin, 1987, in vocabulary development; VanScoder, 1986, in health). On the other hand, some researchers did find significant differences in students' attitudes toward the two methods of instruction (e.g., Darling, 1987, in math; Drzewiecki, 1987, in developing study skills in low achievers; Reed, 1987, in biology).

Using the Computer Appreciator-Critic Scale developed by Mathews and Wolfe (1983), Verducci (1986) measured 119 graduate subjects' attitudes toward microcomputers. He found that microcomputer users' attitudes toward computers improved as a result of their computer training.

Carpenter (1990) examined the relationship between students' learning styles and their attitudes toward computer-assisted instruction. Specifically, he sought to determine whether students' learning styles, as measured by an instrument developed by Kolb (1976), affected their attitudes toward computer-assisted instruction and whether, after students experienced such instruction, their learning styles and/or attitudes toward that

instructional method changed. The sample consisted of 63 students enrolled in three different nursing programs at a medium-sized university. Carpenter discovered that the students' typing ability appeared to be related to their attitudes toward computer-assisted instruction. Individuals who could type had a significantly more positive attitude toward computer-assisted instruction than those who could not type. Another important finding was that students' learning style did change over time. Sixty percent of the participants changed their learning style during the research.

Limited research was found on the effect of computer-assisted instruction on the attitudes and learning of business-education subjects. However, the studies that were conducted on this topic indicated either positive changes or no significant differences in attitudes when computer-assisted instruction was used (Culwell, 1985; D'Souze, 1983; Schuls, 1985).

One study in which a positive change took place in students' attitudes was reported by Seals (1988). In 1986, typewriters were replaced with microcomputers at Illinois Valley High School, and a word-processing software package for teaching keyboarding was installed through a networked system. At the end of the first year, students showed considerable enthusiasm and increased motivation for typing.

In a study comparing students' achievement and attitudes, Greenland and Bartholome (1987) found that students' attitudes toward writing were not affected by using a microcomputer. In a similar study conducted by Oleny (1987), the experimental group

composed their assignments at a computer, whereas the control group composed at a typewriter. The findings indicated that using a microcomputer had a positive effect on students' attitudes toward writing assignments in business education.

Orr (1990) compared two methods of teaching students to operate word-processing equipment, in order to determine whether achievement and attitude would be affected by the method. The two methods used were the traditional approach of following step-by-step printed instructions and a computer-assisted tutorial approach. To measure attitudes, Orr used the Scale to Measure Attitude Toward Any School Subject, developed by Remmers (1960). From the study findings, she concluded that (a) the method of learning equipment operation did not affect students' attitudes toward the course, and (b) using computer-assisted instruction did not significantly affect students' attitudes toward computers.

Crawford (1985) focused on the effectiveness of computer-assisted instruction as compared to teacher-directed instruction. The effect of students' attitudes toward computer-assisted instruction on their achievement in a selected unit in business mathematics also was investigated. The sample consisted of 57 freshman college students who were enrolled in two sections of business mathematics. The findings indicated that the computer-assisted instruction group had a positive attitude toward computers even though they did not view computer-assisted instruction as a better educational tool than teacher-directed instruction. In

addition, no correlation was found between students' attitudes toward computer-assisted instruction and their achievement in the class.

Skinner's (1988) study at The Ohio State University included 36 undergraduates who were enrolled in a behavioral management course. The purpose was to determine the students' attitudes toward working with a personalized system of computer-assisted instruction. The participants were divided into two groups and were exposed to three instructional conditions during the course. A computer-assisted instruction tutorial was used for five units (CAI-GUIDED), a combination of textbook and computer-assisted instruction (TEXT-CAI-GUIDED) was used for two units, and textual materials alone were used for the last two units (TEXT-ONLY). Skinner developed two survey forms to evaluate students' attitudes toward computer-assisted instruction: a short form specifically for the five CAI-GUIDED units and a long form to evaluate the course at the end of the study, regardless of the type of instruction. From the findings, Skinner concluded that students overwhelmingly had positive perceptions and attitudes toward computer-assisted instruction.

According to the literature reviewed for this study, researchers analyzing students' attitudes toward computers have agreed that learners have more positive attitudes toward computers after using them. However, researchers have found that students have expressed mixed reactions when comparing computer-assisted instruction to teacher-directed instruction. Garhart and Hannafin

(1986) remarked that the popularity of learner-controlled, computer-assisted instruction accentuates the importance of further cognitive-monitoring research. The future success of computerized instruction will depend on business educators' ability to use this approach creatively and rationally. If microcomputers are used properly and innovatively, they could revolutionize the entire learning process (Staudacher, 1983).

Cooperative Learning

During the past two decades, researchers have investigated whether cooperative learning is a viable method to use in improving students' achievement, attitudes, and interpersonal and intergroup skills (Glassman, 1990; Morgan, 1988; Nederhood, 1987; Saxe, 1987; Scott, 1985; Valentino, 1989). However, very little research has been done to discover the outcome of cooperative learning and computer-assisted instruction.

In reviewing the literature, only one recent study was found comparing cooperative learning in computer-assisted instruction to teacher-directed instruction in developing keyboarding skills. Carney (1989) examined the effect of cooperative learning on students' acquisition of keyboarding skills. He also investigated the effects of academic aptitude, gender, and software/hardware configuration on the development of keyboarding proficiency. In addition, the researcher explored the extent to which students' attitudes toward their peers changed as a result of working in a cooperative learning environment. The study sample comprised 119

fourth graders at two public elementary schools. The results indicated no significant effect of cooperative learning and no significant difference in students' attitudes toward one another, depending on whether or not they worked in a cooperative learning environment.

Two studies in curriculum and instruction were reviewed to assess the effectiveness of cooperative learning in computer-assisted instruction and teacher-directed instruction. Carrier and Sales (1987) described the relative effects on achievement of pairing students to learn new concepts using computer-assisted instruction versus having them work individually. The participants in the study were 36 undergraduates enrolled in a teacher-preparation program. Students worked on the lessons either individually or in pairs. The findings indicated that individual achievement was not directly related to learning with a partner.

In the second study on curriculum and instruction, Tanamai (1990) investigated the comparative effects of cooperative and individualistic use of computer-assisted instruction on achievement. He also explored the subjects' affective responses to the two different applications of computer-assisted instruction. Using a matched-pairs approach, the researcher randomly assigned students to the computer-assisted cooperative learning group or the computer-assisted individualistic learning group. Sixty-two subjects participated in the three-week study. The findings revealed that, on both the pretest and the posttest, the two groups had similar

attitudes toward computers. There was no interaction between gender or treatment and students' attitudes toward computers. Other findings indicated that the achievement of students using computer-assisted instruction with cooperative learning did not differ significantly from that of students using computer-assisted instruction with individualistic learning.

According to Johnson, Johnson, and Holubec (1988), cooperative learners who participated in their study experienced the following learning outcomes:

1. Higher achievement and increased retention.
2. Greater use of higher level reasoning strategies and increased critical-reasoning competencies.
3. Greater ability to view situations from others' perspectives.
4. Higher achievement and greater intrinsic motivation.
5. More positive attitudes toward subject areas, learning, and school.
6. More positive, accepting, and supportive relationships with peers regardless of ethnic, gender, ability, and social-class differences or handicapping conditions.
7. More positive attitudes toward teachers, principals, and other school personnel.
8. Higher self-esteem based on basic self-acceptance.
9. Greater social support.
10. More positive psychological adjustment and health.
11. Less disruptive and more on-task behavior.

12. Greater collaborative skills and attitudes necessary for working effectively with others.

Swartz (1989) evaluated the effectiveness of cooperative learning in teaching business communication at the postsecondary level. The study sample consisted of 119 students enrolled in four sections of a business-communication class. A quasi-experimental design was used to assess the effectiveness of cooperative learning. Swartz found that certain attitudes of students who participated in cooperative learning groups were significantly different from those of students who experienced the traditional lecture-discussion method of teaching.

The primary objective of a study undertaken by Willard (1986) was to examine the effects of cooperative learning and cognitive style on teaching word-processing skills to adults. One hundred thirty-two adults were paired and randomly assigned to one of six one-day workshops on Wordstar, a word-processing program. The 34 subjects in the first two workshops worked alone, one person to a computer. The 50 subjects in the next two workshops were randomly assigned partners with whom they shared both a computer and a set of instructional materials. In the remaining two workshops, 48 subjects were assigned a partner based on their scores on a pretest. Results showed no significant differences between the scores of participants working in pairs and those working individually.

The findings from research on cooperative learning strongly suggested that educators should consider using this strategy when

teaching students how to use the microcomputer. Findings from studies by Johnson and Johnson (1985) and their colleagues have indicated that a cooperative environment is better than an individualistic one for learning at the microcomputer (Carrier & Sales, 1987). Researchers also have agreed that further studies on cooperative learning are needed.

Summary

Literature on the development of keyboarding skills using the microcomputer or the typewriter was the focus of this chapter. The primary emphasis was on studies comparing computer-assisted instruction with teacher-directed instruction and examining students' attitudes toward the mode of instruction and cooperative learning.

More than 65 studies were reviewed to provide the necessary background information for this study. Few studies have been done with regard to the business education curriculum at the post-high-school level. The majority of researchers who compared computer-assisted instruction with teacher-directed instruction examined these instructional methods in relation to such variables as speed and accuracy scores and students' attitudes toward the mode of instruction. The data from these studies showed the two modes of instruction to be roughly equivalent in terms of these variables.

With regard to speed and accuracy, whereas three researchers found significant differences between computer-assisted instruction and teacher-directed instruction, two did not, implying that both

methods were effective in developing students' speed and accuracy in keyboarding. Other investigators did not compare the two methods but did analyze students' speed and accuracy scores, formatting skills, and/or attitudes; the results were not conclusive as to whether one mode of instruction or type of equipment was superior to the other.

Few studies were found concerning students' attitudes and their relationship to the mode of instruction used in developing keyboarding skills. The majority of these researchers examined students' attitudes toward the computer or the subject matter. Seals (1988) did compare the relationship between students' attitudes and the mode of instruction and found that students had positive attitudes toward using computers. In other studies concerning students' attitudes, it was found that students' personalities played an important role in their success when applying computer-assisted instruction. Researchers in this area found that students preferred both using computer-assisted instruction and interacting with a teacher.

Data from the research on computer-assisted instruction and teacher-directed instruction also indicated that students liked using a computer and thought that computer-assisted instruction was a good way to learn keyboarding skills. With few exceptions, the studies reviewed in this chapter indicated that students' attitudes changed positively as a result of using computers, with or without computer-assisted instruction. These findings were consistent with

those of other studies concerning students' attitudes toward microcomputers (Burns, 1985; Dalgaard & Lewis, 1985; Skinner, 1988).

For the most part, the findings from studies on cooperative learning indicated there was no significant difference in students' performance, based on the mode of instruction. Only one study was found that analyzed cooperative learning and compared computer-assisted instruction to teacher-directed instruction in developing keyboarding skills (Carney, 1989). This study was conducted with fourth-grade students. No significant difference was found in the way these students performed or interacted with each other, depending on whether or not they worked in a cooperative learning environment.

Although studies have revealed that the popularity of microcomputers is increasing, research has not shown that they are far superior to typewriters in teaching keyboarding skills and that typewriters should indeed by replaced with microcomputers. It has been found, however, that students enjoy using microcomputers rather than typewriters and that the role of the teacher does indeed change when computer-assisted instruction is employed. Limited research was found on the effect of various computer-assisted-instruction software programs in teaching keyboarding. Writers strongly suggested, however, that educators who intend to use computer-assisted instruction should explore the effectiveness of particular software programs in developing keyboarding skills.

No study was found in which computer-assisted instruction was compared with teacher-directed instruction in developing keyboarding

skills at the community college level or that examined students' attitudes toward the mode of instruction, their attitudes toward the type of equipment used, and their interaction with one another in collaborative learning. Most of the research in business education was concerned with just one or two of these variables. The present research was intended to provide useful information on all of these topics.

CHAPTER III

METHODOLOGY FOR THE STUDY

The primary purpose of this study was to compare the keyboarding achievement, attitude, and collaborative learning of students who learned keyboarding skills on electronic typewriters, using the traditional teacher-directed method of instruction, as compared to students who learned keyboarding skills on microcomputers, using the computer-assisted method of instruction. The research procedures used in the study are discussed in this chapter. The research design is discussed first, followed by the research questions and hypotheses. Also described are the setting for the study, population definition and sample selection, the treatment protocol, instrumentation, and data-collection and data-analysis procedures.

Research Design

A quasi-experimental design was used in this study. The study lacked the necessary criteria for being a true experiment because subjects were not randomly assigned to the treatment and control groups. Campbell and Stanley (1963) commented that a quasi-experimental design is worth using when true experiments are impossible. Huxley (1981) further stated that the purpose of a

quasi-experimental design is to approximate the conditions of a true experiment in a setting that does not allow the researcher to control and/or manipulate all relevant variables. The researcher must understand what compromises exist in the internal and external validity of the design and proceed within these limits.

The basic design was a pretest, treatment, and posttest design using intact classes at two campuses of an urban community college. The curriculum, teaching methods, course description, and classes included in the study were consistent between the two campuses.

The independent variables studied in this research were teacher-directed instruction using electronic typewriters and computer-assisted instruction using microcomputers to teach keyboarding. The dependent variables were speed, accuracy, basic skills requiring keyboarding, student attitudes, and cooperative learning. Organismic variables included subjects' personal characteristics as well as their previous knowledge of keyboarding.

The researcher was aware that at least two extraneous variables might have affected the outcome of the study. The major variable of concern was the amount of practice time a student put in outside of class. Another extraneous variable was the dropout rate in the classes.

Research Questions

The following questions were posed to guide the collection of data for this study:

1. Does the keyboarding achievement of students who learn keyboarding skills on microcomputers, using computer-assisted instruction, differ from that of students who learn keyboarding skills on electronic typewriters, using teacher-directed instruction?

2. Do the attitudes of students who learn keyboarding skills using computer-assisted instruction differ from those of students who learn keyboarding skills using teacher-directed instruction?

3. Does the collaborative learning of students who learn keyboarding skills using computer-assisted instruction differ from that of students who learn keyboarding skills using teacher-directed instruction?

4. Do the attitudes of students who have had previous keyboarding experience differ from those of students who have had no keyboarding experience?

5. Does the collaborative learning of students who have had previous keyboarding experience differ from that of students who have had no keyboarding experience?

6. Does the speed of students who learn keyboarding skills using electronic typewriters differ from that of students who learn keyboarding skills using microcomputers?

7. Does the accuracy of students who learn keyboarding skills using electronic typewriters differ from that of students who learn keyboarding skills using microcomputers?

Hypotheses

The following hypotheses were tested in this study:

Ho 1: There is no significant difference in the keyboarding achievement of students who learn keyboarding skills on microcomputers, using computer-assisted instruction, and that of students who learn keyboarding skills on electronic typewriters, using teacher-directed instruction.

Ho 2: There is no significant difference in the attitudes of students who learn keyboarding skills using computer-assisted instruction and those of students who learn keyboarding skills using teacher-directed instruction.

Ho 3: There is no significant difference in the collaborative learning of students who learn keyboarding skills using computer-assisted instruction and that of students who learn keyboarding skills using teacher-directed instruction.

Ho 4: There is no significant difference in the attitudes of students who have had previous keyboarding experience and those of students who have had no keyboarding experience.

Ho 5: There is no significant difference in the collaborative learning of students who have had previous keyboarding experience and that of students who have had no keyboarding experience.

Ho 6: There is no significant difference in the speed of students who learn keyboarding skills using electronic typewriters and that of students who learn keyboarding skills using microcomputers.

Ho 7: There is no significant difference in the accuracy of students who learn keyboarding skills using electronic typewriters and that of students who learn keyboarding skills using microcomputers.

The Setting for the Study

Wayne County Community College (WCCC) has five state-of-the-art campuses, which are located in industrial, rural, and metropolitan areas of Michigan where a major share of the state's technical and skilled occupations are located. Because of the diversity of its service area, WCCC places strong emphasis on occupational/career

programs, in addition to traditional college and university transfer programs. WCCC is an accredited institution with an enrollment of more than 11,000 students (WCCC, 1989, p. 1). The Office Information Systems (OIS) Department enrolls students who are preparing for six careers: administrative secretary, legal secretary, medical secretary, general office clerk, court and conference reporter, and information word processor. Keyboarding skills are mandatory for each of these careers.

To develop keyboarding skills, students may enroll in one of two courses--Keyboarding (OIS 100) or Fundamentals of Typewriting (OIS 101). Students entering the keyboarding courses are expected to (a) develop keyboarding skills and (b) become computer literate. Students entering the typewriting course are expected to (a) develop keyboarding skills and (b) acquire other skills necessary for entry-level employment in a business office.

Class size for both courses is usually 15 to 20 students who represent not only the various OIS career majors but also other career majors. There are no prerequisite courses for enrollment in either Keyboarding or Fundamentals of Typewriting.

The Population and Sample

The population consisted of all students at WCCC who were enrolled in Keyboarding (OIS 100) and Fundamentals of Typewriting (OIS 101) during fall semester 1990. The students had met all of the requirements for admission to the community college. The average student at WCCC is an African American female, approximately

25 years old, who is attending school to preparing for employment or to gain additional education. The Keyboarding and Fundamentals of Typewriting classes are not required for all students. Students enrolled in these classes represented a cross-section of all students enrolled in the college as nursing, accounting, computer-data processing, and liberal arts majors. Those who take the keyboarding and typewriting classes are usually first-semester to third-semester students.

The sample for this study consisted of 66 students who enrolled in either Keyboarding (OIS 100) or Fundamentals of Typewriting (OIS 101) at Wayne County Community College, Eastern and Downtown campuses, during fall semester 1990. The two classes met three hours a week for 15 weeks. Students were not randomly selected for the classes, nor were they informed of the research during the registration period. The experimental group comprised the 34 students who enrolled in Keyboarding, whereas the control group comprised the 32 students who enrolled in Fundamentals of Typewriting.

The experimental group learned keyboarding skills on microcomputers, using a computer-assisted instruction software package and Lessons 1 to 25 in Gregg College Typing Series Six, a textbook published by McGraw-Hill. The control group learned keyboarding skills on IBM Wheelwriter 5 electronic typewriters, using teacher-directed instruction and the same textbook as the experimental group. For the duration of this study, students in the

experimental group had access to microcomputers to complete and practice their assignments. Students in the control group had access to electronic typewriters to complete and practice their assignments.

Treatment Protocol

The researcher taught one keyboarding class and one typewriting class. The other keyboarding and typewriting classes were taught by two professional, tenured business teachers in the OIS Department.

Students in both the experimental and control groups were responsible for completing all 25 lessons in a 12-week period. The 25 lessons were grouped into five units, each of which contained five lessons. Unit 1 (Lessons 1-5), introduced students to the home-row keys and nine other alphabetic keys. Unit 2 (Lessons 6-10) introduced students to the remainder of the alphabetic keys and most of the punctuation keys. Unit 3 (Lessons 11-15) emphasized skill development, which included horizontal, vertical, block, and spread centering. Unit 4 (Lessons 16-20) focused on the numeric keys, and Unit 5 (Lessons 21-25) contained the symbol keys. To maximize time and ensure that students would steadily progress through the material, a calendar indicating when lessons were to be completed was developed and distributed to the students (see Appendix A).

During the first three weeks of class, the researcher and the faculty members met with their respective classes to explain class procedures, have students complete survey forms, and administer the pretest. At the end of the first three weeks, the students were

able to (a) operate the microcomputer or the electronic typewriter, (b) operate the printer (experimental group), and (c) complete Lesson 1.

From Week 4 through Week 12, students in the experimental group completed the remaining 24 lessons, working at their own pace. However, the researcher or faculty member was available to answer students' questions. The control group completed their 24 lessons with the instructor at the same time as the experimental group.

To identify students who had had previous keyboarding experience, a Student Survey was distributed to both groups during the first three class sessions. In addition to previous keyboarding experience, the survey was designed to gather information on students' gender, age, educational background, and employment (see Appendix B).

Students in both the experimental and control groups were given a consent form, which they were to sign if they agreed to participate in the study (Appendix C). They were assured that their participation was voluntary and that the results would be treated with strict confidence.

Pretest and Posttest

A pretest and a posttest were used to measure the students' keyboarding achievement on either the electronic typewriters or the microcomputers. The pretest was administered during the first three days of classes to give late enrollees an opportunity to take the

test. The posttest was administered at the end of Lesson 25. Both the pretest and the posttest consisted of two parts.

Part I of the pretest and posttest contained two two-minute timed writings. One timed writing was straight copy; the other was a combination of straight copy and numbers. These timed writings were used to measure students' keyboarding speed and accuracy. The difficulty level for the timed writing was *easy*.

Gross words a minute (GWAM) or speed scores were based on the number of words typed in the timed writing. To determine GWAM, the line score on the timed writing was divided by two (because it was a two-minute timed writing) (see Appendix D). Accuracy was determined by counting the number of errors. Although students could correct their errors during the timed writings, this was neither emphasized nor taught.

Part II of the pretest and the posttest contained four skill-development problems in centering--namely, horizontal, vertical, block, and spread. Scores were based on the accuracy with which students completed each problem. Each completed problem (test item) was assigned a score of 25 points. Points were deducted from the 25 points allocated to each problem for spacing errors, repetition errors, improper capitalization, typographical errors, centering errors, and omission of lines. Points were given for incomplete problems, based on the number of lines typed (Appendix E). Students had 60 minutes in which to complete the four problems.

Instrumentation

The researcher developed three instruments to gather the data necessary to test Hypotheses 2, 3, 4, and 5. These were the Learner Attitude Inventory, the Cooperative Learning Inventory, and the Keyboarding Evaluation Inventory. To establish the validity of these inventories, the researcher mailed them to 25 business teachers throughout Michigan. Nineteen teachers returned the instruments with comments or suggestions. Based on this input, the instruments were modified to improve their face validity. The final version of the inventories may be found in Appendix F.

Reliability was established using a group of students who were not included in the study sample. They were enrolled in a keyboarding class during the semester the instruments were developed. The students completed the instruments twice, approximately four weeks apart. Test-retest analysis was performed using the Pearson product-moment correlation procedure. The coefficient for the Learner Attitude Inventory was .67, and the Cooperative Learning Inventory had an r-value of .54. These values were sufficient to establish the reliability of the instruments for use in this study.

All three instruments were administered to both the experimental group and the control group. Some wording in the instruments was modified to reflect the particular type of equipment used by each group (microcomputers or typewriters).

The Learner Attitude Inventory

The Learner Attitude Inventory contained ten items developed to ascertain (a) students' attitudes toward the class, (b) the problems students encountered while learning keyboarding, and (c) students' attitudes toward using the computer or the electronic typewriter. The students' attitudes toward their method of instruction (computer-assisted instruction or teacher-directed instruction) also were measured with this inventory. Students responded to most statements on the inventory using a Likert-type scale ranging from Strongly Agree to Strongly Disagree. Two open-ended questions allowed students to write in their own comments on parts of lessons that were unclear and their attitudes about doing the keyboarding lessons. The researcher or business instructor administered the instrument at the end of every fifth lesson.

The Cooperative Learning Inventory

The Cooperative Learning Inventory contained six statements; students responded to each statement by checking one of three answers: Never, Frequently, or Sometimes. This instrument was a modification of one developed by Swartz (1989). It was intended to compare the cooperative learning of students in the computer-assisted instruction (experimental) group and those in the teacher-directed instruction (control) group. Students also completed this instrument at the end of every fifth lesson.

The Keyboarding Evaluation Inventory

The Keyboarding Evaluation Inventory was a six-item, yes-no instrument in which students evaluated various aspects of the keyboarding class. The inventory also was intended to discover students' attitudes toward the computer-assisted and the teacher-directed methods of instruction and cooperative learning. Students completed this instrument at the end of Lesson 25.

Data-Collection Procedures

During the first three class meetings of both the experimental and control groups, the initial data were collected by administering the Student Survey and the pretest (Appendix G). At this time, students signed a consent form indicating their agreement to participate in the study. The faculty members kept the consent forms from their students; one faculty member also kept the consent forms from the researcher's classes to prevent any bias. Each student was assigned a number, which was recorded on all survey forms, tests, and inventories administered throughout the study. The researcher or faculty member briefly explained the nature of the research and the students' role in it.

Minimal verbal instructions and assistance were given to students before they began the pretest on the microcomputer or the electronic typewriter. For example, the experimental group's microcomputers were ready for them to begin keying the appropriate information. Students in this group were told two things: (a) that the "Enter" key on the microcomputer was the same as the return key

on a typewriter, and (b) that after touching the "Enter" key repeatedly they would see a line going across the screen, indicating a new page. Students in the control group were told (a) how to turn on the electronic typewriter and (b) how to insert a sheet of paper into the typewriter. Students were given an hour to take the entire pretest. The researcher or faculty member printed out the experimental group's pretests from their microcomputers.

At the end of the third class, all survey forms and pretests were given to the researcher. The pretests were then grouped and coded to indicate which were from the two experimental groups and the two control groups. The pretests were analyzed to determine students' speed and accuracy scores, as well as their points on pre-keyboarding centering skills. The charts in Appendices D and E were used to evaluate students' performance on both the pretest and the posttest.

During the next three class sessions, students became familiar with class procedures and machine operation and had completed Lesson 1. Beginning with the seventh class, students started and completed Lessons 2 through 25 according to the class calendar. Students were told that if they wanted to work with other students at any time they could do so. This was the only time that cooperative learning was mentioned. Students were assigned two or three lessons each week. Upon completing Lessons 1-5, 6-10, 11-15, 16-20, and 21-25, students filled out the Learner Attitude Inventory and the Cooperative Learning Inventory. The researcher gathered these instruments and grouped and coded them according to class section.

Week 13 was set aside for students to take the posttest and complete the Keyboarding Evaluation Inventory. The posttest contained the same activities as the pretest. Part I consisted of two two-minute timed writings, and Part II consisted of four skill-development centering problems (horizontal, vertical, block, and spread). Students were given one hour to complete the centering problems, which allowed the slowest students enough time to complete all problems on the test.

Pretests and posttests were coded as follows:

Code	Definition
Pre1 and Post1	Speed score on straight-copy timed writing
Pre2 and Post2	Accuracy score on straight-copy timed writing
Pre3 and Post3	Speed score on numeric-copy timed writing
Pre4 and Post4	Accuracy score on numeric-copy timed writing
Pre5 and Post5	Achievement test average on four centering problems

After all of the tests had been grouped, coded, and analyzed, the results for the four groups were compared to determine whether there were significant differences between the experimental and control groups. The statistical analyses used in these comparisons are described in the following section.

Data-Analysis Procedures

Descriptive statistics (frequency and percentage) were used to analyze the demographic data and to compare the experimental and

control groups in terms of these personal characteristics. Cross-tabulations and measures of central tendency also were used.

Hypothesis 1, 6, and 7 were tested using analysis of variance and covariance. Hypotheses 2, 3, 4, and 5 were tested using repeated-measures analysis of variance and analysis of covariance to determine whether there were significant differences between the experimental and control groups. A t-test was also used with two independent variables to determine whether there were significant differences between the groups based on data from the Keyboarding Evaluation Inventory. For all statistical analyses conducted in this study, the .05 alpha level was the criterion for significance. The results of the data analyses are reported in Chapter V.

CHAPTER IV

RESULTS OF THE STATISTICAL ANALYSES

Chapter IV contains the results of the statistical analyses performed on the data collected in this study. The subjects were 66 students enrolled in the Fundamentals of Typewriting and Keyboarding classes at Wayne County Community College (WCCC) during fall semester 1990. The sample was divided into two groups. The experimental group was taught keyboarding skills with computer-assisted instruction on microcomputers. The control group was taught similar skills with teacher-directed instruction on electronic typewriters. The two groups were not intentionally matched on any demographic characteristics. The criterion for inclusion in the sample was enrollment in either the Fundamentals of Typewriting course or the Keyboarding course.

This chapter is divided into three sections: Demographic Characteristics of the Respondents, Results of Hypothesis Testing, and Analysis of Responses to the Keyboarding Evaluation Inventory.

Demographic Characteristics of the Respondents

Answers provided on the Student Survey were analyzed using descriptive statistics. This self-report instrument was completed by students in the sample during the first three class meetings.

The researcher did not attempt to verify the answers because the students were told that all information would remain confidential, and thus they had no reason to answer untruthfully.

The Student Survey was designed to elicit information on students' marital status, age, gender, and previous education. Other questions pertained to the number of courses in which students were enrolled, the number of hours they worked, their previous keyboarding experience, keyboarding speed, and reasons for taking the class. In addition, students were asked about the availability of a typewriter or a microcomputer in their homes.

The current marital status of students in the sample is shown in Table 1. The majority of students (50 or 75.7%) were single. Of these 50 students, 27 (40.9%) were in the experimental group and 23 (34.8%) were in the control group. The other students were either married (12.1%) or divorced (12.2%).

Table 1.--Distribution of the sample by current marital status.

Marital Status	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
Single	27	40.9	23	34.8	50	75.7
Married	3	4.5	5	7.6	8	12.1
Divorced	4	6.1	4	6.1	8	12.2
Total	34	51.5	32	48.5	66	100.0

Students were asked to indicate their ages, using one of five categories. The distribution of students by age category is displayed in Table 2. Most of the students (35 or 53.1%) were under 25. They were nearly equally represented in the experimental and control groups (18 or 27.3% and 17 or 25.8%, respectively). Two students (3%), one in each group, were 55 or older.

Table 2.--Distribution of the sample by age category.

Age	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
Under 25	18	27.3	17	25.8	35	53.1
25 to 34	6	9.1	9	13.6	15	22.7
35 to 44	6	9.1	5	7.6	11	16.7
45 to 54	3	4.5	0	0.0	3	4.5
55 and over	1	1.5	1	1.5	2	3.0
Total	34	51.5	32	48.5	66	100.0

The distribution of the sample by gender is shown in Table 3. Fifty-five (83.3%) of the 66 participants were females; the other 11 (16.7%) were males.

Table 3.--Distribution of the sample by gender.

Gender	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
Female	28	42.4	27	40.9	55	83.3
Male	6	9.1	5	7.6	11	16.7
Total	34	51.5	32	48.5	66	100.0

The personal characteristics of the study sample were similar to those of other students enrolled in WCCC. The sample consisted primarily of single females under 25 years of age. Males were underrepresented in the sample, but the percentage of males was proportional to the number of males who normally enroll in the Fundamentals of Typewriting and Keyboarding courses.

On the survey form, students were asked to indicate their previous educational level. Responses to this item are shown in Table 4. The majority of participants (46 or 69.7%) had completed high school, whereas five students (7.6%) had earned a general education degree (GED). Three students (4.5%) did not respond to the question.

Table 4.--Distribution of the sample by educational level.

Educational Level	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
Post-high school	5	7.6	4	6.1	9	13.7
H.S. graduate	21	31.8	25	37.9	46	69.7
Two years H.S.	2	3.0	1	1.5	3	4.5
GED diploma	4	6.1	1	1.5	5	7.6
No response	2	3.0	1	1.5	3	4.5
Total	34	51.5	32	48.5	66	100.0

Students were asked how many classes they were taking. Their responses are summarized in Table 5. The majority of students (44 or 66.8%) were taking three or four classes. Sixteen students (24.2%) were taking two classes, and three students (4.5%) said they were enrolled in six classes.

Table 5.--Distribution of the sample by number of courses in which they were enrolled.

Number of Courses	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
One	2	3.0	1	1.5	3	4.5
Two	9	13.6	7	10.6	16	24.2
Three	11	16.7	12	18.2	23	34.9
Four	11	16.7	10	15.2	21	31.9
Six	1	1.5	2	3.0	3	4.5
Total	34	51.5	32	48.5	66	100.0

Table 6 shows the number of participants who were working in addition to attending school. The 28 (42.4%) students who were working indicated that they worked 20 to 34.6 hours a week. The average was 28.8 hours (standard deviation = 14.6).

Table 6.--Distribution of the sample by employment while attending school.

Sample Members Working	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
Yes	12	18.2	16	24.2	28	42.4
No	22	33.3	16	24.3	38	57.6
Total	34	51.5	32	48.5	66	100.0

Participants also were asked whether they had previous keyboarding experience. Their responses are shown in Table 7. The majority of respondents (51 or 77.3%) had previous keyboarding experience. Of the 32 students in the control group, 30 (45.5% of the total sample) had previous keyboarding experience, compared to only 21 (31.8% of the total sample) of the 34 participants in the experimental group.

Table 7.--Distribution of the sample by previous keyboarding experience.

Keyboarding Experience	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
Yes	21	31.8	30	45.5	51	77.3
No	13	19.7	2	3.0	15	22.7
Total	34	51.5	32	48.5	66	100.0

Students who had had keyboarding experience were asked where they had received their instruction. Most of the students (32 or 48.5%) reported that their previous typing instruction had been in high school. Two students (3%) said they had taught themselves to type. These data are shown in Table 8.

Table 8.--Distribution of the sample by where they had received previous keyboarding instruction.

Location	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
Junior H.S.	2	3.0	5	7.6	7	10.6
High school	15	22.7	17	25.8	32	48.5
Business school	2	3.0	5	7.6	7	10.6
Self-taught	0	0.0	2	3.0	2	3.0
Armed services	0	0.0	1	1.5	1	1.5
Other	2	3.0	0	0.0	2	3.0
No previous exp.	13	19.8	2	3.0	15	22.8
Total	34	51.5	32	48.5	66	100.0

The students who had had previous instruction in keyboarding were asked to indicate their typing speed. The responses are shown in Table 9. Students who had had previous typing instruction reported typing speeds ranging from 15 to 35 words per minute. The greatest number of students (15 or 22.7%) said they did not know how fast they typed. No attempt was made at this time to test the students' typing ability. All of the responses to this item were estimates, based on the students' ability to remember their previous typing experience in a classroom setting.

Table 9.--Distribution of the sample by estimated typing speed.

Typing Speed	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
15 words/minute	2	3.0	1	1.5	3	4.5
20 words/minute	3	4.5	4	6.1	7	10.6
25 words/minute	5	7.6	5	7.6	10	15.2
30 words/minute	1	1.5	5	7.6	6	9.1
35 words/minute	5	7.6	5	7.6	10	15.2
Don't know	5	7.6	10	15.1	15	22.7
No typing exp.	13	19.7	2	3.0	15	22.7
Total	34	51.5	32	48.5	66	100.0

On the Student Survey, participants also were asked why they were currently taking the Fundamentals of Typewriting or Keyboarding class. As shown in Table 10, the greatest number of students (21 or 31.9%) were taking Fundamentals of Typewriting or Keyboarding for

purposes of skill development. The second and third major reasons were for employment (15 or 22.7%) and personal use (14 or 21.1%). Only 12 students (18.2%) said they needed the class as part of their program requirements.

Table 10.--Distribution of the sample by reasons for enrolling in Fundamentals of Typewriting or Keyboarding.

Reason for Enrolling	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
Skill development	10	15.2	11	16.7	21	31.9
Employment	9	13.6	6	9.1	15	22.7
Personal use	9	13.6	5	7.5	14	21.1
Requirement	2	3.0	10	15.2	12	18.2
Other	4	6.1	0	0.0	4	6.1
Total	34	51.5	32	48.5	66	100.0

Students in both the experimental and control groups were asked whether they had ever used a microcomputer. As shown in Table 11, 48 (72.7%) of the students in the total sample had never used a microcomputer.

The number of participants who had typewriters in their homes is shown in Table 12. Thirty-six of the 66 participants (54.5%) indicated that they had typewriters in their homes. Of that number, 15 (22.7%) were in the experimental group and 21 (31.8%) were in the control group.

Table 11.--Distribution of the sample by previous use of a microcomputer.

Computer Use	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
No	23	34.8	25	37.9	48	72.7
Yes	11	16.7	7	10.6	18	27.3
Total	34	51.5	32	48.5	66	100.0

Table 12.--Distribution of the sample by the availability of a typewriter at home.

Availability of Typewriter	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
Yes	15	22.7	21	31.8	36	54.5
No	19	28.8	11	16.7	30	45.5
Total	34	51.5	32	48.5	66	100.0

The final question on the Student Survey concerned whether students had a microcomputer at home. Of the 66 participants, only 4 (6%) had a microcomputer at home (see Table 13). The majority of students (62 or 94%) did not have a microcomputer at home.

Table 13.--Distribution of the sample by the availability of a microcomputer at home.

Availability of Microcomputer	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
No	31	47.0	31	47.0	62	94.0
Yes	3	4.5	1	1.5	4	6.0
Total	34	51.5	32	48.5	66	100.0

Results of Hypothesis Testing

Each of the research questions and its companion hypothesis was evaluated individually. In this section, each research question and the accompanying hypothesis are restated, followed by the results of the hypothesis testing.

Null Hypothesis 1

The first research question was, "Does the keyboarding achievement of students who learn keyboarding skills on microcomputers, using computer-assisted instruction, differ from that of students who learn keyboarding skills on electronic typewriters, using teacher-directed instruction?" Null Hypothesis 1 was:

> Ho 1: There is no significant difference in the keyboarding achievement of students who learn keyboarding skills on microcomputers, using computer-assisted instruction, and that of students who learn keyboarding skills on electronic typewriters, using teacher-directed instruction.

Analysis of variance was used to test for significant differences between the experimental group and the control group

with regard to their keyboarding achievement. Keyboarding achievement was measured by the score on Post5. That score was the dependent variable. The type of instruction--computer assisted or teacher directed--was the independent variable.

Mean scores were analyzed to compare the achievement of the two groups and to compare the achievement of students who had previous typing instruction with that of students who had not had previous typing instruction. The results are shown in Tables 14 through 17. As shown in Table 14, no significant difference in achievement was found at the .05 alpha level between the experimental and control groups or between students who had and those who did not have previous keyboarding experience.

Table 14.--Results of analysis of variance for keyboarding achievement (Post5) by group and previous experience.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects	1585.930	2	792.965	2.340	.106
GROUP	67.049	1	67.049	.198	.658
PREV EXP	1111.011	1	1111.011	3.278	.075
2-way interaction	89.853	1	89.853	.265	.609
Residual	19316.217	57	338.881		
Total	20992.000	60	349.867		

The group means on the fifth posttest are shown in Table 15. As shown in the table, the control group (typewriters) scored higher (77.9%) on the achievement test than did the experimental group (computers) (72.3%). Of the students who had previous keyboarding experience, those in the control group did better than their counterparts in the experimental group (79.1% versus 75.8%, respectively). However, of the students without previous keyboarding experience, those in the experimental group did better than students in the control group (66.5% versus 62.0%, respectively).

Table 15.--Keyboarding achievement (Post5) of students with and without previous keyboarding experience.

Group	Total Means	Previous Keyboarding Exp.	No Keyboarding
Computers	72.3	75.8	66.5
Typewriters	77.9	79.1	62.0
Grand means	75.0	77.7	65.8

Because the majority of students had previous keyboarding experience (30 students in the control group and 21 in the experimental group), an analysis of covariance was used to test for significant differences between the two groups. The achievement score on the fifth pretest (Pre5) was used as the covariate. The results of this analysis are shown in Table 16. As seen in the table, with Pre5 controlled, the F-value of 2.831 was not

statistically significant at the .05 alpha level. Thus, there was no statistically significant difference between the experimental group and the control group on the achievement test.

Table 16.--Comparison of Post5 by group with Pre5.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Covariates					
PRE5	249.614	1	249.614	2.285	.146
Main effects					
GROUP	309.279	1	309.279	2.831	.108
Residual	2184.020	20	109.251		
Total	2743.913	22	124.723		

The final test of Hypothesis 1 was an analysis of variance to test for significant differences in keyboarding achievement between the experimental and control groups. Table 17 contains the results of this analysis. The F-value of 1.366 was not significant at the .05 alpha level. Hence there was no statistically significant difference between the experimental and control groups in terms of keyboarding achievement. Therefore, Null Hypothesis 1 was not rejected.

Table 17.--Comparison of keyboarding achievement between the experimental group and the control group.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects					
GROUP	474.919	1	474.919	1.366	.247
Residual	20517.081	59	347.747		
Total	20992.000	60	349.867		

Null Hypothesis 2

The second research question asked, "Do the attitudes of students who learn keyboarding skills using computer-assisted instruction differ from those of students who learn keyboarding skills using teacher-directed instruction?" Null Hypothesis 2 was as follows:

> Ho 2: There is no significant difference in the attitudes of students who learn keyboarding skills using computer-assisted instruction and those of students who learn keyboarding skills using teacher-directed instruction.

Null Hypothesis 2 was tested at the .05 level of significance using repeated-measures analysis of variance. The method of instruction was the independent variable; the dependent variable was the students' attitudes at five testing times during the course.

The participants responded to a nine-item attitudinal instrument, the Learner Attitude Inventory, at the end of every fifth lesson. To test this hypothesis, responses to each item were evaluated separately to determine whether there were differences in the

students' attitudes over time. Mean scores on each item for the experimental and control groups were then graphed to determine at what testing time(s) differences might have occurred and the nature of the difference.

With regard to the first attitude item ("The lessons were written in a way that made them easy to understand"), the F-value of 2.54 was not significant at the .05 alpha level (see Table 18). When the mean scores were graphed over the five testing times, a significant difference was noted in the two groups' attitudes at Time 3 (Lessons 11-15) (see Figure 1). At Time 3, the experimental disagreed significantly more strongly with Item 1 than did the control group. However, the two groups did not differ significantly with respect to Item 1 overall.

Table 18.--Results of the analysis for Attitude Item 1: "The lessons were written in a way that made them easy to understand."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	87.55	60	1.46	2.54	.116
Group	3.71	1	3.71		

For the second attitude item ("The instructor's explanations helped make the lessons clearer and easier to understand"), the F-value of 25.23 was significant at the .05 alpha level (see Table 19). Thus, the two groups differed significantly in their attitudes

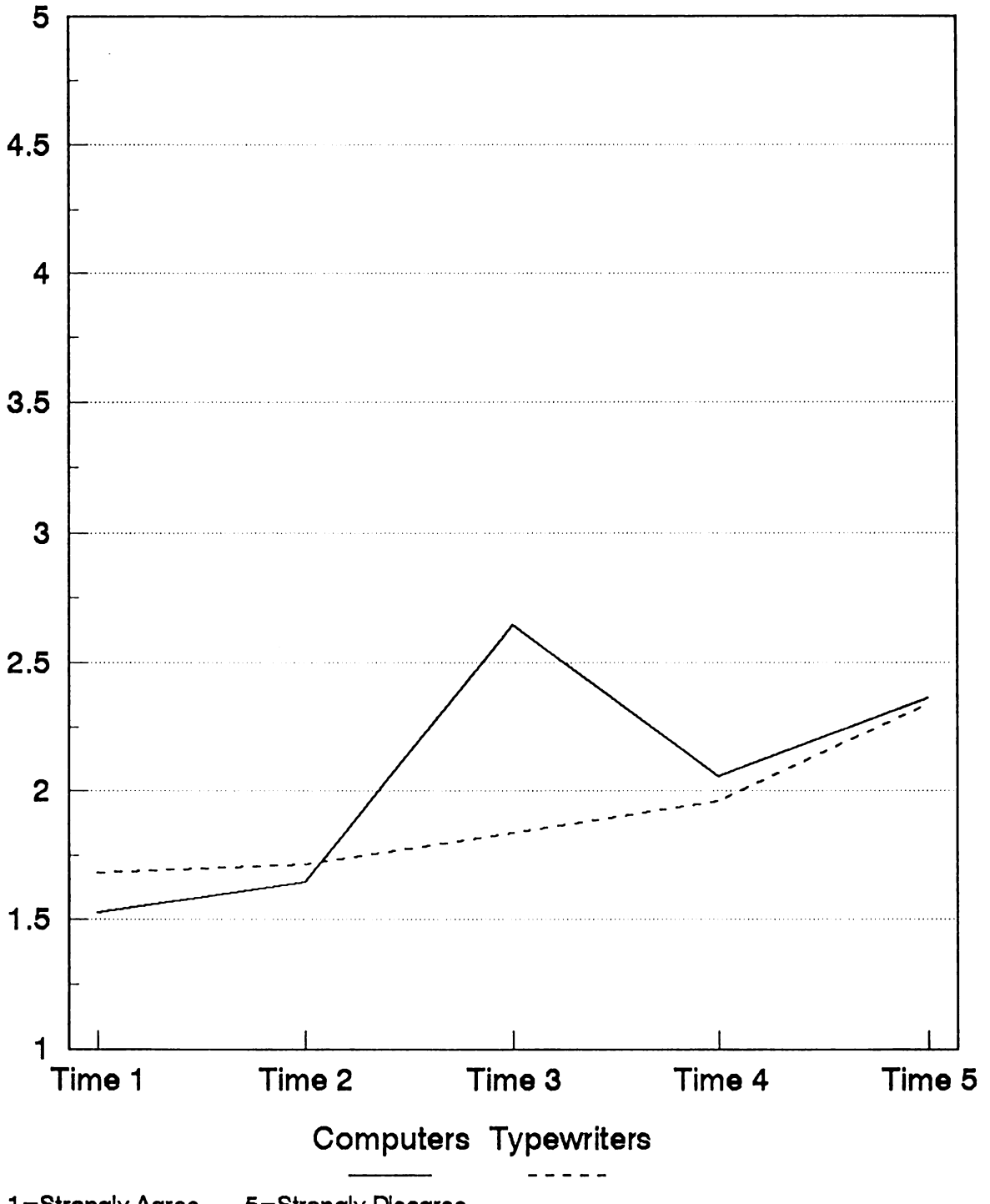

Figure 1: Mean responses of experimental and control groups to Attitude Item 1: "The lessons were written in a way that made them easy to understand."

regarding Attitude Item 2. There were significant differences between groups at all five test times. The control group agreed more strongly with this item at all times than did the experimental group, as shown in Figure 2. The significant difference in attitudes toward this item might be attributed to the method of instruction.

Table 19.--Results of the analysis for Attitude Item 2: "The instructor's explanations helped make the lessons clearer and easier to understand."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	114.37	60	1.91	25.23	.000*
Group	48.09	1	48.09		

*p < .05.

For the third attitude item ("It was not necessary to have an instructor in the classroom in order to understand the lessons"), the F-value of 6.29 was significant at the .05 alpha level (see Table 20). Thus, the two groups differed significantly in their attitudes regarding Item 3. As shown in Figure 3, the groups differed significantly at Times 1 and 4. The control group disagreed significantly more strongly with the statement at those times than did the experimental group.

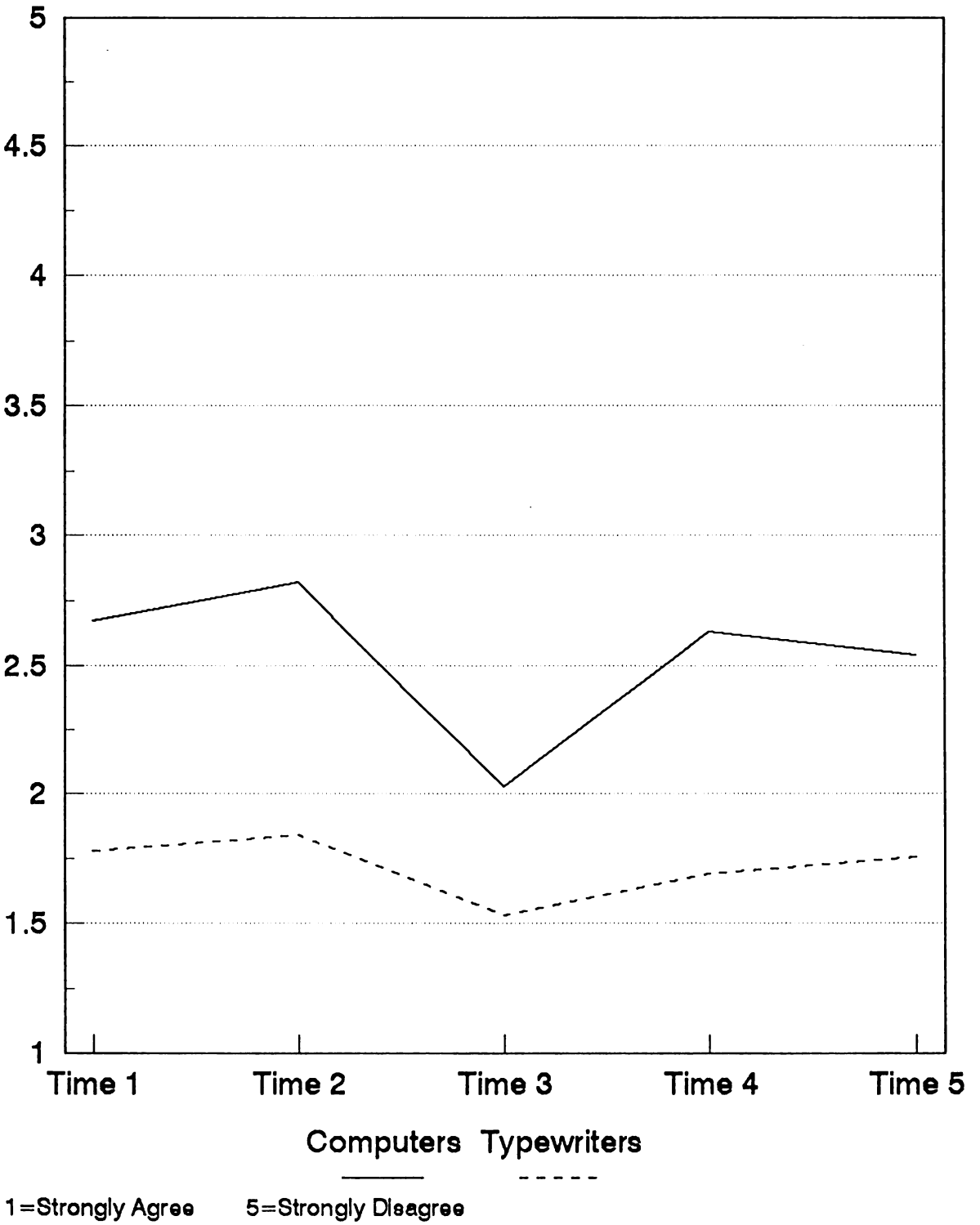

Figure 2: Mean responses of experimental and control groups to Attitude Item 2: "The instructor's explanations helped make the lessons clearer and easier to understand."

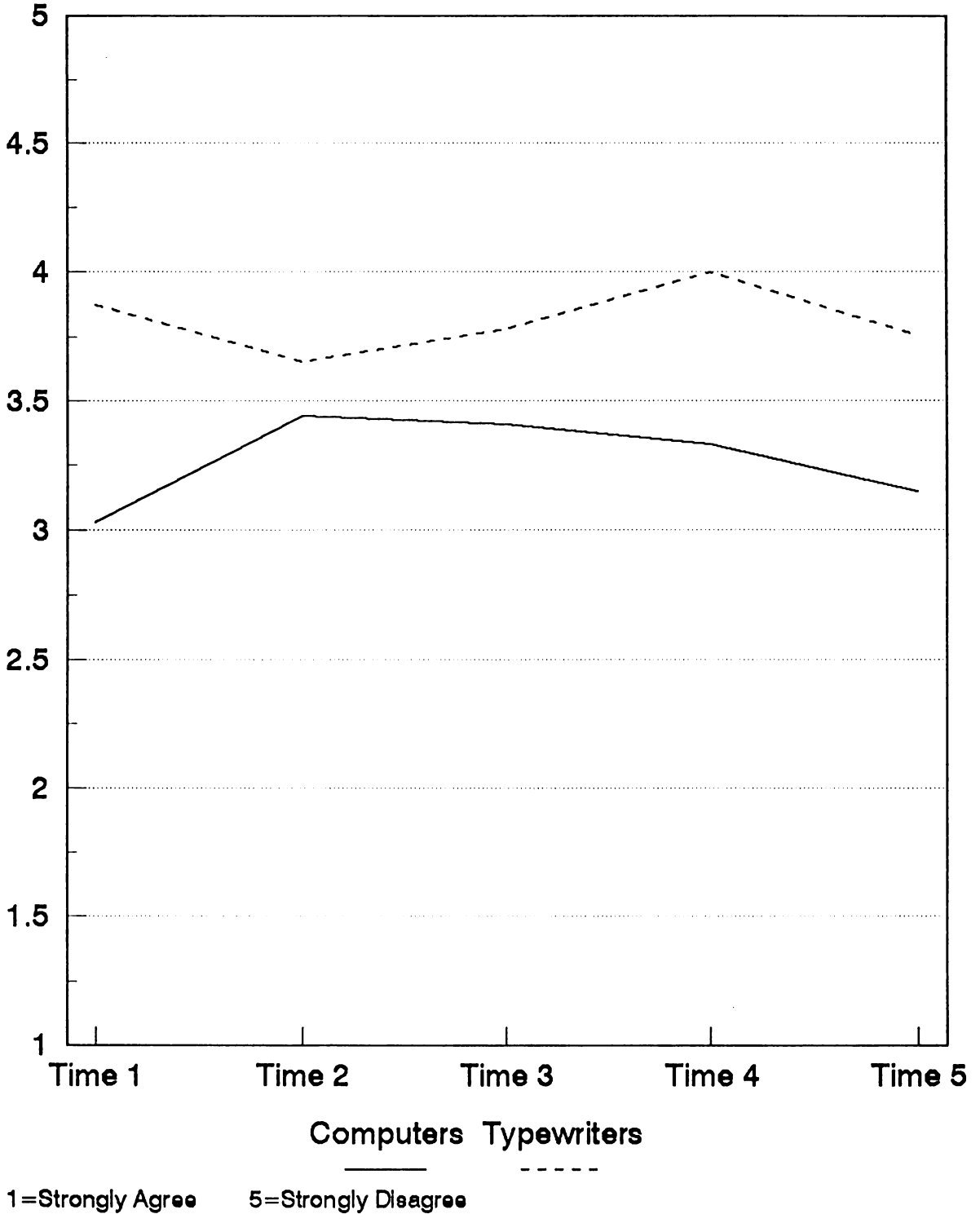

Figure 3: Mean responses of experimental and control groups to Attitude Item 3: "It was not necessary to have an instructor in the classroom in order to understand the lessons."

Table 20.--Results of the analysis for Attitude Item 3: "It was not necessary to have an instructor in the classroom in order to understand the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	216.70	60	3.61	6.29	.015*
Group	22.73	1	22.73		

*p < .05.

With respect to the fourth attitude item ("I would have preferred to have someone explain these lessons to me"), the F-value of 4.28 was significant at the .05 alpha level, indicating that the experimental and control groups differed significantly in their attitudes toward this item (see Table 21). As illustrated in Figure 4, mean scores of the two groups differed significantly at Times 4 and 5, when the control group agreed with the statement significantly more strongly than did the experimental group. At Time 3, both groups were given instruction by their teachers on how to complete the assignments; this might explain why the groups did not differ in their responses at that testing time.

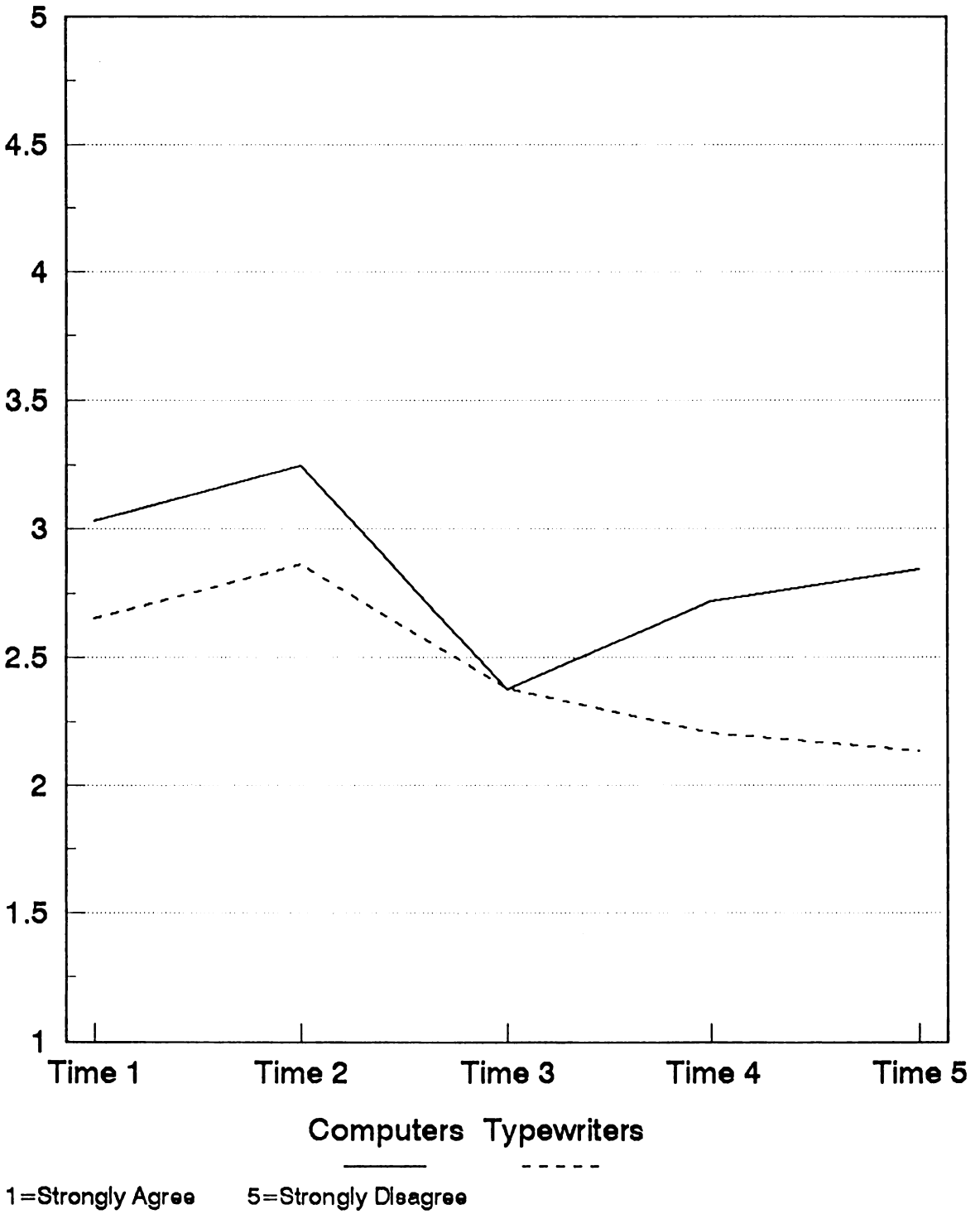

Figure 4: Mean responses of experimental and control groups to Attitude Item 4: "I would have preferred to have someone explain these lessons to me."

Table 21.--Results of the analysis for Attitude Item 4: "I would have preferred to have someone explain these lessons to me."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	164.16	59	2.78	4.28	.043*
Group	11.90	1	11.90		

*p < .05.

On the fifth attitude item ("It was difficult for me to do the assignment because of the way the lessons were presented by the instructor"), the F-value of 2.81 was not significant at the .05 alpha level (see Table 22). The attitudes of students in the two groups did not differ significantly with respect to this item; thus, the means were not graphed.

Table 22.--Results of the analysis for Attitude Item 5: "It was difficult for me to do the assignment because of the way the lessons were presented by the instructor."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	99.99	60	1.67	2.81	.099
Group	4.69	1	4.69		

For the sixth attitude item ("I enjoyed doing the lessons on the typewriter/microcomputer"), the F-value of .21 was not

significant at the .05 alpha level (see Table 23). Participants in the two groups were in agreement with respect to this item; thus, the means were not graphed.

Table 23.--Results of the analysis for Attitude Item 6: "I enjoyed doing the lessons on the typewriter/microcomputer."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	62.99	57	1.11	.21	.646
Group	.24	1	.24		

No significant difference was found in the attitudes of students in the two groups on Attitude Item 7 ("The electronic typewriter/microcomputer is a valuable piece of equipment to learn"); thus, the means were not graphed. The F-value of 1.47 was not significant at the .05 alpha level, as shown in Table 24.

Table 24.--Results of the analysis for Attitude Item 7: "The electronic typewriter/microcomputer is a valuable piece of equipment to learn."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	38.47	55	.70	1.47	.230
Group	1.03	1	1.03		

For the eighth attitude item ("It was difficult for me to manipulate the typewriter/microcomputer while doing these lessons"), the F-value of 1.91 was not significant at the .05 alpha level. This indicates that the attitudes of students in the experimental and control groups did not differ significantly with respect to this item (see Table 25).

Table 25.--Results of the analysis for Attitude Item 8: "It was difficult for me to manipulate the typewriter/microcomputer while doing these lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	151.23	53	2.85	1.91	.173
Group	5.45	1	5.45		

For the ninth attitude item ("Now that I am taking this course, I enjoy using the typewriter/microcomputer"), the F-value of .90 was not significant at the .05 alpha level. This indicates that students in the two groups did not differ significantly in their attitudes concerning this item (see Table 26).

Table 26.--Results of the analysis for Attitude Item 9: "Now that I am taking this course, I enjoy using the typewriter/microcomputer."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	70.04	54	1.30	.90	.348
Group	1.16	1	1.16		

For Items 1-3, 6, 7, and 9 on the Learner Attitude Inventory, the scale values ranged from 1 = Strongly Agree to 5 = Strongly Disagree. For Items 4, 5, and 8, the order was reversed because agreement with these items had a negative connotation. Therefore, to sum the responses to all nine items in the same direction, the scoring was reversed for Questions 4, 5, and 8 (1 = 5, 2 = 4, 3 = 3, 4 = 2, and 5 = 1). That is, for these three questions, high numbers were converted to low scores, and low numbers were converted to high scores. Scores were then summed to arrive at a mean score for each of the nine items.

Analysis of variance was used to determine whether a statistically significant difference existed in the overall attitudes of students in the experimental group and the control group. The results are shown in Table 27. The F-value of .23 was not significant at the .05 alpha level. Hence, there was no statistically significant difference in attitudes between the experimental group and the control group. The attitudes of students in the two groups did not change over time, nor were there significant differences between students exposed to the two instructional modalities. Based on these results, Null Hypothesis 2 was not rejected.

Table 27.--Results of the analysis of variance for attitudes of students using computer-assisted instruction versus those using teacher-directed instruction.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	5.39	60	.09	.23	.637
Group	.02	1	.02		

Null Hypothesis 3

Research Question 3 was, "Does the collaborative learning of students who learn keyboarding skills using computer-assisted instruction differ from that of students who learn keyboarding skills using teacher-directed instruction?" The corresponding null hypothesis stated:

> Ho 3: There is no significant difference in the collaborative learning of students who learn keyboarding skills using computer-assisted instruction and that of students who learn keyboarding skills using teacher-directed instruction.

Repeated-measures analysis of variance was used to determine whether there were significant differences (at the .05 level) in the collaborative learning of students in the computer-assisted and teacher-directed instruction groups. Students responded to statements on the six-item Cooperative Learning Inventory, which was developed to ascertain the extent to which they engaged in collaborative learning (1 = Never, 2 = Sometimes, 3 = Frequently). Students completed this instrument at the end of every fifth lesson.

To test the hypothesis, each item in the inventory was evaluated separately to determine whether significant differences in

cooperative learning existed between the two groups over time. If a significant difference was found, mean scores for the experimental and control groups on the item were graphed for each testing time to determine at what time(s) a significant difference(s) occurred and the nature of that difference(s). The mode of instruction was the independent variable; the dependent variable was the five measurements of cooperative learning.

On Item 1 on the Cooperative Learning Inventory ("I asked other students questions about how to do the lessons"), a significant difference in cooperative learning was found between students in the experimental and control groups with regard to the frequency with which they asked other students questions about how to do the lessons. As shown in Table 28, the F-value of 6.55 was significant at the .05 alpha level.

Table 28.--Results of the analysis for Cooperative Learning Item 1: "I asked other students questions about how to do the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	9.85	60	.16	6.55	.013*
Group	.08	1	1.08		

*p < .05.

The mean scores of the two groups were graphed to show at what testing time(s) the significant difference occurred with regard to Item 1. The results are shown in Figure 5. The greatest difference

was at Time 3 (Lessons 11-15), when students in the experimental group asked other students questions about how to do the lessons significantly more frequently than did students in the control group.

For Item 2 on the Cooperative Learning Inventory ("I asked for help when I needed it"), the F-value of 11.13 was significant at the .05 alpha level (see Table 29). This indicates that students in the two groups differed significantly in the frequency with which they asked for help when they needed it.

Table 29.--Results of the analysis for Cooperative Learning Item 2: "I asked for help when I needed it."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	7.17	60	.12	11.13	.001*
Group	1.08	1	1.33		

*p < .05.

The two groups' mean scores were graphed to show at what testing time(s) the significant difference(s) occurred on Item 2. As shown in Figure 6, the differences occurred at Times 2 and 3. At those times, the experimental group worked with each other and asked for help significantly more frequently than did the control group.

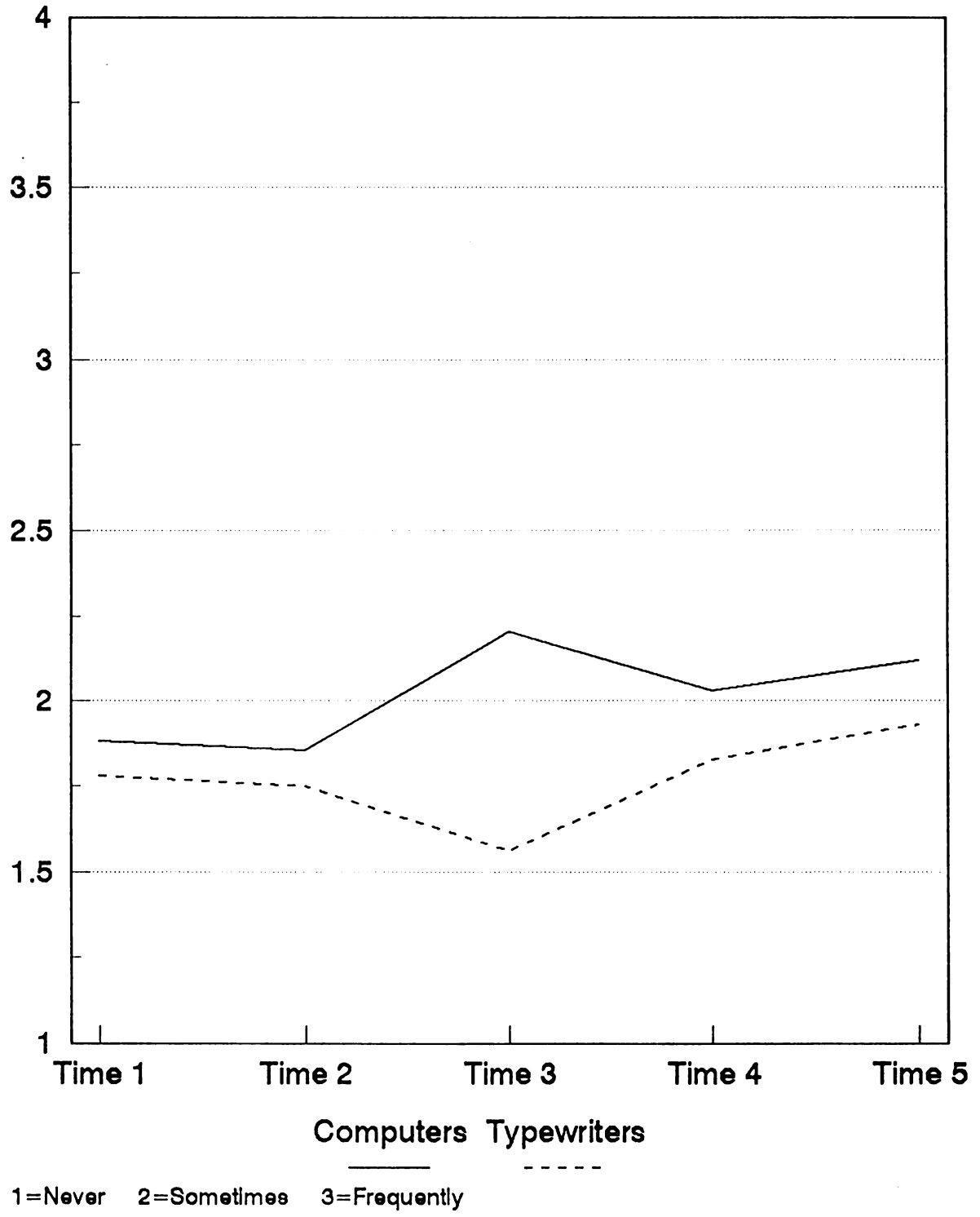

Figure 5: Mean responses of experimental and control groups to Cooperative Learning Item 1: "I asked other students questions about how to do the lessons."

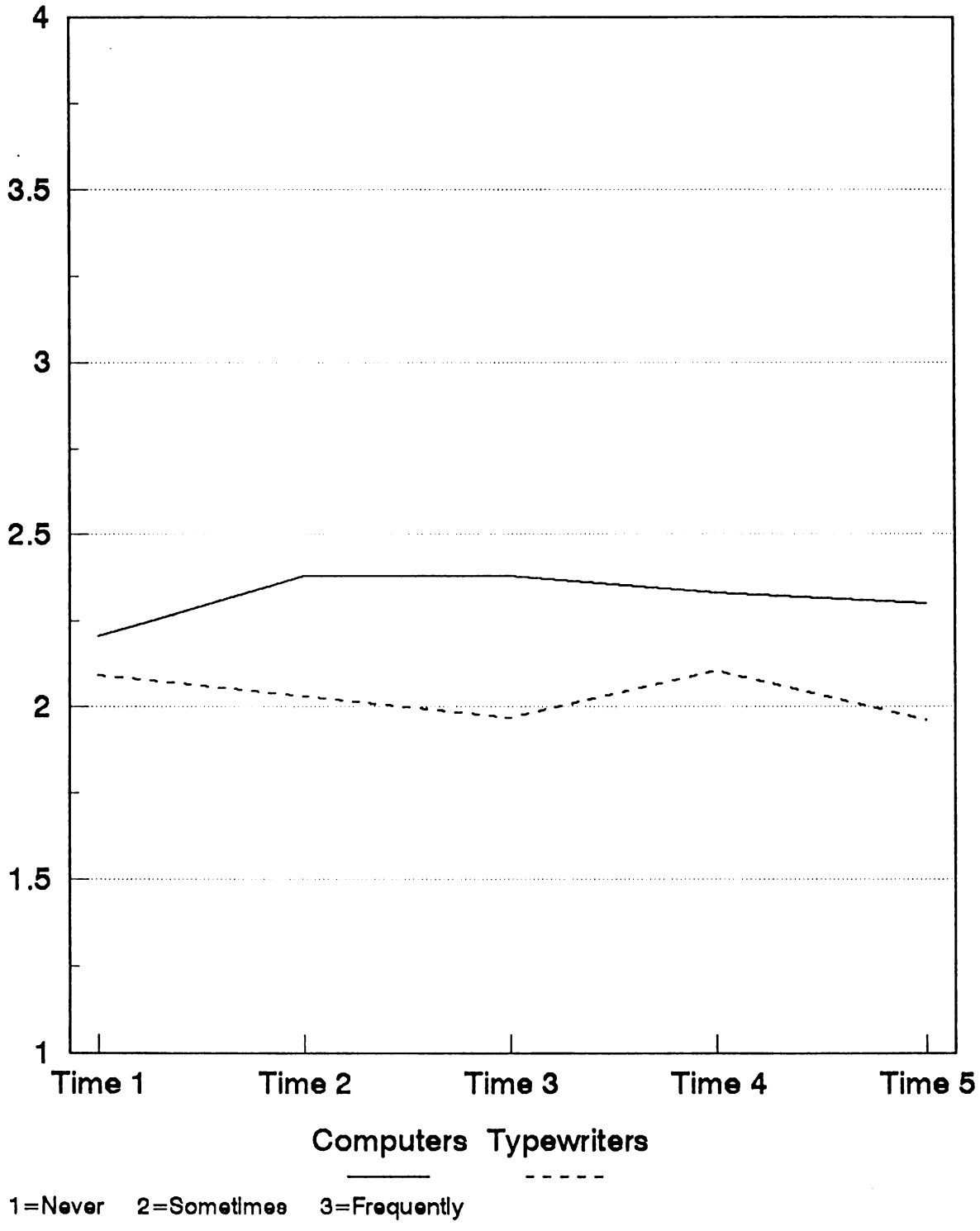

Figure 6: Mean responses of experimental and control groups to Cooperative Learning Item 2: "I asked for help when I needed it."

Differences between the experimental and control groups with regard to Items 3 through 6 on the Cooperative Learning Inventory were not statistically significant at the .05 alpha level. These results are shown in Tables 30 through 33. Because no significant differences were found, the means were not graphed.

Table 30.--Results of the analysis for Cooperative Learning Item 3: "I allowed other students to show me how to do the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	13.15	59	.12	2.13	.150
Group	.48	1	.48		

Table 31.--Results of the analysis for Cooperative Learning Item 4: "I helped other students with the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	14.35	60	.24	.81	.372
Group	.19	1	.19		

Table 32.--Results of the analysis for Cooperative Learning Item 5: "I made certain other students understood the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	13.07	60	.22	.00	.953
Group	.00	1	.00		

Table 33.--Results of the analysis for Cooperative Learning Item 6: "I worked with other students in order to complete my lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within groups	15.11	60	.25	.30	.587
Group	.08	1	.08		

To determine at what time(s), if any, significant differences occurred between the two groups in terms of overall cooperative learning, mean scores for the two groups on the six items on the Cooperative Learning Inventory were summed and graphed. As shown in Figure 7, a statistically significant difference was found between the two groups at Time 3, when the lessons consisted of a variety of centering problems. At that time, students in the experimental group engaged in cooperative learning significantly more frequently than did those in the control group.

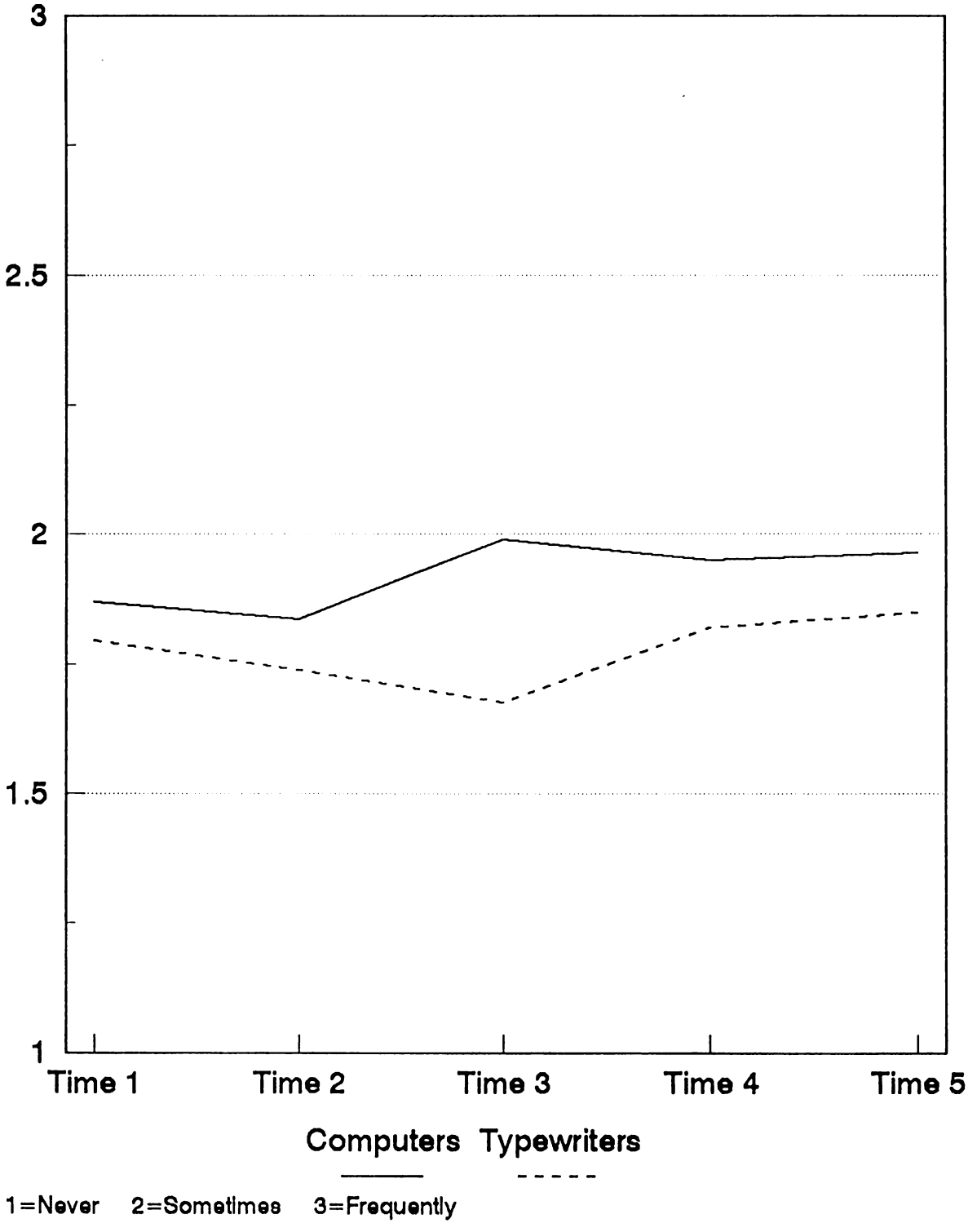

Figure 7: Frequency with which students in the experimental group and the control group engaged in cooperative learning, over time.

Analysis of variance was used to determine whether there was a significant difference between the experimental and control groups in terms of the overall frequency with which they engaged in cooperative learning. The results are shown in Table 34. The F-value of 3.31 was not significant at the .05 alpha level. No statistically significant difference was found between the two groups in terms of cooperative learning. Therefore, Null Hypothesis 3 was not rejected.

Table 34.--Results of the analysis of overall cooperative learning between the experimental and control groups.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	6.40	60	.11	3.31	.074
Group	.35	1	.35		

Null Hypothesis 4

Research Question 4 asked, "Do the attitudes of students who have had previous keyboarding experience differ from those of students who have had no keyboarding experience?" The corresponding null hypothesis was as follows:

> Ho 4: There is no significant difference in the attitudes of students who have had previous keyboarding experience and those of students who have had no keyboarding experience.

Hypothesis 4 was tested using repeated-measures analysis of variance. The independent variable was students' previous history

of typing instruction; the dependent variables were students' scores on the Learner Attitude Inventory, which they completed at five times during the semester. Responses to each item on the Learner Attitude Inventory were evaluated separately to determine whether there were differences in students' attitudes over time and between the two groups. If a significant difference was found, the groups' mean scores on the item were graphed to determine at which time(s) a difference(s) occurred and the nature of the difference(s).

The data in Table 35 show that students with previous keyboarding experience and those without previous keyboarding experience did not differ significantly in their attitudes toward Item 1 in the Student Attitude Inventory ("The lessons were written in a way that made them easy to understand"). The F-value of 2.50 was not significant at the .05 alpha level.

Table 35.--Results of the analysis of previous keyboarding experience and Attitude Item 1: "The lessons were written in a way that made them easy to understand."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	16.16	58	.28	2.50	.068
Group	2.09	3	.70		

On Attitude Item 2 ("An instructor's explanations would have helped make the lessons clearer and easier to understand"), a significant difference was found between students who had previous

keyboarding experience and those who did not. The F-value of 9.36 was significant at the .05 alpha level (see Table 36). Mean scores for Item 2 were graphed to determine at what testing time(s) the difference(s) occurred and the nature of the difference(s). As shown in Figure 8, the groups differed significantly at Time 3, when students with previous keyboarding experience agreed more strongly than those without such experience that an instructor's explanations would have helped make the lessons clearer and easier to understand.

Table 36.--Results of the analysis of previous keyboarding experience and Attitude Item 2: "An instructor's explanations would have helped make the lessons clearer and easier to understand."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	21.89	58	.38	9.36	.000*
Group	10.60	3	3.53		

*p < . 05.

Students with previous keyboarding experience and those without such experience did not differ significantly in their attitudes regarding Item 3 ("It was not necessary to have an instructor in the classroom in order to understand the lessons"). The F-value of 2.47 was not significant at the .05 alpha level (see Table 37).

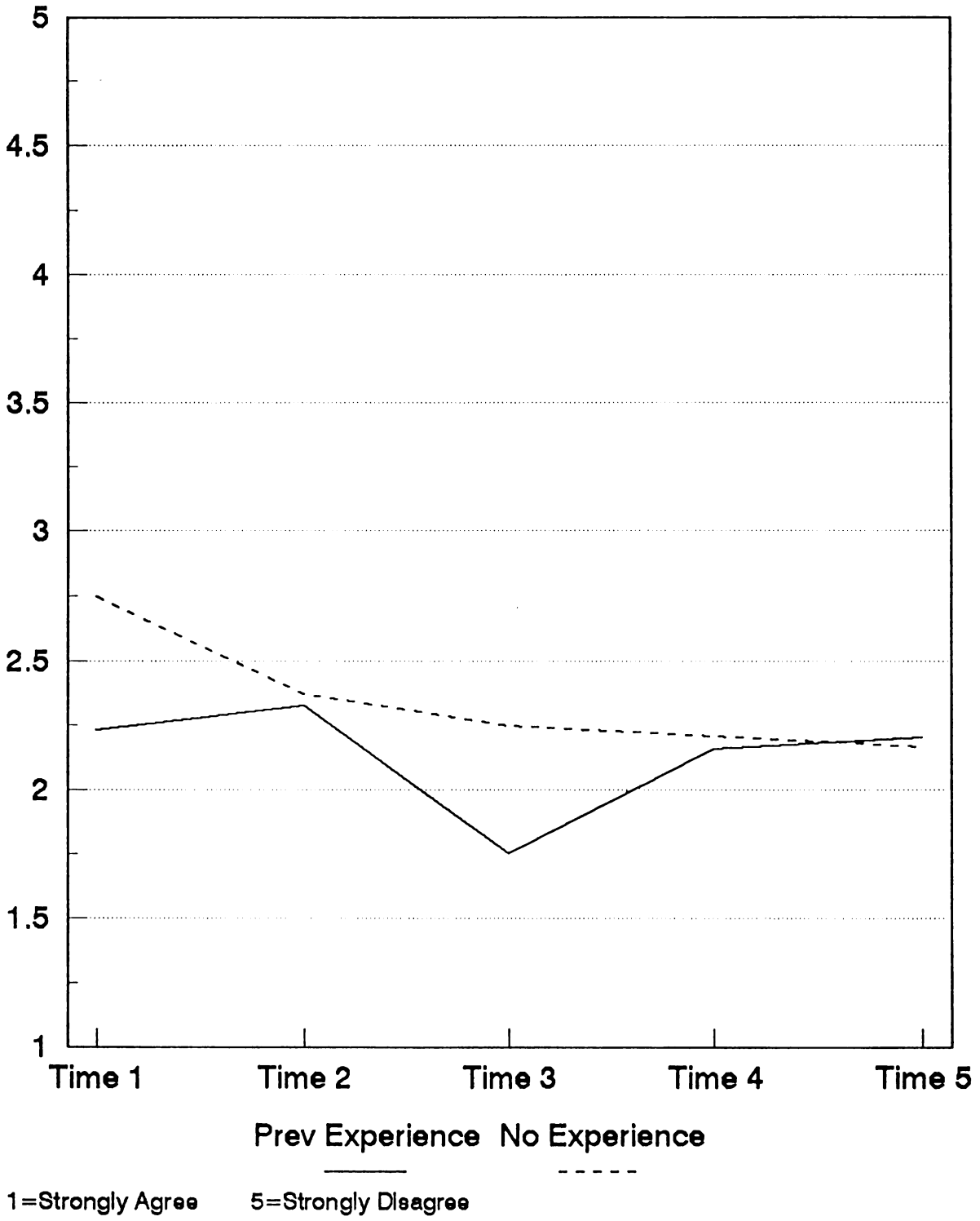

Figure 8: Mean responses of students with previous keyboarding experience and those without such experience on Attitude Item 2: "An instructor's explanation would have made the lessons clearer."

Table 37.--Results of the analysis of previous keyboarding experience and Attitude Item 3: "It was not necessary to have an instructor in the classroom in order to understand the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	42.45	58	.73	2.47	.070
Group	5.43	3	1.81		

With regard to Item 4 ("I would have preferred to have someone explain these lessons to me"), no statistically significant difference was found between students who had previous keyboarding experience and those who did not. The F-value of 1.79 was not significant at the .05 alpha level (see Table 38).

Table 38.--Results of the analysis of previous keyboarding experience and Attitude Item 4: "I would have preferred to have someone explain these lessons to me."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	32.18	58	.56	1.79	.160
Group	3.03	3	1.10		

As shown in Tables 39, 40, and 41, the attitudes of students with and those without previous keyboarding experience did not differ significantly with regard to Items 5, 6, and 7 in the Learner Attitude Inventory. The F-values in these three analyses (1.38,

.93, and 2.50, respectively), were not significant at the .05 alpha level.

Table 39.--Results of the analysis of previous keyboarding experience and Attitude Item 5: "It was difficult for me to do the lessons because of the way the lessons were presented."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	19.54	58	.34	1.38	.258
Group	1.39	3	.46		

Table 40.--Results of the analysis of previous keyboarding experience and Attitude Item 6: "I enjoyed doing these lessons on the computer/typewriter."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	12.03	55	.22	.93	.430
Group	.61	3	.20		

Table 41.--Results of the analysis of previous keyboarding experience and Attitude Item 7: "The computer/typewriter is a valuable piece of equipment to learn."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	7.54	53	.14	2.50	.472
Group	.36	3	.12		

The repeated-measures analysis of variance for Item 8 ("It was difficult for me to manipulate the computer/typewriter while doing these lessons") showed that the F-value of 1.35 was not significant at the .05 alpha level (see Table 42). Thus, there was no significant difference in students' attitudes toward this item, depending on whether they had or did not have previous keyboarding experience.

Table 42.--Results of the analysis of previous keyboarding experience and Attitude Item 8: "It was difficult for me to manipulate the computer/typewriter while doing these lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	29.03	51	.57	1.35	.268
Group	2.31	3	.77		

With regard to Item 9 ("Now that I am taking this course, I enjoy using computers/typewriters"), no significant difference was found in the attitudes of students with previous keyboarding experience and those without such experience. The F-value of 1.07 was not significant at the .05 alpha level (see Table 43). Students in both groups enjoyed the equipment they were using.

Table 43.--Results of the analysis of previous keyboarding experience and Attitude Item 9: "Now that I am taking this course, I enjoy using computers/typewriters."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	13.41	52	.26	1.07	.370
Group	.83	3	.28		

So that all nine items on the Learner Attitude Inventory could be scored in the same direction, answers to Items 4, 5, and 8 were reversed, to arrive at a mean attitude score for each group. Analysis of variance was used to determine whether there was a significant difference in overall attitudes between students with previous keyboarding experience and those without such experience. The results of this analysis are shown in Table 44. The F-value of 1.21 was not significant at the .05 alpha level. This finding indicated that there was no significant difference in the overall attitudes of students who had previous keyboarding experience and those who had no previous experience. Therefore, Null Hypothesis 4 was not rejected.

Table 44.--Results of the analysis of overall attitudes between students with previous keyboarding experience and those without previous keyboarding experience.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	5.09	58	.09	1.21	.316
Group	.32	3	.11		

Null Hypothesis 5

Research Question 5 asked, "Does the collaborative learning of students who have had previous keyboarding experience differ from that of students who have had no keyboarding experience?" The corresponding null hypothesis stated:

> Ho 5: There is no significant difference in the collaborative learning of students who have had previous keyboarding experience and that of students who have had no keyboarding experience.

This hypothesis was tested using repeated-measures analysis of variance. Previous keyboarding experience was the independent variable; cooperative learning was the dependent variable, which was measured at five testing times. If a significant difference between groups was found on a particular item, the means for that item were graphed over the five testing times to determine at what time(s) the difference(s) occurred and the nature of the difference(s).

On Item 1 of the Cooperative Learning Inventory ("I asked other students questions about how to do the lessons"), no significant difference was found between students with previous keyboarding

experience and those without such experience. The F-value of 2.35 was not significant at the .05 alpha level (see Table 45).

Table 45.--Results of the analysis of previous keyboarding experience and Cooperative Learning Item 1: "I asked other students questions about how to do the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	9.74	58	.17	2.35	.081
Group	1.19	3	.40		

A significant difference was found between students with previous keyboarding experience and those without such experience on Item 2 on the Cooperative Learning Inventory ("I asked for help when I needed it"). The F-value of 4.38 was significant at the .05 alpha level (see Table 46).

Table 46.--Results of the analysis of previous keyboarding experience and Cooperative Learning Item 2: "I asked other students questions about how to do the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	6.93	58	.12	4.38	.008*
Group	1.57	3	.52		

*p < .05.

The group means on Item 2 were graphed across the five testing times to determine at which time(s) students with previous keyboarding experience differed significantly from those without such experience and the nature of the difference(s). As shown in Figure 9, the significant difference occurred at Time 3, when students without previous keyboarding experience asked for help when they needed it significantly less frequently than students who had previous keyboarding experience.

No difference in cooperative learning was found between the two groups with respect to Item 3 ("I allowed other students to show me how to do the lessons"). The F-value of .71 was not significant at the .05 alpha level, as seen in Table 47.

Table 47.--Results of the analysis of previous keyboarding experience and Cooperative Learning Item 3: "I allowed other students to show me how to do the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	13.13	57	.23	.71	.548
Group	.49	3	.16		

The results for the fourth item on the Cooperative Learning Inventory ("I helped other students with the lessons") are shown in Table 48. Students with previous keyboarding experience and those without such experience did not differ significantly in their responses to this item. The F-value of .36 was not significant at the .05 alpha level.

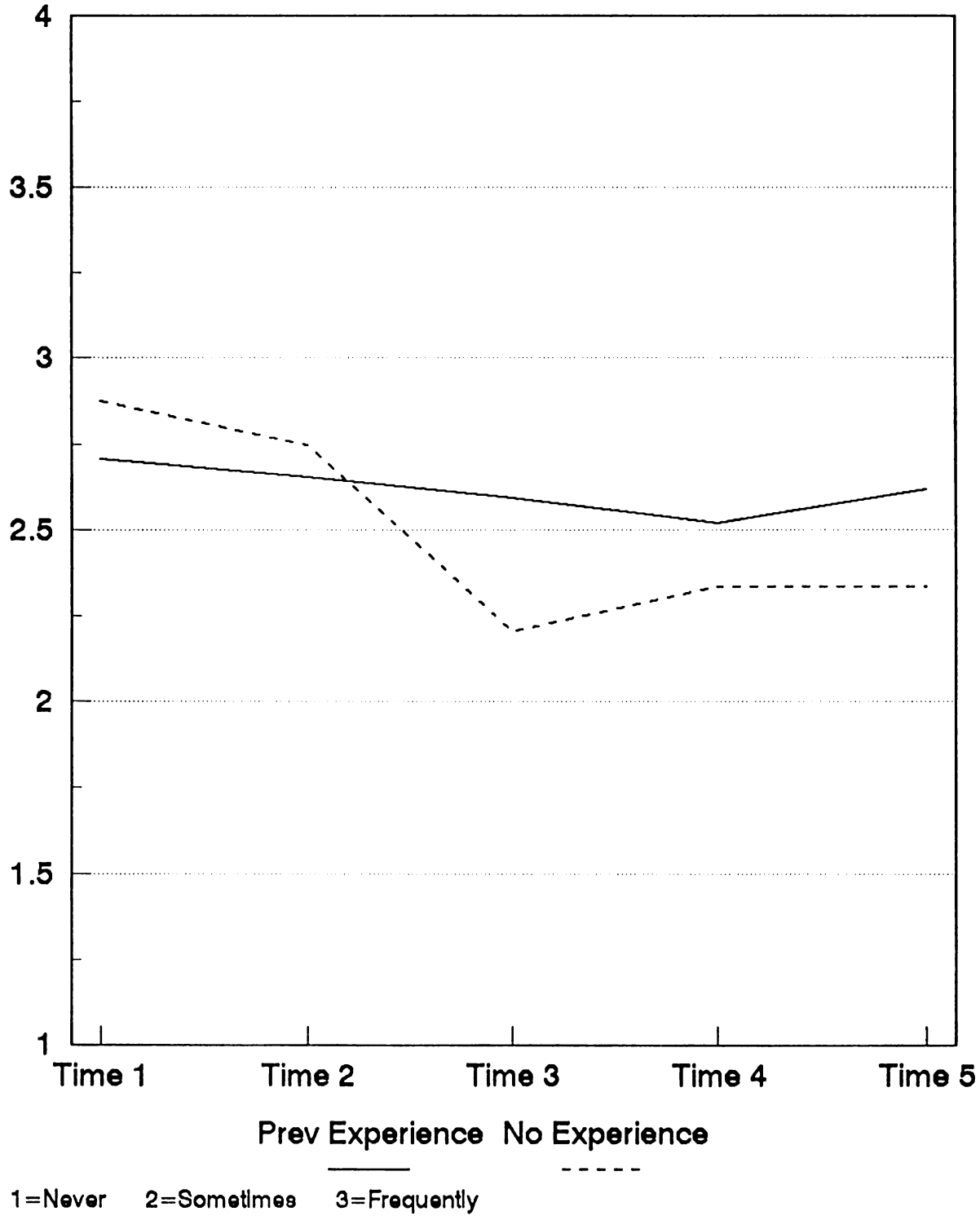

Figure 9: Mean responses of students with previous keyboarding experience and those without previous keyboarding experience on Cooperative Learning Item 2: "I asked for help when I needed it."

Table 48.--Results of the analysis of previous keyboarding experience and Cooperative Learning Item 4: "I helped other students with the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	14.20	58	.24	.36	.709
Group	.34	3	.11		

Likewise, the two groups (students with previous keyboarding experience and those without such experience) did not differ significantly in their responses to Item 5 on the Cooperative Learning Inventory ("I made certain other students understood the lessons"). The F-value of .20 was not significant at the .05 alpha level (see Table 49).

Table 49.--Results of the analysis of previous keyboarding experience and Cooperative Learning Item 5: "I made certain other students understood the lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	12.94	58	.22	.20	.899
Group	.13	3	.04		

Students with previous keyboarding experience and those without such experience did not differ significantly in their responses to Item 6 on the Cooperative Learning Inventory ("I worked with other students in order to complete my lessons"). The F-value of .74 was not significant at the .05 level (see Table 50).

Table 50.--Results of the analysis of previous keyboarding experience and Cooperative Learning Item 6: "I worked with other students in order to complete my lessons."

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	14.62	58	.25	.74	.531
Group	.56	3	.19		

Analysis of variance was used to determine whether there was a significant difference in overall cooperative learning between students with previous keyboarding experience and those without such experience. The results of this analysis are shown in Table 51. As seen in the table, the F-value of 1.11 was not significant at the .05 alpha level. The overall cooperative learning of students with previous keyboarding experience did not differ significantly from that of students with no previous keyboarding experience. Therefore, Null Hypothesis 5 was not rejected.

Table 51.--Results of the analysis of overall cooperative learning between students with previous keyboarding experience and those without previous keyboarding experience.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Within cells	6.38	58	.11	1.11	.351
Group	.37	3	.12		

Null Hypothesis 6

Research Question 6 asked, "Does the speed of students who learn keyboarding skills using electronic typewriters differ from that of students who learn keyboarding skills using microcomputers?" The corresponding null hypothesis was as follows:

> Ho 6: There is no significant difference in the speed of students who learn keyboarding skills using electronic typewriters and that of students who learn keyboarding skills using microcomputers.

Students were given a pretest for speed at the beginning of the study and a posttest at the end of the 12-week study. The pretest and posttest consisted of two two-minute timed writings; the first timed writing was straight copy, and the second was numeric copy.

Analysis of variance was used to test Null Hypothesis 6. Mode of instruction was the independent variable; posttest speed was the dependent variable. Mean scores were analyzed to compare the speed of students who had previous keyboarding instruction with that of students who did not have such instruction and also to compare the speed of the control group with that of the experimental group. The results are shown in Table 52. As shown in the table, the F-value of 2.232 was not significant at the .05 alpha level in the comparison between the experimental and control groups. However, in comparing the students who had previous keyboarding experience with those who did not have such experience, the F-value of 17.252 was significant at the .05 alpha level. This indicates that the two groups differed in their posttest speed on the straight-copy timed writing.

Table 52.--Post1 speed by group and previous experience.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects	2376.458	2	1188.229	13.823	.000
GROUP	191.882	1	191.882	2.232	.141
PREV EXP	1482.935	1	1482.935	17.252	.000*
2-way interaction					
GROUP/PREV EXP	72.399	1	72.399	.842	.363
Explained	2448.857	3	816.286	9.496	.000
Residual	4899.700	57	85.960		
Total	7348.557	60	122.476		

*p < .05.

The group means on the Post1 test are shown in Table 53. Students in the control group (typewriters) typed faster (31.4 wpm) than students in the experimental group (microcomputers) (23.7 wpm). Students with previous keyboarding experience who were in the control group also typed faster (33.6 wpm) than those who were in the experimental group (26.9 wpm). Yet students who had no keyboarding experience and were in the experimental group typed faster (16.7 wpm) than those in the control group (14.5 wpm).

Table 53.--Post1 speed by group: students with and without previous keyboarding experience.

Group	Total Means	Previous Keyboarding Exp.	No Keyboarding
Computers	23.7	26.9	16.7
Typewriters	31.4	33.6	14.5
Grand mean	27.3	31.1	15.2

Differences between experimental and control group students with previous keyboarding experience were tested further using analysis of covariance. Prel speed scores were used as the covariate. The results for the Pre/Postl speed test analysis are shown in Table 54. Prel speed was a significant covariate (F = 26.856, significant at the .05 alpha level). The F-value of 4.374 was also significant at the .05 alpha level. Thus, there were significant differences in straight-copy speed between students in the control and experimental groups who had previous keyboarding experience. This difference might be attributed to the fact that the majority of students in the control group (typewriters) had previous typing experience.

Table 54.--Postl speed by group with Prel.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Covariates					
PREl	1435.885	1	1435.885	26.856	.000*
Main effects					
GROUP	233.860	1	233.860	4.374	.044*
Residual	1871.308	35	53.466		
Total	3541.053	37	95.704		

*p < .05.

Analysis of variance was then used to determine whether there was a significant difference in straight-copy speed scores between the experimental group and the control group, regardless of previous keyboarding experience. Table 55 contains these data. The F-value of 8.167 was significant at the .05 alpha level, indicating there was a significant difference between students in the experimental and control groups in terms of their straight-copy speed scores.

Table 55.--Comparison of straight-copy speed scores between the experimental group and the control group.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects					
GROUP	893.523	1	893.523	8.167	.006*
Residual	6455.034	59	109.407		
Total	7348.557	60	122.476		

*p < .05.

The Post3 speed test (numeric copy) was analyzed in the same manner as the Post1 (straight copy) speed test. Results of this analysis are shown in Table 56. A significant difference was found between students in the experimental and control groups who had previous keyboarding experience, as indicated by the F-value of 12.022, which was significant at the .05 alpha level.

Table 56.--Post3 speed by group and previous experience.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects	1311.931	2	655.965	9.827	.000
GROUP	128.750	1	128.750	1.929	.170
PREV EXP	802.502	1	802.502	12.022	.001*
2-way interaction					
GROUP/PREV EXP	99.835	1	99.835	1.496	.226
Explained	1411.765	3	470.588	7.050	.000
Residual	3738.168	57	66.753		
Total	5149.933	60	87.287		

*p < .05.

Group means for the Post3 numeric-copy speed test are shown in Table 57. According to the figures shown in this table, students in the control group typed faster on numeric copy (26.3 wpm) than did those in the experimental group (20.5 wpm). Of the students with no previous keyboarding experience, those in the experimental group typed, on average, faster on numeric copy than did their counterparts in the control group (15.5 wpm and 11.5 wpm, respectively).

Table 57.--Post3 speed by group: students with and without previous keyboarding experience.

Group	Total Means	Previous Keyboarding Exp.	No Keyboarding
Computers	20.5	23.3	15.5
Typewriters	26.3	27.4	11.5
Grand mean	23.3	26.2	13.0

Analysis of covariance was used to test the hypothesis further for students with previous keyboarding experience in the control and experimental groups. The Pre3 numeric-copy speed score was used as the covariate; the Post3 numeric-copy speed score was the dependent variable. The findings are shown in Table 58. The F-value of 6.524 was significant at the .05 alpha level for Pre3 speed. However, on Post3, there was no significant difference between the control and experimental groups when only those students who had previous keyboarding experience were included in the analysis.

Table 58.--Post3 speed by group with Pre3.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Covariate					
PRE3	454.424	1	454.424	6.524	.015*
Main effects					
GROUP	144.390	1	144.390	2.073	.159
Residual	2507.545	36	69.654		
Total	3106.359	38	81.746		

*p < .05.

Analysis of variance was performed to determine whether there was a significant difference in numeric-copy speed scores between the experimental group and the control group regardless of previous keyboarding experience. The results of this analysis are shown in

Table 59. The F-value of 6.367 was significant at the .05 alpha level, indicating there was a significant difference between the two groups in terms of their numeric-copy speed scores. The control group typed significantly faster than the experimental group on both straight and numeric copy. Therefore, Null Hypothesis 6 was rejected.

Table 59.--Comparison of numeric-copy speed scores between the experimental group and the control group.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects					
GROUP	509.428	1	509.428	6.367	.014*
Residual	4640.505	59	80.009		
Total	5149.933	60	87.287		

*p < .05.

Null Hypothesis 7

Research Question 7 asked, "Does the accuracy of students who learn keyboarding skills using electronic typewriters differ from that of students who learn keyboarding skills using microcomputers?" The corresponding null hypothesis was as follows:

> Ho 7: There is no significant difference in the accuracy of students who learn keyboarding skills using electronic typewriters and that of students who learn keyboarding skills using microcomputers.

Keyboarding accuracy was measured using the number of errors students made on speed Pretests/Posttests 1 and 3. Analysis of

variance was used to test this hypothesis. The method of instruction and previous keyboarding experience were the independent variables. The posttest accuracy score was the dependent variable. Mean scores were used to compare students who had previous keyboarding experience with those who did not have such experience and also to compare the control group with the experimental group. The data are contained in Table 60. The F-values of 2.306 and 1.851 were not significant at the .05 alpha level, indicating that no significant difference in accuracy was found between the experimental and control groups or between students who had previous keyboarding experience and those who did not.

Table 60.--Post2 accuracy by group and previous experience.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects	91.785	2	45.892	1.517	.231
GROUP	69.747	1	69.747	2.306	.136
PREV EXP	55.991	1	55.991	1.851	.181
2-way interaction					
GROUP/PREV EXP	.467	1	.467	.015	.902
Explained	92.252	3	30.751	1.017	.394
Residual	1330.727	57	30.244		
Total	1422.979	60	30.276		

The group means for Post2 straight-copy accuracy are shown in Table 61. The figures in the table indicate that students in the control group (typewriters) made more errors (5.7) on straight copy

than students in the experimental group (microcomputers) (4.0). Students with previous keyboarding experience who were in the control group also made more errors than their counterparts in the experimental group (5.7 and 3.7, respectively). Students with no keyboarding experience who were in the experimental group made fewer mistakes (5.8) than their counterparts in the control group (8.0).

Table 61.--Post2 accuracy by group: students with and without previous keyboarding experience.

Group	Total Means	Previous Keyboarding Exp.	No Keyboarding
Computers	4.0	3.7	5.8
Typewriters	5.7	5.7	8.0
Grand mean	4.9	5.2	6.9

Difference in accuracy based on previous keyboarding experience was tested further using analysis of covariance. Mode of instruction and previous keyboarding experience were the independent variables, the Post2 straight-copy accuracy score was the dependent variable, and the Pre2 straight-copy accuracy score was the covariate. The Pre2/Post2 accuracy test results are shown in Table 62. As shown in the table, Pre2 accuracy was not a significant covariate (F = .055 and .738, not significant at the .05 alpha level). Therefore, there was no significant difference in accuracy on straight copy between the control and experimental groups when

only those students who had previous keyboarding experience were included in the analysis.

Table 62.--Post2 accuracy by group with Pre2.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Covariate					
PRE2	1.802	1	1.802	.055	.816
Main effects					
GROUP	24.164	1	24.164	.738	.397
Residual	950.034	35	32.760		
Total	976.000	37	31.484		

Analysis of variance was used to test for a significant difference in straight-copy accuracy between the experimental group and the control group, regardless of previous keyboarding experience. The results of that analysis are shown in Table 63. The F-value of 1.187 was not significant at the .05 alpha level, indicating that no significant difference was found between the two groups in terms of their straight-copy accuracy.

Table 63.--Comparison of straight-copy accuracy between the experimental group and the control group.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects					
GROUP	35.794	1	35.794	1.187	.282
Residual	1387.185	59	30.156		
Total	1422.979	60	30.276		

Post4 accuracy (numeric copy) was tested in the same way as Post2 (straight copy) accuracy. The findings are presented in Table 64. No significant difference was found between the experimental and control groups or between students who had previous keyboarding experience and those who did not have such experience in terms of their numeric-copy accuracy.

Table 64.--Post4 accuracy by group and previous experience.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects	29.141	2	14.571	1.657	.203
GROUP	29.137	1	29.137	3.313	.076
PREV EXP	3.625	1	3.625	.412	.524
2-way interaction					
GROUP/PREV EXP	12.801	1	12.801	1.456	.234
Explained	41.943	3	13.981	1.590	.206
Residual	369.383	57	8.795		
Total	411.326	60	9.141		

The Post4 accuracy means are shown in Table 65. As seen in the table, the experimental group made fewer errors (2.9) on numeric copy than did the control group (4.4). However, when only those students with no previous keyboarding experience were compared, it was found that students in the experimental group made more mistakes on numeric copy than their counterparts in the control group.

Table 65.--Post4 accuracy by group: students with and without previous keyboarding experience.

Group	Total Means	Previous Keyboarding Exp.	No Keyboarding
Computers	2.9	2.6	3.8
Typewriters	4.4	4.5	3.0
Grand mean	3.7	3.9	3.4

Analysis of covariance was used to test the hypothesis further with regard to students who had previous keyboarding experience. The Pre4 numeric-copy accuracy score was used as the covariate; the Post4 numeric-copy accuracy score was the dependent variable. The findings are shown in Table 66. For Pre4 accuracy, the F-value of .005 was not significant at the .05 alpha level. Neither was a significant difference found between the experimental and control groups (F-value = 2.770, not significant at the .05 alpha level). Thus, there was no significant difference in the numeric-copy

accuracy of students in the control and experimental groups, when only those students who had previous keyboarding experience were included in the analysis.

Table 66.--Post4 accuracy by group with Pre4.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Covariate					
PRE4	.051	1	.051	.005	.942
Main effects					
GROUP	26.016	1	26.016	2.770	.106
Residual	281.812	36	9.394		
Total	307.879	38	9.621		

Analysis of variance was then used to determine whether there was a significant difference in numeric-copy accuracy between the experimental and control groups, regardless of previous keyboarding experience. The results of this analysis are shown in Table 67. As seen in the table, the F-value of 2.910 was not significant at the .05 alpha level. Even though the experimental group (microcomputers) made fewer errors on both straight copy and numeric copy than did the control group (typewriters), these differences were not statistically significant. Therefore, Null Hypothesis 7 was not rejected.

Table 67.--Comparison of numeric-copy accuracy between the experimental group and the control group.

Source of Variation	Sum of Squares	df	Mean Square	F	Sig. of F
Main effects					
GROUP	25.517	1	25.517	2.910	.095
Residual	385.810	59	8.768		
Total	411.326	60	9.141		

Analysis of Responses to the Keyboarding Evaluation Inventory

The students were asked to complete an end-of-course evaluation, the Keyboarding Evaluation Inventory, which contained seven questions. Responses to each question were measured separately to determine whether students in the experimental and control groups evaluated the course differently, based on the mode of instruction and previous keyboarding experience.

A t-test was used to test for significant differences on questions receiving less than an 80% affirmative response. The results for each of the questions are shown in Tables 68 through 76.

As shown in Table 68, the majority of students in the total sample (57 or 93.4%) responded that they did learn how to keyboard. Students also responded affirmatively (59 or 96.8%) to Question 2, indicating that the teacher's instructions helped them learn keyboarding skills. Even though the experimental group did not have

a teacher in the classroom at all times, the instructor was accessible to answer their questions, particularly at Time 3.

Table 68.--Responses to Question 1: "Did you learn how to keyboard?"

Response	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
No	30	49.2	27	44.2	57	93.4
Yes	2	3.3	2	3.3	4	6.6
Total	32	52.5	29	47.5	61	100.0

Table 69.--Responses to Question 2: "Did you find that the teacher's instructions helped you to learn keyboarding skills?"

Response	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
No	31	50.9	28	45.9	59	96.8
Yes	1	1.6	1	1.6	2	3.2
Total	32	52.5	29	47.5	61	100.0

Of the 60 students who responded to Question 3, 52 (86.6%) said they would take another typing/computer-aided instruction course, whereas 8 (13.4%) said they would not (see Table 70). Students giving negative responses were evenly distributed between the experimental and control groups. Five of the eight students

responding negatively had no previous keyboarding experience, and three had such experience.

Table 70.--Responses to Question 3: "Would you take another typing/computer-aided instruction course?"

Response	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
No	27	45.0	25	41.6	52	86.6
Yes	4	6.7	4	6.7	8	13.4
Total	31	51.7	29	48.3	60	100.0

Most of the students (56 or 91.8%) responded affirmatively when asked whether working with other students made the course enjoyable (see Table 71). Only five (8.2%) said that working with other students did not make the course enjoyable. Three of the students who responded negatively had no previous keyboarding experience; the other two had previous experience.

Table 71.--Responses to Question 4: "Did working with other students make the course enjoyable?"

Response	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
No	30	49.2	26	42.6	56	91.8
Yes	2	3.3	3	4.9	5	8.2
Total	32	52.5	29	47.5	61	100.0

Only 48 (78.7%) of the students said they used a typewriter/ microcomputer outside the classroom to practice or complete their assignments (see Table 72). The majority of these students (30 or 49.2%) were in the experimental group.

Table 72.--Responses to Question 5: "Did you use a typewriter/ microcomputer outside the classroom to practice or complete assignments?"

Response	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
No	30	49.2	18	29.5	48	78.7
Yes	2	3.3	11	18.0	13	21.3
Total	32	52.5	29	47.5	61	100.0

Because Question 5 received less than an 80% affirmative response, a t-test was used to determine whether there was a significant difference between the experimental and control groups on this question. The results are shown in Table 73. The t-value of -3.22 was significant at the .05 alpha level, indicating that the two groups differed significantly with regard to whether or not they used the microcomputer or typewriter outside the classroom. This difference could be explained by the fact that students in the experimental group had less experience with a microcomputer than students in the control group had with a typewriter. Also, more

students in the control group than in the experimental group had typewriters at home.

Table 73.--Results of t-test for students' use of a typewriter/ microcomputer outside the classroom, by group.

Group	n	Mean	Standard Deviation	t-Value	2-Tailed Prob.
Computers	32	1.0625	.246	-3.22	.002*
Typewriters	29	1.3793	.494		

*p < .05.

The next evaluation question asked students how many hours per week they practiced or completed their assignments. Responses are shown in Table 74. A total of 47 students said they practiced or completed their homework outside the classroom. Thirty (63.8%) of those students were in the experimental group, and 17 (36.1%) were in the control group. Three to four hours was the amount of time a majority of students (19 or 40.5%) spent practicing or completing their assignments. More than twice the number of students in the experimental group as in the control group spent that amount of time practicing or completing their assignments (13 or 27.7% and 6 or 12.8%, respectively).

Table 74.--Responses to Question 6: "How many hours do you practice or complete assignments?"

Hours	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
1-2	9	19.1	8	17.0	17	36.1
3-4	13	27.7	6	12.8	19	40.5
5-6	4	8.5	2	4.3	6	12.8
7+	4	8.5	1	2.1	5	10.6
Total	30	63.8	17	36.2	47	100.0

A t-test was performed to determine whether there was a statistically significant difference between the experimental and control groups on Question 6. The results are shown in Table 75. The t-value of 1.15 was not significant at the .05 alpha level, indicating that there was no significant difference between the two groups. Even though the experimental group spent longer than the control group doing assignments or practicing, the difference was not statistically significant.

Table 75.--Results of t-test for number of hours spent outside the classroom practicing or completing assignments, by group.

Group	n	Mean	Standard Deviation	t-Value	2-Tailed Prob.
Computers	30	2.100	.995	1.15	.258
Typewriters	17	1.764	.903		

The last question on the Keyboarding Evaluation Inventory asked students whether they would recommend the course to another student. As shown in Table 76, a majority of the students (60 or 98.3%) responded affirmatively. Only one student (1.6%) responded negatively to Question 7.

Table 76.--Responses to Question 7: "Would you recommend this course to another student?"

Response	Experimental Group		Control Group		Total	
	Freq.	%	Freq.	%	Freq.	%
No	31	50.9	29	47.5	60	98.4
Yes	1	1.6	0	0.0	1	1.6
Total	32	52.5	29	47.5	61	100.0

Summary

This chapter contained the results of the statistical analyses carried out in this study. The demographic characteristics of the student respondents were discussed first, followed by the results of hypothesis testing. Analyses of students' responses to the Keyboarding Evaluation Inventory were presented in the last section. Chapter V contains a summary of the study, findings and conclusions, recommendations for practice and further research, and the researcher's reflections.

CHAPTER V

SUMMARY, FINDINGS AND CONCLUSIONS, RECOMMENDATIONS, AND REFLECTIONS

Summary

Modern technology has led many educational institutions to invest in microcomputers for instructional purposes. Two important questions have resulted from the varied uses of computers in the business education curriculum. First, is there still a need for typewriters? Second, what method of teaching is best in developing keyboarding skills: computer-assisted or teacher-directed instruction?

One of the researcher's purposes in conducting this study was to compare the keyboarding achievement, speed, and accuracy of students who learn keyboarding skills on electronic typewriters, using the traditional teacher-directed method of instruction, with that of students who learn keyboarding skills on microcomputers, using the computer-assisted method of instruction. Additional purposes were to determine whether students taught by these two methods differed in terms of their attitudes and the frequency with which they engaged in collaborative learning in the keyboarding/typewriting class. Further purposes were to discover whether the attitudes and collaborative learning of students who had

had previous keyboarding experience differed from those of students who had not had keyboarding experience.

Sixty-six students who were enrolled in two sections of Keyboarding and two sections of Fundamentals of Typewriting at Wayne County Community College in Detroit, Michigan, participated in the study during fall semester 1990. The students were divided into two groups. Those in the experimental group were given computer-assisted instruction on microcomputers, using a keyboarding software package. Students in the control group were given traditional instruction by a teacher, using electronic typewriters. The researcher taught one experimental and one control group. The other experimental and control groups were taught by two teachers in the business department at the community college.

By the end of the 12-week study period, students had completed five units containing five lessons each (a total of 25 lessons). At the end of each unit, students completed two instruments designed to ascertain their attitudes toward the class and the extent to which they engaged in cooperative learning in completing the lessons. The data from these instruments, as well as students' speed and accuracy on timed writings, were used in the statistical analyses.

Descriptive statistics (frequency and percentage) were used to analyze the demographic data and to compare the experimental and control groups in terms of these personal characteristics. Cross-tabulations and measures of central tendency also were used.

Hypotheses 1, 6, and 7 were tested using analysis of variance and covariance. Hypotheses 2, 3, 4, and 5 were tested using

repeated-measures analysis of variance and analysis of covariance to determine whether there were significant differences between the experimental and control groups. A t-test was also used with two independent variables to determine whether there were significant differences between the groups based on data from the Keyboarding Evaluation Inventory. For all statistical analyses conducted in this study, the .05 alpha level was the criterion for significance.

Findings and Conclusions

The majority of participants in this study (51 or 77.3%) had previous keyboarding experience; of that number, 30 were in the control group. Only two students in the control group did not have previous keyboarding experience, as compared to 13 in the experimental group.

In the following pages, each of the null hypotheses formulated for the study is restated, followed by the major findings and conclusions pertaining to that hypothesis.

Null Hypothesis 1

> There is no significant difference in the keyboarding achievement of students who learn keyboarding skills on microcomputers, using computer-assisted instruction, and that of students who learn keyboarding skills on electronic typewriters, using teacher-directed instruction.

Findings.

1. No statistically significant difference was found in the achievement of students in the experimental group and those in the control group.

2. Students in the control group who had previous keyboarding experience scored higher on the four centering problems than did their counterparts in the experimental group. However, this difference was not statistically significant.

3. Students in the experimental group who had no previous keyboarding experience scored higher on the four centering problems than did their counterparts in the control group. However, this difference was not statistically significant.

Conclusions. Based on the findings regarding Null Hypothesis 1, it was concluded that, regardless of the mode of instruction, students' achievement in formatting text using vertical, horizontal, block, or spread centering was not affected. Students in both the control and experimental groups who entered the keyboarding or typewriting class with previous keyboarding skills achieved a higher degree of skill than those students who had no experience, regardless of the mode of instruction.

Null Hypothesis 2

> There is no significant difference in the attitudes of students who learn keyboarding skills using computer-assisted instruction and those of students who learn keyboarding skills using teacher-directed instruction.

Findings.

1. No statistically significant difference was found in the overall attitudes of students using the two modes of instruction.

2. A statistically significant difference was found in students' attitudes concerning Items 2 ("The instructor's explanations helped make the lessons clearer and easier to understand"), 3 ("The

lessons were written in a way that made them easy to understand"), and 4 ("I would have preferred to have someone explain these lessons to me") on the Learner Attitude Inventory. The control group had significantly more positive attitudes toward these items than did the experimental group.

3. The experimental group's attitude was less positive than that of the control group at Time 3 (Lessons 11-15); however, this difference was not significant. The experimental group thought that these lessons were not written in a way that made them easy to do and understand.

Conclusions. Based on the findings regarding Null Hypothesis 2, it was concluded that, regardless of the mode of instruction, the overall attitudes of students were not affected. Students in the control group, who were taught by a teacher, tended to express a more favorable attitude toward completing the assignments than did students in the experimental group, who had little or no interaction with a teacher.

Null Hypothesis 3

> There is no significant difference in the collaborative learning of students who learn keyboarding skills using computer-assisted instruction and that of students who learn keyboarding skills using teacher-directed instruction.

Findings.

1. No statistically significant difference was found in the cooperative learning of students using the two methods of instruction.

2. Students in the experimental group asked questions and sought help more often than those in the control group, especially at Time 3, but this difference was not statistically significant.

Conclusions. Based on the findings regarding Null Hypothesis 3, it was concluded that students' cooperative learning was not affected by the mode of instruction.

Null Hypothesis 4

> There is no significant difference in the attitudes of students who have had previous keyboarding experience and those of students who have had no keyboarding experience.

Findings.

1. No statistically significant difference was found between the overall attitudes of students who had previous keyboarding skills and those of students who had no previous keyboarding skills.

2. At Time 3 (Lessons 11-15), the attitudes of students in the experimental group who had no previous keyboarding experience were not as positive as those of their counterparts in the control group. However, this difference was not statistically significant.

Conclusions. Based on the findings regarding Null Hypothesis 4, it was concluded that, regardless of the mode of instruction, previous keyboarding experience did not affect students' attitudes toward developing keyboarding skills.

Null Hypothesis 5

> There is no significant difference in the collaborative learning of students who have had previous keyboarding experience and that of students who have had no keyboarding experience.

Findings.

1. No statistically significant difference was found between the collaborative learning of students who had previous keyboarding experience and those who did not have such experience.

2. Students in the experimental group who had no previous keyboarding experience engaged in cooperative learning with others in the class more often than did their counterparts in the control group, especially at Time 3. However, this difference was not statistically significant.

Conclusions. Based on the findings regarding Null Hypothesis 5, it was concluded that the mode of instruction did not affect students' cooperative learning, regardless of their previous keyboarding experience. Inexperienced students who had little contact with a teacher asked for help more often than did experienced students, regardless of the mode of instruction.

Null Hypothesis 6

> There is no significant difference in the speed of students who learn keyboarding skills using electronic typewriters and that of students who learn keyboarding skills using microcomputers.

Findings.

1. A statistically significant difference was found between students in the experimental and control groups with regard to their keyboarding speed. Students in the control group keyed significantly faster than those in the experimental group on both straight and numeric copy.

2. Inexperienced students in the experimental group keyed faster than inexperienced students in the control group. However, the difference was not statistically significant.

Conclusions. Based on the findings regarding Null Hypothesis 6, it was concluded that the mode of instruction did make a difference in students' keyboarding speed. However, because 51 of the 66 students (77.3%) who participated in this study had previous keyboarding experience and of that number 30 were in the control group, it was further concluded that this difference resulted from a combination of the teaching method used and the students' previous keyboarding experience.

Null Hypothesis 7

> There is no significant difference in the accuracy of students who learn keyboarding skills using electronic typewriters and that of students who learn keyboarding skills using microcomputers.

Findings.

1. No statistically significant difference was found between students in the experimental and control groups with regard to their keyboarding accuracy.

2. Students in the experimental group made fewer errors than those in the control group on the two-minute timed writings. However, this difference was not statistically significant.

Conclusions. Based on the findings regarding Null Hypothesis 7, it was concluded that the two methods of instruction were equivalent in developing students' keyboarding accuracy. However,

on average, students in the experimental group were more accurate in keyboarding than those in the control group.

Summary of Conclusions and Related Findings

Based on the findings for Null Hypotheses 1, 2, 3, 4, 5, and 7, it was concluded that, regardless of the mode of instruction, students' achievement, attitudes, cooperative learning, and accuracy were not affected. Further, the attitudes and cooperative learning of students who had previous keyboarding experience also were not affected by the mode of instruction. However, based on the findings for Null Hypothesis 6, previous keyboarding experience did affect students' keyboarding speed, regardless of the mode of instruction.

Related Findings

The findings from this study concurred with those from similar studies conducted by D'Souze (1983) and Schuls (1985). These researchers reported that both modes of instruction were equal in teaching keyboarding skills to students. The findings from this study also confirmed the results of Culwell's (1985) and Perreault's (1984) research, which indicated that students using computer-assisted instruction made fewer errors than those using teacher-directed instruction. In the present study, no statistically significant difference was found between computer-assisted instruction and teacher-directed instruction with regard to their effects on students' attitudes and the extent to which students engaged in cooperative learning while developing keyboarding skills.

Recommendations

The following recommendations for educational practice and further research are based on the conclusions drawn from the study findings.

1. Students should be able to use both electronic typewriters and microcomputers effectively. To keep abreast of the needs of modern offices, students need to be able to adapt to various types of office equipment.

2. Business teachers should develop attitudinal instruments and periodically assess students' attitudes. This will help educators develop teaching strategies that foster positive student attitudes and create an atmosphere conducive to learning.

3. Business educators should carefully examine and test a variety of instructional software to determine whether it is clearly written and easy for students to understand without the help of an instructor. With the increased cost of software, it is critical for educators to ensure that software meets the goals and objectives of their classes before making expensive purchases.

4. If computer-assisted instruction is used to teach keyboarding skills, teachers should make certain they establish an environment that encourages cooperative learning. Such an environment will enable students, regardless of their previous knowledge and experience, to understand the value of cooperative learning and teamwork in performing and completing tasks. Such an environment also can maximize the teacher's time by enabling him or her to work with groups of students rather than one student at a time.

5. When computer-assisted instruction is used to teach keyboarding skills, a teacher should be present in the classroom at all times. The teacher should provide a balance between the student and this mode of instruction to ensure that every student understands the assignments. In computer-assisted instruction, the role of the teacher becomes that of facilitator, coordinator, resource person, and tutor.

6. Research should be undertaken to determine the speed requirements for students who correct their errors while taking timed writings on both the electronic typewriter and the microcomputer. Such studies might help business teachers make a definite distinction between the number of keyboarding errors allowed when corrections are permitted as opposed to when they are not permitted. These studies will further assist teachers in developing a more realistic and updated error-assessment scale.

7. Further studies should be undertaken to analyze students' attitudes and cooperative learning as they develop keyboarding skills on both the electronic typewriter and the microcomputer. Because so little comparative research has been done on this topic, studies are needed to provide business educators with the information necessary to develop relevant business curricula and teaching strategies to enhance students' keyboarding skills.

8. This study should be replicated with students who have had previous keyboarding experience and those who have not had such

experience, to determine whether the findings corroborate those from this study.

Reflections

In this study, computer-assisted instruction and teacher-directed instruction were both found to be effective methods of teaching keyboarding skills to students at the community college level.

Although students were receptive to both methods of instruction at the beginning of the study, the microcomputer group became confused and expressed concern when they attempted to do the centering assignments without the help of a teacher. The teacher had to intervene and help them learn centering skills. Students in the teacher-directed group also had difficulty developing this skill. Comments on the learner Attitude Inventory showed that students in both the experimental and control groups thought they needed a teacher to demonstrate how to do the various centering problems.

Even though cooperative learning was stressed only once during the semester, students worked cooperatively with each other throughout the 12 weeks. However, observations showed that the shy, nonassertive students did not seek help or ask as many questions as the assertive students. On the other hand, those students who had previous keyboarding experience and indicated their initial typing speed was 25 gross words a minute (GWAM) engaged in cooperative learning the least. This observation supported the belief that, for

many students, individual success is more important than group achievement (Swartz, 1989). Both of these observations illustrate that the presence of a teacher is a prime factor in providing the feedback, clarification, reinforcement, and communication that are needed to foster the positive attitudes and interpersonal relationships desired in a classroom setting.

Although more students in the control group had typewriters at home than students in the experimental group had microcomputers at home, correcting errors during timed writings seemed to be easier on a microcomputer than on a typewriter. On average, students using microcomputers made fewer errors than those using typewriters.

The fact that the experimental group made fewer errors during the timed writings may be attributed to two important factors. First, the experimental group spent more time completing their assignments and practicing outside of class than did the control group. Second, the experimental group might have been more familiar with the location of keys on the keyboard. During the initial introduction of the alphabet keys, students in the experimental group were "locked out" of continued keying by a "beep" sound when they touched an incorrect key. Perhaps this "beep" technique forced the students to learn the correct location of keys and made them more aware of letter placement on the keyboard. The control group, on the other hand, could make an error on the typewriter and continue keying. Because these students had no lockout system or control mechanism for keying the correct letters, their familiarity with the keyboard was not reinforced during the developmental

stages. However, despite the experimental group's lower number of errors on the timed writings, the difference between the two groups with regard to accuracy was not statistically significant.

Attendance during this study was stable, and the majority of students completed their assignments as outlined on the course calendar or shortly thereafter. At the conclusion of the study, both groups expressed positive attitudes toward the course and said that cooperative learning made the course more enjoyable. The students overwhelmingly stressed that they did learn how to keyboard, that they enjoyed the way the class had been taught, and that they would recommend the class to other students.

APPENDICES

APPENDIX A

WAYNE COUNTY COMMUNITY COLLEGE: KEYBOARDING OIS 100 AND FUNDAMENTALS OF TYPEWRITING OIS 101--CALENDAR OF LESSONS

WAYNE COUNTY COMMUNITY COLLEGE
KEYBOARDING OIS 100
FUNDAMENTALS OF TYPEWRITING OIS 101
CALENDAR OF LESSONS

Please complete and turn in the following lessons according to the dates listed below. Should you have any difficulty completing lessons when due, please consult the instructor.

WEEK No.	WEEK OF	LESSONS	LESSONS DUE DATE
4	September 17	Lessons 1-3	September 26
5	September 27	Lessons 4-6	October 3
6	October 1	Lessons 7-9	October 10
7	October 8	Lessons 10-11	October 17
8	October 15	Lessons 12-13	October 24
9	October 22	Lessons 14-16	October 31
10	October 29	Lessons 17-19	November 7
11	November 5	Lessons 20-22	November 14
12	November 12	Lessons 23-25	November 21
13	November 19	Post Test	

APPENDIX B

STUDENT SURVEY

STUDENT SURVEY

NAME_____ MARITAL STATUS: S____M____D____

ADDRESS_____ SOC SEC NO._____

Please answer the following questions:

1. Age:
   25 and Under____
   26-34_____
   35-44_____
   45-54_____
   55 and Over____

2: Sex:
   Male_____
   Female_____

3: Education:
   Post high school___
   High School Grad___
   2 yrs high school__
   G.E.D. _____
   No high school_____

4. How many courses are you taking this semester?_____

5. Are you presently working? _____Yes _____No

6. If you are working, how many hours per week _____.

7. Have you ever had any typing instruction before?
   _____Yes _____No

   _____Jr. High School
   _____Business School
   _____Armed Services
   _____High School
   _____Self-taught
   _____Other

8. If Yes to Question 7, approximately how fast can you type?

   _____15 wpm
   _____20 wpm
   _____25 wpm
   _____30 wpm
   _____35+ wpm
   _____Don't Know

9. Why are you taking this course?

   _____Requirement
   _____Employment
   _____Other
   _____Personal Use
   _____Skill Development
   Please Explain_____

10. Have you ever used a microcomputer before? Yes___ No___
    If Yes, please explain:_____

11. A. Do you have a typewriter at home? Yes_____ No_____

    B. Do you have a microcomputer at home? Yes____ No____

APPENDIX C

CONSENT FORM

CONSENT FORM

Dear Student

The need to develop keyboarding skills will become a necessity as we enter the year 2000. To meet this need, the Information Systems Department (OIS) and faculty continuously involve themselves in curriculum improvement.

This study is being conducted to determine whether or not there are any significant differences in (1) the keyboarding skills of students who are taught using a teacher-directed method of instruction with those of students who are taught using a computer-assisted method of instruction and (2) the students preference of learning by the methods.

The study will last approximately 12 weeks and will basically follow the same course outline and format used during the regular school year. Course goals, objectives and grade requirements, therefore, would remain the same. Textbooks and computer disks will be provided.

During the study, no risks are involved. All results will be treated with strict confidence. Data collected will be analyzed as a group--not as individuals.

Your participation in this study is strictly voluntary and would be greatly appreciated to assist me in analyzing keyboarding skills. By signing this form, you indicate your agreement to participate in this research. Thank you.

_____ _____

Signature Date

APPENDIX D

SPEED SCORES CHART FOR PRE AND POST TEST

SPEED SCORES CHART FOR PRE AND POST TEST

This chart is based on the 2-minute timed writings on both the alphabetic copy and the numeric copy. The gross words a minute (GWAM) is based on line score for line completed divided by 2. If a line was not completed, one point per word is added to the line score before calculating the GWAM.

LINES TYPED	LINE SCORE	SPEED SCORE GWAM
1	10	5
2	20	10
3	28	14
4	38	19
5	48	24
6	56	28
7	66	33
8	76	38
9	84	42
10	94	47
11	104	52
12	112	56

APPENDIX E

SKILL DEVELOPMENT POINT CHART

SKILL DEVELOPMENT POINT CHART

This Chart is based on the four centering test items. Each test item was worth 25 points if completed. The following assigned points were deducted from the 25 points based on the type of error found in each problem.

TYPE OF ERROR	POINTS DEDUCTED
1. Spacing between words	1
2. Spacing between lines	2
3. Repetition of words	2
4. Capitalization	2
5. Typographical error	3
6. Horizontal centering	5
7. Vertical centering	5
8. Block centering	5
9. Spread centering	5
10. Line Omission	5

The following points were given for complete test items.

TEST ITEM	LINES COMPLETED	POINTS
C,D,E,F	ALL	100
C,D,E	ALL	75
C,D	ALL	50
C	ALL	25

The following points were given to incomplete problems based on the test item and the number of lines typed.

TEST ITEM	LINES TYPED	POINTS
C,D,F	1 - 3	3
	4 - 6	6
	7 - 9	13
	10 - 11	25
E	1 - 3	6
	4 - 6	13
	7 - 8	25

APPENDIX F

LEARNER ATTITUDE INVENTORY, COOPERATIVE LEARNING INVENTORY, AND KEYBOARDING EVALUATION INVENTORY

LEARNER-ATTITUDE INVENTORY (Typewriter)

LESSONS COMPLETED _____ DATE_____

Directions: The following ten statements are about the lessons you have just completed. Please read each statement carefully, then circle the letter that best describes your agreement or disagreement with that statement.

SA -- Strongly Agree A -- Agree
D -- Disagree SD -- Strongly Disagree
U -- Undecided

1. The lessons were written in a way that made them easy to understand.

SA A U D SD

2. The instructor's explanations helped make the lessons clearer and easier to understand.

SA A U D SD

3. It was not necessary to have an instructor in the classroom in order to understand these lessons.

SA A U D SD

4. I would have preferred to have someone explain these lessons to me.

SA A U D SD

5. It was difficult for me to do the assignment because of the way the lessons were presented by the instructor.

SA A U D SD

Please write down the part of any lesson that was unclear or difficult. Be specific; for example, the instructor's directions were not clear.

A. _____

B. _____

C. _____

6. I enjoyed doing the lessons on the electronic typewriter.

SA A U D SD

7. The electronic typewriter is a valuable piece of equipment to learn.

SA A U D SD

8. It was difficult for me to manipulate the typewriter while doing these lessons.

SA A U D SD

9. Now what I am taking this course, I enjoy using the typewriter.

SA A U D SD

10. COMMENTS: Please write down any comments, ideas or suggestions you wish to express concerning your attitudes and feelings while doing these lessons.

LEARNER-ATTITUDE INVENTORY (Computer)

LESSONS COMPLETED _____ DATE_____

Directions: The following ten statements are about the lessons you have just completed. Please read each statement carefully, then circle the letter that best describes your agreement or disagreement with that statement.

SA -- Strongly Agree A -- Agree
D -- Disagree SD -- Strongly Disagree
U -- Undecided

1. The lessons were written in a way that made them easy to understand.

SA A U D SD

2. The instructor's explanations helped make the lessons clearer and easier to understand.

SA A U D SD

3. It was not necessary to have an instructor in the classroom in order to understand these lessons.

SA A U D SD

4. I would have preferred to have someone explain these lessons to me.

SA A U D SD

5. It was difficult for me to do the assignment because of the way the lessons were presented on the computer.

SA A U D SD

Please write down the part of any lesson that was unclear or difficult. Be specific; for example, the vocabulary directions were not clear.

A. _____

B. _____

C. _____

6. I enjoyed doing the lessons on the computer.

SA A U D SD

7. The computer is a valuable piece of equipment to learn.

SA A U D SD

8. It was difficult for me to manipulate the computer while doing these lessons.

SA A U D SD

9. Now what I am taking this course, I enjoy using the computer.

SA A U D SD

10. COMMENTS: Please write down any comments, ideas or suggestions you wish to express concerning your attitudes and feelings while doing these lessons.

COOPERATIVE LEARNING INVENTORY

LESSONS COMPLETED_____ DATE_____

Directions: The following six statements are about working with other students. They pertain to the lessons you have just completed. Please read each statement carefully, then place a check mark (x) by the answer that best describes your actions.

1. I asked other students questions about how to do the lessons.

   _____Never _____Frequently _____Sometimes

2. I asked for help when I needed it.

   _____Never _____Frequently _____Sometimes

3. I allowed other students to show me how to do the lessons.

   _____Never _____Frequently _____Sometimes

4. I helped other students with the lessons.

   _____Never _____Frequently _____Sometimes

5. I made certain other students understood the lessons.

   _____Never _____Frequently _____Sometimes

6. I worked with other students in order to complete my lessons.

   _____Never _____Frequently _____Sometimes

KEYBOARDING EVALUATION INVENTORY (Typewriter)

Directions: Please read each question carefully. Then place a check mark (x) by your answer. In the space provided, write down any comments you wish to make regarding your answer. Your comments are needed to help us evaluate and improve this course for future students. Thank you.

1. Did you learn how to keyboard? _____YES _____NO
   If YES, why? If NO, why not?

2. Did you find that the teacher's instructions helped you to learn keyboarding skills? _____YES _____NO
   If YES, why? If NO, why not?

3. Would you take another typing course? _____YES ____NO
   If YES, why? If NO, why not?

4. Did working with other students make the course enjoyable? _____YES _____NO If YES, why? If NO, why not?

5. Did you use a typewriter outside the classroom to practice or complete assignments? _____YES _____No. If YES, please check the approximate number of hours.

   _____1-2 hrs per week _____5-6 hrs per week
   _____3-4 hrs per week _____7 or more hrs per week

6. Would you recommend this course to another student?
   _____YES _____NO If YES, why? If NO, why not

KEYBOARDING EVALUATION INVENTORY (Computers)

Directions: Please read each question carefully. Then place a check mark (x) by your answer. In the space provided, write down any comments you wish to make regarding your answer. Your comments are needed to help us evaluate and improve this course for future students. Thank you.

1. Did you learn how to keyboard? _____YES _____NO
   If YES, why? If NO, why not?

2. Did you find that the computer-assisted instructions helped you to learn keyboarding skills? _____YES _____NO If YES, why? If NO, why not?

3. Would you take another CAI course? _____YES _____NO
   If YES, why? If NO, why not?

4. Did working with other students make the course enjoyable? _____YES _____NO If YES, why? If NO, why not?

5. Did you use a computer outside the classroom to practice or complete assignments? _____YES _____No. If YES, please check the approximate number of hours.

   _____1-2 hrs per week _____5-6 hrs per week
   _____3-4 hrs per week _____7 or more hrs per week

6. Would you recommend this course to another student?
   _____YES _____NO If YES, why? If NO, why not

APPENDIX G

PRETEST

PRETEST

TEST 1-A
2-Minute Timed Writing On Alphabetic Copy

Let it snow. If those three words make your pulse race, you probably like winter sports. You may like to ski, skate, or sled in Vail.

The three words cause you to gaze quietly in the distance as you don and adjust the right gear for your expected trip to winter sports.

1 2 3 4 5 6 7 8 9 10

TEST 1-B
2-Minute Timed Writing On Copy With Numbers

San Francisco has a public library system of 26 branches. The budget was over 13.2 million in 1986 for this 26-branch library system.

There are over 1,950,684 volumes in the system and a circulation of over 2,695,510. Many of the 712,753 citizens use the libraries.

1 2 3 4 5 6 7 8 9 10

TEST 1-C
Horizontal and Vertical Centering

Directions: Title displayed: Spread-centered, 2 Blank Lines. Line: Center longest line; block-center listing Tab: Center only Spacing: As shown

C R U I S E S

The Hill-Rowe Travel Company is pleased to announce its annual winter cruises to the carribbean. The cruises include stops at:

Antigua
Barbados
Grenada
Guadeloupe
Martinique
St. Lucia
St. Maarten

TEST 1-D
Block Centering

Directions: Center Title, 2 blank lines. Line: To Center longest item. Tab: Center Spacing: Single

MODERN U. S. SUSPENSION BRIDGES

Bronx-Whitestone
Delaware Memorial
Gas Pipe Line
George Washington
Golden Gate
Mackinac Straits
Seaway Skyway
Tacoma Narrows
Transbay
Verrazano-Narrows

TEST 1-E
Line Centering

Directions: Title: Center 2 Blank Lines Line: Center each line horizontally Tab: Center Spacing: Double

FOREIGN EXCHANGE

British Pound

Canadian Dollar

French Franc

German Mark

Japanese Yen

Mexican Peso

Swiss Franc

TEST 1-F
Block Centering

Directions: Title: Spread Centered 2 Blank Lines Lines: To center longest item Tab: Center Spacing: Single

TEN LARGEST U. S. CITIES

New York
Los Angeles
Chicago
Houston
Philadelphia
Detroit
Dallas
San Antonio
Phoenix
San Francisco

APPENDIX H

POSTTEST

POSTTEST

TEST 1-A
2-Minute Timed Writing On Alphabetic Copy

When approaching the middle of April, people realize that it is time for taxes. This is quite a busy time in many homes in the nation.

It is time to review some records and to see just what deductions and credits can be taken. A smaller tax liability is the objective.

1 2 3 4 5 6 7 8 9 10

TEST 1-B
2-Minute Timed Writing On Copy With Numbers

The Crane Company, 1568 Alpine Street, lists more than 2,240 items in its 92-page catalog. It sold items to 1,247 customers last week.

The company employs 642 workers in its Alpha plant and 540 in Easton. There are 142 marketing people who call on the 10,952 customers.

1 2 3 4 5 6 7 8 9 10

TEST 1-C
Horizontal and Vertical Centering

Directions: Title displayed: Spread-centered, 2 Blank Lines. Line: Center longest line; block-center listing Tab: Center only Spacing: As shown

T O U R S

The Memphis chapter of the Certified Public

Accountants is sponsoring a special trip for

its members to tour these Italian cities:

Florence
Genoa
Milan
Naples
Perugia
Rome
Venice

TEST 1-D
Block Centering

Directions: Center Title, 2 blank lines. Line: To Center longest item. Tab: Center Spacing: Single

WORLD SERIES WINNERS FOR LAST TEN YEARS

Los Angeles Dodgers
Minnesota Twins
New York Mets
Kansas City Royals
Detroit Tigers
Baltimore Orioles
St. Louis Cardinals
Los Angeles Dodgers
Philadelphia Phillies
Pittsburgh Pirates

TEST 1-E
Line Centering

Directions: Title: Center 2 Blank Lines Line: to Center each line horizontally Tab: Center
Spacing: Double

LAST SEVEN VICE PRESIDENTS OF THE U.S.A.

George Bush

Walter Mondale

Nelson Rockefeller

Gerald Ford

Spiro Agnew

Hubert Humphrey

Lyndon Johnson

TEST 1-F
Block Centering

Directions: Title: Spread Centered 2 Blank Lines
Lines: To center longest item Tab: Center
Spacing: Single

M O S T E L E C T O R A L C O L L E G E V O T E S

California
New York
Pennsylvania
Texas
Illinois
Ohio
Michigan
Florida
New Jersey
Massachusetts

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