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EFFECTS OF COMPUTER-ASSISTED INSTRUCTION UPON SEVENTH-GRADE STUDENTS' GROWTH IN WRITING PERFORMANCE

by

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EFFECTS OF COMPUTER-ASSISTED INSTRUCTION UPON SEVENTH-GRADE STUDENTS' GROWTH IN WRITING PERFORMANCE

John D. Crook, Ed.D.

University of Nebraska, 1985

Advisors: Rex Reckewey and Gordon Culver

The primary purpose of this study was to determine if there were significant differences between the growth in writing performance of seventh-grade students who received computer-assisted instruction and seventh-grade students who did not receive computer-assisted instruction. More specifically, the researcher sought to determine the difference in the students' growth in the general, mechanical, and total writing performance between the two groups.

In addition this study was designed to: (1) ascertain the total, general, and mechanical writing performance of those students who experienced writing with word processors; (2) ascertain the difference in the total, general, and mechanical writing performance between male and female students who experienced writing with word processors; (3) compare the total language percentile scores on the Comprehensive Tests of Basic Skills with the percentage of growth, as determined by the Diederich Composition Rating Scale, for those students who experienced writing with word processors; and (4) compare the perceptions toward writing between the students who experienced writing with word processors and students who wrote with pen and paper.

Two seventh-grade classes were compared for writing growth. The experimental class wrote their assignments on word processors, while the control group wrote with pen and paper during an entire semester. A team of three trained raters scored the pretest and posttest essays, using the Diederich Composition Rating Scale. The mean scores on these essays provided the basic data used to test the hypotheses.

The results of the study indicated that seventh-grade students successfully completed their writing assignments on word processors. There was no significant difference between the growth in writing performance of the group of students who wrote with word processors and those students who wrote with pen and paper. However, the majority of students who wrote with word processors experienced considerable writing growth and their growth in writing was greater than those students who wrote with pen and paper.

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The writer thanks the Westside Community Schools for granting permission to conduct this study and to Superintendent Dr. Kenneth Hansen and Associate Superintendent Dr. Jim Tangdall for their support. A special thanks also goes to Lavonne Lorenzen, the English teacher who taught the two classes that were the center of the study. The writer is also indebted to Patsy Hein, Valley View's secretary, for her many contributions, and to Dave Thronson for his help with the statistical analysis.

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J.D.C.

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CHAPTER I

INTRODUCTION

Although most educators have always been interested in improving the student's ability to write, the public interest in the teaching of writing has greatly increased during the past two decades. Because writing is considered to be an essential lifetime skill by both the public and professional educators, teachers and administrators have sought to develop more effective ways to teach essential writing skills and to improve the processes used in teaching students to write.

The current interest in teaching writing was first triggered by the launching of Sputnik in 1957. The same year James Bryant Conant began his studies of American education. In his book, The American High School Today, Conant presented twenty-one recommendations to improve secondary schools in the United States. It was his recommendation that all students be required to take four years of English during which half of this time should be devoted to English composition with an average of one theme per week required. In order that English teachers could read and correct these themes, it was also recommended they not be responsible for more than one hundred students.

The announcement in 1974 by the Educational Testing Service that SAT verbal scores had declined over a ten-year period gave rise to a barrage of questions from the public and the news media

about the quality of school writing programs, questions that were incisive, sometimes hostile, and occasionally downright absurd (Judy, 1981). With this SAT score decline announcement, increased research was undertaken to learn more about how students write.

Recent major reports on American education have placed a high premium on literacy in general and writing in particular. Earnest L. Boyer declared, "Clear writing leads to clear thinking; clear thinking is the basis of clear writing" (cited in Toch, 1984). Although writing is one of the three basic skills in education, there is mounting evidence that pupils' proficiency in this skill has decreased rather than increased since the 1960's.

Personnel in the United States Office of Education, using survey results from a federally funded study in 1975 by the University of Texas and 1980 census data, estimated there are as many as seventy-two million Americans who have difficulty or are incapable of performing such basic tasks as reading the label on an aspirin bottle, writing a check, or following the directions for cooking a T.V. dinner (Toch, 1984).

According to the third National Assessment of Writing conducted by the National Assessment of Educational Progress (N.A.E.P.) (1981), most American high school students never attain the goals of good writing and careful thinking. The N.A.E.P. study found that while America's 17-year-olds have a general grasp of the mechanics of writing, only half could write a satisfactory piece of explanatory prose.

Toch (1984) reported that 84 percent of the personnel from the 1,392 colleges and universities recently surveyed by professors at the University of Texas said they had established remedial programs in reading, writing, and mathematics within the last several years. "By and large, freshmen are not conscious of language," said Michael Holzman, an assistant professor of English at the University of Southern California who just completed four years as chairman of the university's 3,000-student freshman writing program. "They show very little stylistic creativity and they possess few higher-order rhetorical skills" (Toch, 1984, p. 4).

There has been a growing concern regarding the amount of time students actually spend writing. Graves (1978), in a study sponsored by the Ford Foundation, found that second graders averaged only three pieces of writing in three months' time and that secondary school students wrote even less.

Applebee and others (1980) conducted one of the most comprehensive studies on writing in the public schools, known as "The National Study of Secondary School Writing." This observational study revealed that while students held a pencil 44 percent of the time during class, only three percent of that time was spent composing prose of a paragraph or more in length. The researchers found that only three percent of the students' homework involved writing a paragraph or more.

Goodlad (1983), in his book A Place Called School, reported the results of a survey of 38 public elementary, junior high, and high

schools which revealed that student writing in the early years involved primarily the tasks of answering questions and filling in blanks. According to Goodlad, by junior high school, the frequency of writing had dropped by one-third and in high school by one-half.

The on-going search for more effective ways to improve writing skills of youth has been intensified in recent years. As a result of this new emphasis, writing has regained greater attention in the schools. While there is no one universally effective program or technique that has been identified, a number of the new approaches have met with some success.

During the past decade, four major developments have converged to produce a "paradigm shift" in the teaching of writing. Kuhn (1981) defined a paradigm shift as the replacement of one conceptual model by another. According to Kuhn, such a replacement is often controversial and occurs only when unsolved problems in a discipline reach a crisis stage. When such a crisis occurs, professionals in the field must then search for alternative solutions. During the 1970's, the amount of poor writing by students produced a paradigm shift in the teaching of writing.

The first of the developments of the new conceptual models focused on writing as a composing process. For many years, composition was taught primarily by instinct and intuition and emphasized the final product. More recently, the process of writing began to receive equal attention. In this approach, the composing process was viewed as a way of thinking, learning, and knowing. As a result,

many theorists have postulated a three-stage linear model of pre-writing, drafting, and revising. However, some current researchers believe that this linear three-stage model is too simple to explain the complex process of composing. Theorists who perceived a more complex structure generally agreed with the following conclusions and principles identified by Glatthorn (1981):

> - The composing process is complex, involving memory, cognition, language, and psychomotor behaviors.
> - The composing process is multiphased, involving several different stages and many subprocesses.
> - The process seems recursive and interactive; the stages overlap, relate closely to each other, and affect each other. (p. 1)

While there does not seem to be conclusive evidence at the present time to support one revision process over another, there is substantial evidence that the revision process itself is critical in the improvement of writing (Bamberg, 1978). Neill (1982) indicated that the most commonly accepted bit of wisdom in the new writing programs was that "writing is a process, and it must be taught that way" (p. 15). To their credit, the researchers, curriculum specialists, and teachers who have developed the programs have successfully established the truth that writing is not simply a function of grammar, but a "composing process" that requires preparation, planning, and revision.

The second development in the teaching of writing pertains to the proliferation of writing workshops for teachers. The Bay Area Writing Project, recently renamed the National Writing Project, is perhaps the most well-known of these writing workshops. According to a NASSP Curriculum Report (1983), the BAWP-model workshops were based

on the following common assumptions:

> (1) The writing problem is shared by universities and schools and can be solved best by cooperatively funded efforts.
> (2) Most teachers have not been adequately prepared as teachers of writing and know little of what is now known about teaching writing.
> (3) The best teachers of teachers are teachers who have succeeded, who are identifiable, and whose strategies are demonstrable.
> (4) Teachers of writing are writers themselves. (p. 2)

As of 1983, more than 41,000 elementary and secondary teachers had participated in the National Writing Project. Many of these summer workshops were subsidized by grants from the National Endowment for the Humanities, the Carnegie Foundation, universities, state boards of education, and federal programs.

The third development in the paradigm shift was the concept of writing across the curriculum. This concept was born in Britain and was based on the idea that not only English teachers but all teachers must teach writing as a way of learning and should provide students frequent opportunities to write. The philosophy of this concept was that when teachers teach writing as a way of learning in every discipline students will develop both better writing and learning skills.

The fourth and most recent movement to improve student writing skills involves the use of microcomputers. Since its inception, computer-assisted instruction (CAI) has been defined as "any method of learning in which a computer is the primary delivery system" (Burke, 1982). Computer-assisted instruction dates back to the 1960's,

when attempts were made to provide students with direct instructional assistance through the use of large, stationary mainframe computers which were connected to school-based terminals by long-distance telephone. However, these early CAI systems were often found to be expensive, unreliable, and too centralized to be practical in the public schools. Nevertheless, by the late 1970's, the advances in computer technology offered the school a new tool to aid in improving the writing process.

Incorporating computer-assisted instruction into the language arts curriculum obviously depends upon the availability of appropriate, cost-effective instructional software. According to Blaschke (1979), the development of such software lagged far behind the developments in computer hardware. Bonham (1983) found that the highest quality of software was largely the "work of talented individual teachers who have little chance of making their work nationally available" (p. 33).

Nicholl (cited in Zaharis, 1983) indicated that language arts instructors working with existing programs would likely experience one or more of the following limitations:

(1) the program is incompatible with the hardware available for use in the school.
(2) It is too costly to merit purchase.
(3) It contains factual errors.
(4) It is pedagogically unsound.
(5) It does not quite fit the class's needs and cannot be modified by the teacher to do so.
(6) It fails to take advantage of the computer's capabilities and is, therefore, little more than an electronic workbook.
(7) Its instructions are so complicated that students cannot follow them or so verbose that students lose interest before they begin or finish the exericses.

> (8) Its response times are too long or too short.
> (9) Adequate documentation for the program is not available. (p. 991)

At the same time, these limitations need not be an inherent part of the software programs and are not sufficient reason for the exclusion of CAI from the language arts classroom.

The modes of delivery presently employed in the language arts classroom include (1) drill and practice, (2) tutorials, (3) educational games, (4) simulations, and (5) demonstrations. Text analysis programs are also available which scan student compositions for structural mistakes, mark the place where the error occurs, and require that students make the necessary corrections (Cornnell & Humes, 1981).

More recent advances in the computer science field have led to the development of relatively inexpensive word processors. Teachers and students with access to these microcomputers and supplied with appropriate text-editing software and high-speed printers can now organize, enter, edit, format, and print out anything they might write.

Coburn et al. (1982) reported:

> Schools using word processing programs have found that even young children will revise their work to correct punctuation, spelling, word selection, sentence structure, and the dozens of errors common to student writing, such as word and letter juxtaposition. Using word processing programs encourages students to write who might otherwise avoid writing. All students using such programs tend to write longer, more detailed stories and essays. As a side benefit, learning to use such programs properly often results in the students' overall improvement in following directions. (p. 993)

Increasingly, teachers have found that the ability of the computer to function as a word processor makes it a useful tool in teaching composition. This capability allows students to compose on the keyboard; save their work so that it may be recalled at a future time; edit every aspect of what has been written; shift sentences and paragraphs from one location to another; and print out a finished product without having to be concerned about spacing, pagination, headings, or margins. In other words, revision, a necessary part of the process of learning how to write well, can be so simplified by the word processing power of the computer that students who have tried it actually enjoy it (Shostak, 1983).

The emerging potential of the microcomputer as an instructional tool in the teaching of writing makes it a worthy topic for further exploration.

Statement of the Problem

The primary purpose of this study was to determine if there was a statistically significant difference between the growth in writing performance of seventh-grade students who received computer-assisted instruction and the growth in writing performance of seventh-grade students who did not receive computer-assisted instruction.

Hypotheses

The following hypotheses were investigated in this study. Stated in the null form, these hypotheses were:

Hypothesis 1. When pretest and posttest scores of total, general, and mechanical writing performance, as measured by the Diederich Composition Rating Scale, are compared by the use of a t-test, there will be no significant difference between the growth in writing performance of the group of students who received computer-assisted instruction for their written compositions and the growth in writing performance of the group of students who did not receive computer-assisted instruction.

Hypothesis 2. When the pretest and posttest scores of total, general, and mechanical writing performance, as measured by the Diederich Composition Rating Scale, are compared by the use of a t-test, there will be no significant growth in writing performance for those students who experienced computer-assisted instruction.

Hypothesis 3. When pretest and posttest scores of total, general, and mechnical writing performance, as measured by the Diederich Composition Rating Scale, are compared by use of a t-test, there will be no significant difference in the writing growth between male and female students in the experimental group that received computer-assisted instruction.

Hypothesis 4. When the total language percentile scores on the Comprehensive Tests of Basic Skills (CTBS) and the percentage of growth scores are compared, using the Pearson product-moment coefficient of correlation, there will be no significant difference between the experimental groups's CTBS scores and the percentage growth scores.

In addition to the four hypotheses tested in this study, a comparison was made between the perceptions of students who received computer-assisted instruction for their written compositions and students who did not receive computer-assisted instruction by utilizing a survey administered to both groups at the end of the semester.

Design of the Study

A pretest-posttest control-group design was utilized for the study. A comparison was made between two seventh-grade English classes. One section (control group) was taught the traditional way with all writing done with pen and paper. The other seventh-grade section (experimental group) wrote and revised compositions with the assistance of a word processor. This procedure enabled the researcher to test for differences in the writing growth between the two groups. Both seventh-grade classes were taught by the same English teacher in a suburban junior high school located in the Omaha metropolitan area.

The study compared the writing growth of the two classes during the second semester 1983-1984. Both classes involved in the study had twenty-three students who had been randomly assigned to these classes and were heterogeneously grouped. During the sixteen-week duration of the study, both classes spent the same amount of time on writing instruction. The twenty-three students in the experimental group followed a rotation system that enabled all students to work individually on a computer at least two times per week.

Identification of the Subjects for the Study

The study was conducted at Valley View Junior High School in suburban Omaha, Nebraska, where the investigator was the principal during the 1983-1984 school year. Valley View Junior High School was one of three junior highs in the Westside Community School District. Valley View Junior High was built in 1964 and reached a peak enrollment of approximately 800 students in 1973; by the fall of 1983, the enrollment had declined to 470 students. The student population was drawn from a predominantly upper-middle and middle-class area of the city of Omaha.

All seventh graders at Valley View were required to take two semesters of English. Two instructors taught all of the seventh-grade sections during the 1983-1984 school year. One of the seventh grade teachers was assigned five sections plus one journalism class, while the other teacher was assigned the remaining two seventh-grade classes as well as two eighth- and two ninth-grade classes. The students in the two seventh-grade classes taught by the one teacher were chosen as the subjects for the study.

Selection of the Topics for the Writing Exercises

An effort was made to select appropriate writing topics for use during the pretest and posttest periods. The four English teachers at Valley View Junior High School served as "professional jurors" for the selection process. Each of these English teachers had taught at least ten years at the junior high level. Each teacher submitted several topics believed to be appropriate writing topics

for the study. The "professional jurors" selected those topics believed to be "most appropriate" for seventh graders and "equal in difficulty" for pretest-posttest purposes. The investigator took the six topics selected and conducted a "blind draw" to determine which three would be assigned for the pretest and which three would be assigned for the posttest.

Administration of Pretest and Posttest Essays

All students in the two sections wrote three pretest and three posttest essays on six separate dates. The pretest and posttest essays consisted of a one-page expository writing assignment. The pretest and posttest writing dates and the six writing topics are shown in Appendix A. The tests were not administered on consecutive days in order to assure quality performance.

Students in both the experimental and control group wrote the pretest and posttest essays during a forty-five minute class session. All students wrote each pretest and posttest essay during the same period of the day under close supervision of the instructor.

The pretests were administered early in the second semester of the 1983-1984 school year. The three pretest writing assignments were collected and three copies were made of each student's essay and were scored by the professional evaluators at a later date. The original copy of the essays was examined by the classroom teacher and returned promptly to the students.

The use of three writing assignments for pretest and posttest measurement of student writing ability was based on the recommendation

of Kincaid (1963) who stated:

> A single paper written by a student on a given topic at a particular time cannot be considered as a valid basis for evaluating his achievement in a writing course at any time. (p. 45)

Kincaid also noted that the writing performance of poor writers often varied according to the composition topic assigned.

In order to ensure anonymity of the writers, the investigator blocked out the students' names on all essays and assigned each paper a student code number. By use of the code number, the investigator was able to determine the sex of each student, to ascertain whether the student was in the experimental or control group, and to discern whether the paper was written during the pretest or posttest period. The pretest and the posttest essays were photocopied and sealed in envelopes to be scored later by the trained raters at the conclusion of the study.

Selection of Software Program

The educational software selected for this study was the "Bank Street Writer" program. Bank Street Writer is a classroom word processor program jointly produced by the Center for Children and Technology at Bank Street College and the publishers of Classroom Computer News. This software program developed from earlier research on children's revision strategies conducted at Bank Street College. The Bank Street Writer program had been thoroughly field-tested and had been determined to be quite successful for use in the upper elementary grades.

Selection of the Raters and Evaluation of the Writing Samples

At the close of the study in the spring of 1984, all of the essays (pretest and posttest) were scored by a three-person team of raters. Since each student in the control and experimental group wrote essays on six different occasions, there were a total of 276 essays to be scored by each of the three raters.

Each of the three raters had taught English at least ten years at the junior high level. Two of the raters held Master's degrees in English. All three raters had experience in holistic scoring prior to their selection.

The investigator conducted two training sessions for the three raters. The first session provided an explanation of the Diederich Composition Rating Scale which had been selected as the instrument to be used for rating the essays written by the subjects in the study. (A copy of the Diederich Composition Rating Scale is included in Appendix B.) After discussing the various factors involved in the use of the rating scale, each of the raters scored four sample essays. The raters then compared their scores and the reasons for rating the papers as they had. Each rater was assigned seventeen additional essays and asked to rate them during the following week. The Pearson product moment correlation coefficient was used to compute inter-rater reliability on the papers and the investigator found the results to be acceptable.

At the second training session, the raters discussed the Diederich Scale further and re-scored the four essays in which their

ratings had been discrepant by more than ten points. At the conclusion of the second training session, each of the three raters was provided with a set of 276 papers for the rating.

In preparing the sets of essays for scoring, the investigator mixed the pretest essays with the posttest essays to avoid boredom from reading a large number of essays on the same topic. The 276 essays were also divided into three separate sets of approximately ninety essays. Each rater was requested not to rate more than one set of ninety papers during one sitting. In addition, each rater was given a written set of instructions for scoring the essays:

1. The papers in each package are arranged in the order in which you should rate them. Do not deviate from this order.

2. Read the Diederich Scale before rating.

3. Before rating any papers in a set, chose four papers at random and scan them. After scanning, be certain to return these papers to their original order in the package before beginning to rate.

4. Return to the first paper in the set and begin rating. Rate each paper rapidly, spending no more than three minutes on a typical paper. Do not write on the essays as you are rating them. After you have read the paper, circle the appropriate numbers on the rating sheet and total the score for the paper.

5. If you rate more than one set of essays on the same day, rest at least thirty minutes after rating the first set before beginning the second set.

Statistical Analysis

When the ratings of the pretest and posttest essays were completed, the score for each student was entered into the computer.

The mean scores for each student on the three pretests and three posttests were then computed and analyzed using a t-test.

The computer facilities at the Westside Community Schools were used to analyze the first three hypotheses. A t-test was computed for each of the first three null hypotheses. An alpha level of .05 was established as the level for statistical significance required for the rejection of the three hypotheses.

The fourth hypothesis was tested by using the Pearson product moment coefficient correlation (r); the alpha level of .05 was established as the level for statistical significance.

Definition of Terms

The following terms are defined in order to provide clarity for the study:

Bank Street Writer. A commercially developed wordprocessing software program.

Comprehensive Tests of Basic Skills (CTBS). A national standardized testing program.

Diederich Composition Rating Scale. A writing assessment scale developed by Paul Diederich which combines the mechanics and the general aspects of writing.

Microcomputer. A small computer system that includes the functional components of unit, memory, output, and central processing unit.

Wordprocessor. A technological addition to microcomputers

allowing students to enter, save, revise, and print on paper the text that appears on the screen.

Computer-assisted instruction (CAI). Any method of learning in which a computer is the primary delivery system.

Limitations

The applicability of the findings in this study was limited to a comparison of two seventh-grade classes. In addition, the study's duration was only one semester in length. Although one semester falls within the recommended parameters for such research, a study extending for a full academic year would have been preferable. The study was further limited in that the subjects were not previously trained in the keyboarding phase of operating the computer. The students had, however, completed a four-week unit on computeronics. The computeronics course was designed to familiarize the students with computers through a "hands-on" approach. A final limitation of the study was that only eight computers were available for use with a class of twenty-three students.

Significance of the Study

The results of this study should indicate whether a computer-assisted writing program can produce significant amounts of growth in basic writing skills. It should also provide needed input for making future instructional and curriculum decisions. The results of this research may also raise further questions for study. For

example, is the seventh grade the most appropriate grade for computer-assisted writing instruction? Or, do the results of this study justify the expenditure of time and money spent on computer-assisted writing instruction?

Organization of the Study

In Chapter I, the basic problem was defined and the four specific hypotheses to be tested were presented. A brief description of the procedures that were followed in the conduct of the study, the definition of terms, limitations, and significance of the study were also presented.

The literature related to the teaching of writing and computer-assisted instruction is presented in Chapter II.

The specific findings of the study are presented and analyzed in Chapter III.

The major findings of the study are summarized and their applicability to educational practice is reviewed in Chapter IV.

CHAPTER II

RELATED LITERATURE

The literature reviewed in this study was directed at two major areas of concern. The first of these areas was an examination of different theories or approaches to writing instruction. This phase of the review was undertaken in order to better understand the background and scope of this topic. Most of the available material on this topic has been written in the last two decades (i.e., since 1965). The second major area reviewed involved the use of computers in the teaching of writing. Because computers were not readily available until the last ten years, most of the articles on this topic were written after 1977. Although this time span is rather brief, there has been an increasing amount of material written on this topic. Indeed, since 1980, there has been a dramatic increase in the number of articles regarding the use of computers in the teaching of composition.

Theories or Approaches to Writing Instruction

One of the earliest studies that investigated the composing process was conducted by Van Bruggen in 1946. Van Bruggen investigated the rate of flow of words used by eighty-four junior high students during the composing process. Van Bruggen's study incorporated a system of hardware that measured bursts and pauses in the students' writing. Van Bruggen discovered that "good" writers spent more time

in long pauses, often pausing before they wrote whole segments of text. In addition, he found those students who had mastered the mechanics of writing wrote at a rapid rate between pauses. At the same time, the less competent writers wrote more slowly and paused for briefer intervals.

Another major study undertaken by Emig (1971) was particularly significant because it served as a prototype for numerous subsequent projects. Emig sought to investigate "the ways that students usually or typically behave as they write." She attempted to identify the students' feelings, attitudes, and self-concepts that formed the "invisible components of composition." Emig's approach involved her own adaptation of the case-study method. Her data were drawn from tape recordings of the comments made by eight twelfth-grade students who were asked to compose aloud; that is, to express orally the thoughts and feelings that came to them while they were engaged in writing three short themes during individual sessions with the investigator.

In her analysis, Emig indicated several significant contradictions between what good students and established writers actually do and what language textbooks say that student writers "ought to do" during the composition process. Emig also examined the ways that "school-sponsored" and "self-sponsored" writing influenced the student's choice of topic, the student's selection of materials, their inclination toward "deep personal engagement" in writing, and the attention students devoted to planning, prewriting, and revision. Her findings indicated prewriting to be a far longer process, with

more revision, in student self-sponsored writing. She also noted that students did not voluntarily revise school-sponsored writing. In addition, Emig found that students did little planning before they began translating on paper and they seldom outlined. Emig concluded that students should be allowed to do more self-sponsored writing in order to encourage good writing behavior, such as planning and revising.

Mischel (1974) replicated Emig's design, with similar results, in his study of a 17-year-old high school student. Mischel observed that all of the student's planning was mental, without physical activity such as taking notes or outlining. Mischel found that planning time ranged from less than one minute for school-sponsored writing to 20 minutes for self-sposored writing. The student paid little attention to revising, although some time was spent on reordering groups of words.

In Stallard's (1974) study, longer planning time distinguished the writing processes of good writers. Stallard's investigation revealed the composing behavior of thirty high school seniors through use of an observational checklist, an interview technique, and an analysis of written products. Stallard concluded that "a major behavioral characteristic of the good writer is a willingness to put forth effort to make communication clearer to a reader." It was evident that good student writers spent more time in contemplating the assignment (planning) from the first draft through revision and the final product.

Britton et al. (1975) attempted to identify qualitative changes in writing ability. They based their research in England on a national collection of routine samples of writing from all curriculum areas by students aged eleven through eighteen. They found a development (reflected in age grading) in the samples from "expressive" (relatively undisciplined) writing to "transactional" and "poetic" writing. Britton et al.'s research was groundbreaking in that it was one of the earliest studies which looked at "function" rather than at superficial aspects of form. As such, it influenced the development of much subsequent research on writing development.

Pianko (1979) examined aspects of the writing processes of seventeen writers who were freshmen in a community college. Ten of the students were remedial while seven were average and good writers. Each student in the study wrote 400-word essays on five different occasions. During these writing assignments the participants were videotaped and interviewed. Observers recorded the length and number of occurrences for various writing behaviors.

Pianko reported that most students began translating on paper before they had a complete idea of what they wanted to write. Nearly all students wrote only one draft in which the planning took place during the composing. It was apparent that two behaviors, pausing and scanning, significantly influenced composing time and rate. Traditional students paused to plan and then rescanned to reorient themselves before continuing to write. According to Pianko, the traditional students were more concerned with communicating their

ideas than correcting mechanics and usage. In contrast, the remedial students often paused for diversion or to consider the correctness of the surface elements in their texts.

Researchers have shown sentence combining to be an effective technique for improving the syntactic skills of student writers at various grade levels. Studies by Perron (1975) with elementary students, O'Hare (1973) with middle-level youngsters, Sullivan (1978) with secondary students, and Daiker, Kerek and Morenberg (1978) with college students agreed that sentence combining enhanced syntactic fluency. Lawlor (1980) noted an improvement in overall quality of student writing when using sentence combining and concluded it to be an important component--but not the only component--of a comprehensive writing program.

Reseachers of much of the early literature about writing described the process as linear and emphasized a three-stage model comprised of planning, writing, and revising. However, more recent researchers indicate these models may be inadequate or inaccurate because writing is not linear but recursive. Many theories that differ only in the numbers and labels applied to the various stages or components of the writing process are presented in the literature. In any event most researchers emphasized writing as a process (how people write) rather than a product (what people write).

Rohman (1965) was one of the early advocates of the three-stage model of prewriting, writing, and rewriting. Rohman used the labels because they suggested to him invention, arrangement, and style. The

three-stage theory was also described by Applebee (1979), who stated, "It is quickly apparent that the process has a number of distinct stages. At the simplest level, these include prewriting, writing and editing." The three-component theory was also supported by Murray (1978), who used the labels "prevision, vision, and revision," and Britton (1978), whose terms were "preparation, incubation, and articulation."

All of the above theories characterized writing as a linear activity. More recent researchers indicated these linear models may be inaccurate becuse they describe the product, not the "inner process of producing the product" (Flower & Hayes, 1981). According to Flower and Hayes, the writing process does not occur in linear fashion but moves back and forth among these processes. Their position was based on their analysis of a five-year collection of transcripts prepared from tape recordings of both novice and expert writers. The recursiveness of writing was also supported by Perl (1979) and Nold (1981).

Experienced writers compose in many drafts. They revise early drafts structurally and conceptually, and modify individual words and sentences in later drafts (Bartlett, 1981; Calkins, 1979; Graves, 1978; Nold, 1981). The goals of this process are to explore and clarify ideas and to create a written text that communicates effectively with the intended audience. For expert writers, the composing process, with its components of planning, writing, and revising, is reader-directed and iterative, incorporating a wide

variety of strategies for revision.

Shaughnessy (1977) found that students' models of the composing process contrast sharply with those of skilled writers. Students strive to make their compositions "right" the first time. Before starting to write, they mentally organize their ideas. Their goal is to relate what they know rather than to refine their understanding or to have a particular effect on the readers (Flower, 1979; Scardamalia & Bereiter, 1982). Students write by starting with the first sentence and continue linearly until they are finished. Except for corrections in spelling and punctuation, they rarely modify their texts (Bartlett, 1981; Emig, 1971). Most students write only two drafts, the second merely a neater and more legible copy of the first.

Calkins (1979-80) collected data in the form of verbatim scripts of interviews, videotapes, and copies of children's writing in which the writing process was emphasized. The fourth-grade students in the study wrote every day, chose their own subjects, had conferences with the teacher and with other students, and drafted and redrafted pieces of their writing. The students' engagement in writing was constant, eager, and highly social. Writing was an important part of their daily experience for these youngsters. The aim of this research project was to move the children into concentrated writing in the content areas and to promote more objective writing than the personal writing they had been doing.

The following conclusions were drawn from Calkin's case study:

1. Narrative allows children to absorb information.

2. In working on narratives, children enlarge their store of information, learning more than appears in the writing.

3. Constructing a narrative allows children to play with information, making it their own.

4. Constructing a narrative reveals to children where/ when more information is needed.

5. When the topic of research lies too far outside children's experience, they copy.

6. A good research topic is one children already know something about.

7. The transfer of the writing process from personal writing to objective writing in the content areas is facilitated by narrative. (Calkins, cited in Olenn, 1984, p. 382)

Graves (1983) conducted a longitudinal study in which he investigated children's writing in the context of their own classrooms. The purpose of his study was to investigate the order and types of problems children solved as they learned to write. Teachers were free to do whatever they thought was best when teaching writing. As a result, many of the practices were not used in the same way the second year as they were in the first year. Graves believed that children would learn through solving problems and that they should learn to control their own writing. He indicated that most of the time children are capable of handling imbalances without any help from the teacher. He further contended that if students control most of their topics, write regularly, and are permitted to express their intentions freely, they will develop a strong repertoire for handling things on their own.

According to Graves, revision is a necessary part of the writing process; however, he cautioned against excessive use of this practice. Graves felt he found some instances where the reasoning seemed to be, "if a sign of growth is revision, then let us keep the child revising. Surely a child who has done five drafts has written better than a child who has not revised at all." However, according to Graves, revision is misused when children are forced to revise willingly or unwillingly, or there is a numerical justification (five drafts to one) in order for growth to occur. It was Graves' opinion that best revision comes when children make changes on their own and the teacher has little to do with the process in a direct sense.

Perl (1979) examined the composing process of five unskilled college writers. Data were collected on the student's written products, tapes of oral composing, and their responses to interviews. Perl found that only a small amount of time was spent in planning to write. In addition, he found that these unskilled writers generally revised to fix mechanics, lexicon, and syntax. Despite these editing efforts, the students' essays still contained serious problems (e.g., omitted words, missing suffixes). Perl believed these problems may have been caused by (1) the students' tendency to assume their readers could understand their text, and (2) the students' selective perception, as evidenced by the fact they often read aloud what they thought they had written rather than what they actually composed.

Gould (1980) found planning to be a significant element of

writing for college-educated adults. His study consisted of videotaping fifty adults as they composed business letters, either by dictating or writing with a pen or a typewriter. Gould found that planning consumed a consistently high proportion of their total composing time (65 percent).

Glassner (1980) researched the left and right hemispheres of writers' brains as they composed. He employed both an electroencephalogram and videotape collecting data on thirty college students. Glassner found that writers evidenced high levels of right-hemisphere activity when they chose unrehearsed topics that caused them to pause and engage in significant in-process planning. He found high levels of activity in writers' left brains when they were writing on rehearsed topics. Through interviews, Glassner verified the automatic nature of their writing at the time of their heavier left-brain activity.

Flower and Hayes (1980) reported their analysis of a five-year collection of data on novice and expert writers. They found that good writers addressed all elements of the writing task, while poor writers were concerned with features such as the number of pages to be written. In addition, Flower and Hayes found that the expert writers created many problem-solving goals that helped them generate content, whereas the poor writers were concerned with statements about the subject. In another study, Flower and Hayes (1981) analyzed the location and duration of writing pauses of three expert and one novice writer. They found the length of time spent translating between

pauses was greater for the expert writers than for the novice writer.

Matsuhashi (1981) also reported on writing pauses. Four skilled writers who were high school seniors were videotaped for his study. Matsuhashi found that pause time increased according to the type of discourse composed by students, in the following order: reporting, persuading, and generalizing. He also found the writers paused for a short time when they were planning their next words or phrases, and paused for longer periods when they were planning longer segments of text. According to Matsuhashi, skilled writers spent more than half of their total composing time in pauses.

Three recent major studies centered around one element of composing--the process of revising. Bridwell (1980) examined the writing of 171 twelfth-grade students. In the study, students composed on a designated topic and made changes in their text on that day. The drafts were collected and distributed at a second session, where teachers instructed the students to mark their essays with additional revisions and then write a new draft. Both drafts were collected and analyzed at the surface level (e.g., spelling and punctuation), word level, phrase level, clause level, sentence level, and text level. Bridwell found that surface and word level changes accounted for more than half of the students' revisions. She also found most changes were made while students were composing their final draft. According to Bridwell, the final revised versions were rated higher in quality than were the early drafts, verifying the importance of the revision process.

Sommers (1980) studied the revising behavior of twenty freshman college students and twenty experienced adult writers. Each participant produced three essays and rewrote each essay twice. The drafts were analyzed for the frequency of revision operations (i.e., deleting, substituting, adding, and reordering) and for the levels of these operations (i.e., word, phrase, sentence, theme). Sommers found that the students did not employ either reordering or adding operations. According to Sommers, the student writers generally viewed revising as a rewording activity. On the other hand, his results showed the experienced adult writers revised differently than the students. He found these experienced writers revised most frequently by adding and deleting at the sentence level.

Faigley and Witte (1981) examined the revising processes of six inexperienced student writers, six advanced student writers, and six expert adult writers. They found the expert writers revised at a higher level than did student writers. Faigley and Witte also found the inexperienced writers corrected errors most often by substituting synonyms. The advanced student writers made similar changes plus structural changes that altered the meaning of their texts. In addition, they found the adult writers made a greater number of changes that affected meaning than did the two groups of students.

Lloyd-Jones et al. (1980) studied syntactic fluency and rhetorical fluency in the writing of seventeen-year-olds. Their data were taken from the National Assessment of Educational Progress

and consisted of 160 compositions rated by the primary trait method of writing assessment. The researchers felt the study was valuable in that it provided teachers with a scientific, non-intuitive basis for counseling their students on stylistic practices.

Computer-Assisted Writing Practices

The majority of studies on computer-assisted writing instruction have been conducted since the introduction of the Apple microcomputer in 1977. The following section summarizes the most relevant work currently available on the use of computers in composition. Actual programs and instructional techniques as they relate to composition theory were examined in many of the studies. However, at the time of this review, there were a number of research studies related to computers and composition underway that had not been reported. There were also a growing number of unsubstantiated reports concerning the accomplishment of students who had not shown any particular interest in writing, but because of the introduction of computers were displaying a great deal more interest.

Researchers have only begun to design evaluation studies to effectively examine the results of computer-based instruction. Although these studies have produced potentially valuable information about the effects of computer-based teaching, the evidence has not been totally clear or completely conclusive. At the same time, several of the early researchers concluded that computer-based instruction is effective in raising student achievement, especially

when it is used to supplement the regular instruction in the elementary schools.

According to Schantz (1979), students using a text-editing system were able to overcome the mechanical barriers of writing and their general motivation was high. Vinsonhaler and Bass (1972) reported that the results from ten independent studies showed a substantial advantage for computer-augmented instruction. Elementary school children who received computer-supported drill and practice generally showed performance gains of one to eight months over children who received only traditional instruction. Edwards and others (1975) also reviewed studies of computer-based instruction in various subjects and reached similar conclusions about its effectiveness in raising achievement test scores. These researchers noted that computer-based instruction also reduced the time it took students to learn.

There has been an increase in the use of computers to help students learn to write. Woodruff, Bereiter, and Scardamelia (1981) explored the feasibility of using computer-assisted instruction in helping school-age children handle high-level aspects of the composing process. The results of this exploratory investigation indicated that students will interact with a computer while developing a composition. Furthermore, the students' perceived use of the computer made their writing significantly easier, better, and more enjoyable than traditional paper and pencil approaches although the holistic scores indicated such use was not necessarily producing better quality texts.

A second study by Woodruff et al. (1982) found that students

perceived the computer as making writing easier, better, and more enjoyable. The researchers also concluded that using computer-assisted text writing programs improved student attitudes toward writing. Additional findings from this study suggested the students were overloaded if they had to deal with the novelty of a computer keyboard and a questioning routine at the same time. However, this handicap was largely overcome by a single session of keyboard composing. Further analysis revealed that the arguments produced in the computer-questioning conditions were less well thought out, more one-sided, and less mature.

Black and Wilkes-Gibbs (1982) reported a similar decline in performance in writers who were asked to plan aloud as compared to composing in silence. Their findings seemed to indicate that any such additional task demand diverts mental capacity from the main task and results in writing that appears simpler or less mature.

Burns and Culp (1980) conducted a study to examine invention in English composition through computer-assisted instruction. According to the researchers, invention is the process of exploring a subject to discover ideas, arguments, or propositions--those features which one must know in order to write convicingly about a subject. The major question in the study was: Could supplementary computer-assisted instruction be designed, developed, and programmed which would effectively stimulate most individual's inventive process? The subjects consisted of seventy-two students in four, second-semester English composition classes at the University of Texas. The students who

elected to take this course were interested in improving their expository composition skills. Two significant findings were found in Burns and Culp's pretest-posttest experimental study. The primary finding was that computer-assisted instruction which encouraged both growth in the number and sophistication of ideas could be programmed; questioning dialogues could help students articulate, refine, and preserve their ideas and such questioning dialogues could ignore content in favor of perspective and still help students begin writing; and theories of creativity based on intersecting content and perspective were programmable at the present time and were certain to be even more programmable in the future. The second important finding was that computer-administered, post-test methodology represented a stringent way for controlling and perhaps later replicating quasi-experimental research in rhetoric.

Warren (1980-81) described an "Electric Pencil" program on a TRS-80 and stated that those who attempt word processing regard the conventional typewriter as a quaint antique.

Hennings (1981) examined the use of microcomputers for writing and editing small-group language experience stories in the primary grades. He also investigated teacher-guided writing and editing in the upper-elementary grades and research-writing experiences in the junior high school. Hennings listed the following positive effects of word processing: students were motivated, time was saved, writing and reading activities could be integrated, and the users became computer literate.

Watt (1982) utilized a word processor in the classroom and conducted a case study of a twelve-year-old girl whose achievement was at the second grade level. According to Watt, motivational, behavioral, and attitudinal changes were achieved with the introduction of a text-editing program. The changes in this student's behavior were attributed to gaining a tolerance for making errors, improved ability to produce neat, beautiful copies, and more positive feedback from those who read her compositions. According to Watt, the use of the word processor avoided some of the physical difficulties of writing with pen and paper and allowed the student's writing abilities to catch up with her verbal ability. Nold (1981) agreed with Watt that revision should be an integral part of the writing process and was particularly valuable as an exercise in the creation of alternate presentations.

A number of research studies focused on the use of word processing with college populations. Schwartz (1982) stated that the use of a computer-based text editor encouraged greater manipulation of written material by college students. In addition, he reported on the positive effects of using microcomputers as a writing tool to promote needed revisions. Magarrel (1982) reported that students at Cornell University produced better essays on computers because they were not reluctant to make revisions. Bradley (1982) also reported positive results when students used word processing programs for creative writing. According to Papert (1981), children using his MIT computer lab often went from "total rejection of writing to

an intense involvement accompanied by rapid improvement of quality within a few weeks of beginning to write with a computer" (p. 55). Lawlor (1982) reported positive results when students used a computer-assisted instruction sentence-combining program, but noted limitations of programs of this type, especially in the area of text evaluation and answer judging. Bradley (1982) also found word processing packages to be successful in developing the sentence-combining abilities of six graders.

Other computer programs have been developed to stimulate the generation of ideas which students use in creating compositions. Generally, the student chooses a topic and the computer asks a set of heuristic questions about the topic. These programs provide for the students' answers to be stored and presented to them when they beging writing as an aid to invention (Cronnell, 1981).

Electronic mail, in which students write letters to each other via the computer, seems to be a powerful motivator for student writing. One such system developed by Bolt, Beranek, and Newman was installed in a school for the deaf and quickly became the most popular computer activity in the school. Forty of the children who had previously been reluctant writers wrote more than 1500 letters to each other during the year using this system (Rubenstein & Rollins, 1978).

Text analysis programs assist writers and their teachers by scanning compositions for structural mistakes. Programs such as "Writers Workbench" developed at Bell Laboratories and IBM's "Epistle"

can analyze student writing in terms of spelling, punctuation, grammar, and word use. The errors are pointed out by these programs and the correcting is left to the students. One of the biggest advantages of these programs is the amount of time saved in correcting the compositions.

Since 1980, word processors have increased in their use as an aid to writing instruction. Previous research had shown that revision is an important part of the composing process, but students did not receive much instruction in how to do it and they did not revise very much (Cronnell, 1981). Word processors allow students to add new text, delete parts of it, insert a word or line, or rearrange the text without rewriting the entire composition. Students can also save their text for further revision at a later time and print it when they are satisfied with the final version.

Several other studies concerning word processors have shown positive results. Kleinman and Humphrey (1982) reported that learning disabled children seven to sixteen years of age, many of whom had refused to do any type of writing, began writing enthusiastically when permitted to use word processors. When word processors were introduced in the East York School in Canada, children began to "write more, edit more, and produce better compositions."

> The most immediate result is that students want to write often and produce longer compositions. Teachers of young children have reported that the length of the average essay doubles. The next change occurs when the children become familiar with the editing capabilities of the word processor. First, they start being more careful to correct typing, spelling, and

> punctuation errors. Then they begin to change words and sentences. Finally they learn to reorganize the material, moving, adding, and deleting large sections of the text. They no longer just edit for details, but also pay more attention to the meaning of ideas and the order of presentation. (Kleinman & Humphrey, 1982, cited in Bradley, 1982, p. 733)

Collier's (1983) research with word processors helped to explain why inexperienced writers do not adopt more complex, holistic, and mature tactics in their writing. Collier's study was a pilot project involving a small number of subjects and was concerned primarily with "invisible trends." The investigation was confined to four operations (addition, deletion, substitution, and reordering) and six domains (punctuation, words, phrases/clauses, T-units, idea clusters, and paragraphs). He attempted to test the hypothesis that the use of computer-based text editors would significantly expand the number and complexity of the operations used by inexperienced writers when revising and would increase the range of domains upon which these operations were performed, thus improving the overall effectiveness of the subject's revising strategies.

Collier's study involved four subjects from an introductory composition course. All subjects could touch type, but none had used a word processor before; two possessed average writing skills, one weak skills, and one superior skills. The participants were acquainted with the terminals and the basic functions necessary for designing the text page and revising that page. The participants then revised previous work in the traditional manner (from handwritten copy to handwritten copy) so as to obtain a record of their

normal revising strategies. Then, once each week for a six-week period, the original handwritten essays were revised on the terminals. At the conclusion of the experiment it became clear that Collier's hypothesis, generally speaking, had not been confirmed, although there was sufficient variation in the data to suggest that it should not be entirely rejected. Collier did find the use of the word processor for revision had some advantages over the traditional method of transferring text from one handwritten page to another and it did not have any detrimental effects on revising strategies. Revisions on the word processor were found not to be worse than those done in the traditional format, and they displayed modest improvements for the subjects who were already good writers or who mastered text editing with some ease. According to Collier, revising on the word processor was by and large quicker and more extensive.

The Bank Street School of Education (1981), under a grant from the Richard Lounsbery Foundation, explored the potential of using word processing technology to promote the development of composing skills--with special emphasis on revision. This study was designed to provide insight into two questions:

1. Can students use this word processing technology? Is it sufficiently easy to use so that it will not interfere with composing?

2. Will students become more fluent and more flexible writers by using word processing technology?

One teacher and five eighth graders from the Bank Street School for Children participated in this exploratory study. The

students used the word processing equipment during a five-week minicourse that met for two, 45-minute sessions each week. The students were encouraged to write expressively whatever came to mind, and to continue without concern for structure or transition.

The major conclusions from this study were:

> All students were able to use the technology for composing, and all said they would like to use it regularly for both school assignments and personal writing. Students preferred the computer to pencil and paper.
>
> The 10-session minicourse was too brief to effect any fundamental changes in students' models for composing. However, the results of the minicourse point to six ways in which the technology may be used to support students' development as writers.
>
> Students spend more time composing when they use a word processing system.
>
> Students feel free to explore their ideas in writing because deleting is easy, even from the middle of the text.
>
> When using the computer, students consider the overall structure of their text.
>
> Using word processing technology may facilitate use of the revision strategies students have already learned, eventually resulting in their automatic application.
>
> Students will be motivated to learn new strategies for evaluating and revising their texts because changes are easy to execute with a word processor.
>
> The computer can influence the extent of collaboration while writing. (Kane, 1981, p. 8)

Daiute (1981) investigated the capabilities of word processors in helping students with their revision. Daiute adapted a text-editing program and studied the characteristic error patterns

in the writing of fourth to eighth graders. The students in this pilot study used the computer as a tool to find out "whether a writing instrument that is interactive stimulates revising and relatively simple error identification and 'prompts' can draw children into the text sufficiently so they do more revising than they do with paper and pencil" (p. 15). Daiute found that most of the subjects mastered the program in a few hours and enjoyed using it. According to Daiute, the children found writing on the computer easier than writing by hand, and they wrote more willingly. He reported that they also enjoyed making changes in their texts and learned to make more types of revisions.

A group of writing instructors at Montana State University conducted a study using word-processing technology. In their study, the four students each wrote six papers on the computer. The students were encouraged to implement Elbow's (1973) technique of doing a first draft rapidly, which allowed them to get an initial text quickly into the computer before the major shaping and focusing stages of revising occurred. The students reported an average of three to four trips to the computer center for each essay. Although the available funding did not provide for a controlled study of the kinds of changes revising on the computer made in each student's writing process, each student's individual testimony was made available. Perhaps the most supportive testimony came from one student's "final report" on the computer-revising experiment:

> The computer has helped my writing skills because of the easy access I had during the revision stage. Before I started using the computer, I would write a rough draft and the make some corrections. I could hardly decipher my messy handwritten revision because of arrows running every which way and because of words jammed in here and there. Finally, once I figured out the rough draft, I would not retype it because of the time factor involved. In order to change a sentence or add a paragraph, I would have had to revise and then retype the whole paper. However, now that I use the computer I go back over my paper time after time changing whatever I wish, not having to worry about retyping the whole paper. . . . For example, I revised one of my papers five times, and I was more eager to revise because of the fresh crisp copy I was able to obtain after each revision. I could read the sentences in clear typewritten print and have seven inches of computer paper to make the [changes] right beside the problem area . . . . (Bean, 1983, pp. 147-148)

The results of the experiment at Montana State University suggested that the computer can be a powerful revision aid for students by relieving them of the burden of frequent manuscript recopying. According to Bean (1983), the students in this study enjoyed using the word processor and this seemed to create an incentive to spend more time with revisions.

Wresch (1982) reported on four computer programs recently developed to help students with the composition process. Each of the four programs took a completely unique approach to the problem. Each program was partially successful in giving students instant and individualized instruction in some phase of the writing process. Taken together, the four programs enabled students to prewrite, write, and edit a composition--all by the computer.

The first of the above programs was a prewriting program created by Burns of the U.S. Air Force Academy and was designed to

help students prepare for their writing by asking then a series of questions. Wresch (1982) described these questions as similar to those an instructor would ask, and the intent was to help students think more deeply about their subject. The second writing program, developed at the University of Wisconsin, also contained prewriting questions but attempted to show how information gathered during the questioning can be structured during the actual writing stage by creating a model rough draft of the essay. The third program, a text-editing system, was created at the University of Michigan in 1973 by Bishop. This system relied on a matching routine that took a series of predetermined key words and searched for them in the student's news story. The program acknowledged pertinent information and pointed out errors with an explanation when the pertinent information was missing. The fourth program, created by Lanham at U.C.L.A., also employed a computer editor system in which the computer "read" the entered essays, then printed out statistics on sentence length, use of prepositions, and use of "to be" verbs and nouns ending in "tion." These statistics were then followed by an appropriate warning about convoluted sentences or excessive use of the "tion" nouns or "to be" verbs.

According to Wresch (1982), each of the four programs described above was used by students on a daily basis. Although flawed and limited, they took students through their assigned phases in the writing process, freeing the instructor for more individualized instruction.

O'Brien (1981) found from her experience utilizing word processors in English classes that the students who already wrote well "loved" writing with the computer and quickly learned to use it. She also discovered that the weaker students were insistent about having their turn with the computer. According to O'Brien, the poorer writers showed signs of competence and growth in writing.

Boudrot (1980) found that fourth graders could successfully use a word processing program. In addition, he found that his fourth-grade computer writers tended to write more. According to Boudrot, students who used the text editor revised and experimented since they knew their words were not permanently etched on paper. As a result, Boudrot reported that the students soon recognized their writing flaws and produced better sentences.

Womble (1983) utilized a word processor with her tenth-grade students and found the students' willingness to work on their own time was gratifying. According to Womble, the students tended to "stay" longer with a piece of writing--adding, deleting, and moving text when writing on the word processor. In addition, she found the students often spent more time revising when they wrote with the computers. Womble believed that writing with the processor helped her students become more aware personally of what happens intellectually as people write.

Loheyde (1984) reported that researchers have consistently found that writers who compose on the computer write more. Loheyde reviewed the advantages of word processing for composition. Cited most

often was the advantage of correcting surface errors while maintaining neatness. Insertions, deletions, and spelling corrections were readily accommodated on a computer terminal. According to Loheyde, this neatness benefited the teachers in reading legible work and the students in the positive aspects of seeing their neatly printed products. However, most of the recent research indicated that despite the ease of revision, most writers actually revise very little with or without a computer.

Gould (1980) studied adult writers who drafted letters utilizing word processors. He concluded that the use of a word processor seemed to be a barrier for these writers for three reasons: (1) inability to see the entire document at one time, (2) the lure of gadgetry to get text in print without planning first, and (3) the design of the "editor" itself. Unfortunately, Gould drew no conclusions as to the quality of prose produced by writers using the comters as compared with the control group that wrote their letters in longhand.

Bridwell, Narcarrow, and Ross (in press) found in college-aged writers a compulsive need to correct as they wrote. According to Bridwell et al., this produced a "hunt-and-peck" action to correct, for example, a typographical error, which resulted in breaking the stream of thought and flow of ideas.

Dauite (1983) found that the computer can help beginning writers with the concepts of voice and audience. According to Dauite, the students were using the computer as an audience. He found that

using the computer as the audience showed promise in leading to clarity in explanations and greater use of details.

A one million dollar, three year, U.S. Department of Education effort to develop a successful computer-based writing program culminated in September of 1984. This new program, called Quill, had evaluations that showed it substantially improved student writing ability. According to Zaccehei (1984), Quill had been field tested in schools in seven states for the past two years. The program received a "seal of approval" from a federal review panel, based on evaluation results which showed Quill students performed substantially better than control groups of similar students. Because of Quill's newness, the evaluations of D.C. Heath's version of this program are not available at this time.

The research on the effects of using microcomputers in the composing process is incomplete and inconclusive. However, it is beginning to provide encouraging results. Although limited, the research to date on the effects of CAI on writing achievement has generally produced positive results. The jury is still out, however, and more conclusive studies are needed.

CHAPTER III

PRESENTATION AND ANALYSIS OF THE DATA

The basic purpose of this study was to determine if there was a significant difference between the growth in writing performance of a group of students who received computer-assisted instruction in their written compositions and the growth in writing performance of a group of students who did not receive computer-assisted instruction. Findings that compare differences in growth in general and the mechanical writing performance of the two groups of students as well as the total growth are also reported.

The Diederich Scale, used for rating the essays written by the students, was utilized to report scores related to eight specific areas of the total writing performance. The specific aspects of the general merit portion of the Diederich Scale consisted of ideas, organization, wording, and flavor. The specific aspects of the mechanical portion of the scale included usage, punctuation, spelling, and handwriting. These individual aspects were included to ascertain which specific areas were affected by computer-assisted writing instruction. However, data related to the total writing performance constituted the primary concern of this study.

The general merit portion of the Diederich Scale indicated that the control group scored slightly higher than the experimental group (see Table 1). However, the mean growth score for the control group actually revealed a slight drop (-0.107), while the mean growth

TABLE 1

A Comparison of Mean Scores, Percentage Growth and t Scores on the General Merit Portion of the Diederich Rating Scale for Students in the Experimental and Control Groups

Area		Control Group	Experimental Group	t Score
Ideas	Pre	5.870	5.295	
	Post	5.667	5.527	
	Growth	-0.203	0.232	1.827
	% of Growth	-3.46	4.38	
Organization	Pre	5.681	5.280	
	Post	5.758	5.585	
	Growth	0.077	0.305	0.952
	% of Growth	1.36	5.78	
Wording	Pre	2.853	2.628	
	Post	2.903	2.783	
	Growth	0.050	0.155	1.015
	% of Growth	1.75	5.90	
Flavor	Pre	3.089	2.804	
	Post	3.058	2.990	
	Growth	-0.031	0.186	
	% of Growth	-1.00	6.63	1.609
General merit total	Pre	17.493	16.005	
	Post	17.386	16.884	
	Growth	-0.107	0.878	1.509
	% of Growth	-0.61	5.49	

N = 46
df = 44

score for the experimental group was 0.878. As shown in Table 1, all four of the specific areas that made up the general merit portion of the Diederich Scale revealed higher growth scores for the experimental group. The mean growth scores and percentage of growth scores are listed for the control and experimental groups in the areas of ideas, organization, wording, and flavor. Although the experimental group experienced greater writing growth than the control group, the t score of 1.509 was not significant.

Data from the total mechanics portion of the Diederich Scale revealed that the control group scored slightly higher than the experimental group (see Table 2). The mean growth score for the total mechanics portion of the control group was 0.318 and the percentage of growth was 2.79 percent. The experimental group score indicated a growth of 0.336 and a percentage growth of 3.06 percent. A t score of 0.047 was revealed and the null hypothesis was accepted. The only noteworthy difference between the control and experimental group scores in the mechanics portion was found in the area of usage. The control group experienced a mean growth score of 0.075 and a percentage growth of 2.75 percent. The experimental group experienced a growth score of 0.263 and a percentage growth of 10.30 percent. The percentage growth of 10.30 in usage by the experimental group was noticeably higher than any of the other aspects of the Diederich Scale in the control or experimental groups.

The experimental group experienced a greater growth in total writing when compared with the control group (see Table 3).

TABLE 2

A Comparison of Mean Scores, Percentage Growth and t Scores on the Mechanics Portion of the Diederich Rating Scale for Students in the Experimental and Control Groups

Area		Control Group	Experimental Group	t Score
Usage	Pre	2.727	2.551	
	Post	2.802	2.814	
	Growth	0.075	2.263	1.563
	% of Growth	2.75	10.30	
Punctuation	Pre	2.870	2.778	
	Post	2.981	2.809	
	Growth	0.111	0.031	-0.725
	% of Growth	3.87	1.11	
Spelling	Pre	2.857	2.787	
	Post	2.986	2.816	
	Growth	0.129	0.029	-0.963
	% of Growth	4.51	1.04	
Handwriting	Pre	2.957	2.870	
	Post	2.961	2.884	
	Growth	0.004	0.014	0.090
	% of Growth	0.14	0.49	
Mechanics total	Pre	11.411	10.986	
	Post	11.729	11.324	
	Growth	0.318	0.336	0.047
	% of Growth	2.79	3.06	

N = 46
df = 44

TABLE 3

Summary Comparison of the Mean Scores and Percentage Growth Scores on the General Merit, Mechanics, and Total Writing Portions of the Diederich Rating Scale for Students in the Experimental and Control Groups

Portion		Control Group	Experimental Group	t Score
General Merit	Pre	17.493	16.005	
	Post	17.386	16.884	
	Growth	-0.107	0.878	1.509
	% of Growth	-0.61	5.49	
Mechanics	Pre	11.411	10.986	
	Post	11.729	11.324	
	Growth	0.318	0.336	0.047
	% of Growth	2.79	3.06	
Total Writing	Pre	28.904	26.991	
	Post	29.115	28.208	
	Growth	0.211	1.217	1.044
	% of Growth	0.73	4.50	

t score of 2.017 significant at the .05 level (df = 44)
N = 46

The mean growth score for the total writing performance of the control group was 0.211 and the mean growth score for the experimental group was 1.215. The percentage growth for the control group was 0.73 and for the experimental group was 4.50. The statistical analysis of the mean growth scores produced a t score of 1.044. According to Best,[1] a t score of 2.017 was necessary for significance at the .05 level with 44 degrees of freedom. Therefore, comparison of the growth scores between the control and experimental groups was not significant and the null hypotheses was accepted.

Growth in Writing Performance for Students Using Wordprocessors

The second hypothesis of the study stated there would be no significant growth in writing performance for those students who experienced computer-assisted instruction. The total writing mean score on the pretest was 26.991 and the posttest mean score was 28.208. The mean growth score was 1.217 which produced a t score of 1.044. Although there was growth in the mean scores of students from pretest to posttest on the total writing scale, the results were not significant and the null hypothesis was accepted.

Student performance on the general merit portion of the Diederich Scale produced a mean growth score of 0.878 and a t score of 1.117. Although not statistically significant, the growth score

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[1]John W. Best, Research in Education (4th ed; Englewood Cliffs, New Jersey: Prentice-Hall, 1981).

on the general merit portion was higher on the posttest. Each of the four areas of the general merit portion of the Diederich Scale (ideas, organization, wording, and flavor) showed growth in mean scores from pretest to posttest.

Student performance on the mechanics portion of the Diederich Scale resulted in a mean growth score of 0.336 and a t score of 0.047. Again, all four aspects of the mechanics portion (usage, punctuation, spelling, and handwriting) showed growth with the greatest growth occurring in the area of usage. The mean growth score for the usage area was 0.263 and the t score was 1.563.

A t score of 2.074 was needed for significance at the alpha level of .05 with 22 degrees of freedom. Although the null hypothesis was accepted, the t score of the usage area in the mechanics portion of the Diederich Scale was 1.563. A comparison of the mean pre- and posttest mean scores and t scores for students in the experiemental group on the general merit portion, the mechanics portion and the total writing performance is shown in Table 4.

Growth in Writing Performance for Male and Female Students Using Wordprocessors

The third hypothesis stated there would be no significant difference in the writing growth between male and female students in the experimental group who received computer-assisted instruction. Girls in the experimental group experienced the greatest growth in writing performance. The mean growth score for the girls in the experimental group was 1.67 and for the boys it was 0.72 (see Table 5).

TABLE 4

Comparison of the Mean Pre- and Posttest Growth Scores and *t* Scores on the General Merit, Mechanics, and Total Writing Portions of the Diederich Rating Scale for Students in the Experimental Group

Area	Mean Scores			*t* Score
	Pretest	Posttest	Growth	
Ideas	5.295	5.527	0.232	0.895
Organization	5.280	5.585	0.305	1.067
Wording	2.628	2.783	0.155	1.188
Flavor	2.804	2.990	0.186	1.292
General Merit Mean Total	16.005	16.884	0.878	1.117
Usage	2.551	2.814	0.263	1.563
Punctuation	2.778	2.809	0.031	0.245
Spelling	2.787	2.816	0.029	0.262
Handwriting	2.870	2.884	0.014	0.124
Mechanic Mean Total	10.986	11.324	0.336	0.766
Grand Total Mean	26.991	28.208	1.217	1.041

t score of 2.074 is significant at the .05 level

TABLE 5

Comparison of Mean Pre- and Posttest Growth Scores for Male and Female Students in the Experimental Group

Girls			Boys		
Pretest	Posttest	Growth	Pretest	Posttest	Growth
23.11	29.00	5.89	28.44	33.67	5.23
19.00	24.11	5.11	26.44	29.44	3.00
21.33	24.89	3.56	23.44	25.67	2.23
29.56	33.00	3.44	25.44	27.55	2.11
25.67	28.78	3.11	26.33	27.00	0.67
21.56	23.89	2.33	35.44	35.83	0.39
25.22	27.17	1.95	28.67	28.67	0.00
29.00	30.33	1.33	34.00	32.89	-1.11
25.33	26.33	1.00	23.83	22.67	-1.16
26.78	25.67	-1.11	24.55	23.33	-1.22
30.11	27.67	-2.44	33.56	31.33	-2.23
34.00	29.89	-4.11			
Mean Growth Score =		1.67	Mean Growth Score =		0.72
Standard Deviation =		2.98	Standard Deviation =		2.23

N = 23
t Score = 0.859 (df = 21)

The statistical analysis resulted in a t score of 0.859 for the male-female comparison. Although the girls experienced more growth than the boys, the growth difference was not significant at the 0.05 level and the null hypothesis was accepted.

The student performance on the general merit portion of the Diederich Rating Scale revealed a mean growth score of 1.12 for the girls and a mean growth score of 0.61 for the boys. These differences resulted in a t score of 0.638 which was not significant at the 0.05 level. A comparison of the mean pretest and postest growth scores on the general merit portion of the Diederich Rating Scale is shown in Table 6.

The female students also experienced greater growth in the mechanics portion of the Diederich Rating Scale than their male classmates while writing on word processors. The mean growth score for the female students on the mechanics portion was 0.55 while the male students' mean score was 0.11. The statistical analysis produced a t score of 1.016 which was not significant at the 0.05 level. A comparison of mean pre- and posttest growth scores for male and female students on the mechanics portion is shown in Table 7.

Comparison of Total Language Percentile Scores to Growth Scores in the Experimental Group

The fourth hypothesis investigated in this study involved a comparison between the total language scores on the Comprehensive Tests of Basic Skills and the percentage of growth scores on the Diederich Rating Scale. The statistical analysis employed to test this

TABLE 6

Comparison of Mean Pre- and Posttest Growth Scores for Male and Female Students on the General Merit Portion of the Diederich Rating Scale

Girls			Boys		
Pretest	Posttest	Growth	Pretest	Posttest	Growth
13.56	17.11	3.55	16.78	21.00	4.22
10.89	14.22	3.33	15.33	17.33	2.00
11.56	14.44	2.89	13.56	15.33	1.78
12.00	14.33	2.33	15.33	16.44	1.11
17.33	19.33	2.00	21.33	22.33	1.00
15.00	16.78	1.78	15.22	16.00	0.78
14.33	15.50	1.17	14.78	15.11	0.33
14.33	15.00	0.67	20.44	20.11	-0.33
17.00	17.44	0.44	15.00	14.50	-0.50
15.44	15.56	0.11	17.83	17.22	-0.61
18.33	17.00	-1.33	22.33	19.22	-3.11
20.44	17.00	-3.44			
Mean Growth Score =		1.12	Mean Growth Score =		0.61
Standard Deviation =		2.02	Standard Deviation =		1.85

N = 23
$\underline{t}$ Score = 0.638 (df = 21)

TABLE 7

Comparison of Mean Pre- and Posttest Growth Scores for Male and Female Students on the Mechanics Portion of the Diederich Rating Scale

Girls			Boys		
Pretest	Posttest	Growth	Pretest	Posttest	Growth
9.56	11.89	2.33	11.67	12.67	1.00
8.11	9.89	1.78	10.11	11.11	1.00
12.22	13.67	1.45	11.11	12.11	1.00
10.67	12.00	1.33	11.22	12.11	0.89
12.00	12.89	0.89	10.83	11.44	0.61
10.89	11.67	0.78	8.83	8.17	-0.67
9.78	10.44	0.67	9.89	10.33	0.44
11.00	11.33	0.33	11.11	11.00	-0.11
9.56	9.56	0.00	14.11	13.50	-0.61
13.56	12.89	-0.67	9.78	8.22	-1.56
11.78	10.67	-1.11			
Mean Growth Score =		0.55	Mean Growth Score =		0.11
Standard Deviation =		1.13	Standard Deviation =		0.90

N = 23
$\underline{t}$ Score = 1.016 (df = 21)

hypothesis was the Pearson product-moment coefficient of correlation (r). This statistical method allowed the investigator to make use of the raw data collected in this study.

The r score gives a comparison between the students' percentage growth scores in the experimental group and the total language percentile scores on the Comprehensive Tests of Basic Skills. The r score was -0.363 and was not statistically significant at the 0.05 level. Although the r score was not significant, it did indicate a slight negative correlation. Those students who scored high on the language portion of the Comprehensive Tests of Basic Skills did not experience as much growth in computer-assisted writing skills as those students who scored low on the Comprehensive Tests of Basic Skills. The CTBS scores were taken from the previous school year and were available for only 20 of the 23 students in the experimental group. A comparison of the scores on the language portion of the Comprehensive Tests of Basic Skills and the percentage growth scores on the Diederich Rating Scale for the experimental group is shown in Table 8.

In addition to the four hypotheses tested in this study, a comparison was made between student perceptions toward writing in the experimental and control groups. As can be seen from Table 9, there were no discernible differences in student perceptions toward writing between the experimental and control groups.

TABLE 8

Comparison of the Percentage Growth Scores on the Diederich Rating Scale and the Total Language Percentile Scores on the Comprehensive Tests of Basic Skills for the Experimental Group

Student	Mean Score			Percentage of Growth	CTBS Total Language Percentile Scores
	Pretest	Posttest	Growth		
1	35.44	35.83	0.39	1.10	99
2	24.56	23.33	-1.22	-4.98	98
3	26.44	29.44	3.00	11.34	96
4	34.00	29.89	-4.11	-12.09	95
5	33.56	31.33	-2.22	-6.62	94
6	29.56	33.00	3.44	11.65	92
7	25.33	26.33	1.00	3.95	85
8	28.67	28.56	0.00	0.00	85
9	26.33	27.00	0.67	2.53	82
10	28.44	33.67	5.22	18.36	79
11	23.44	25.67	2.22	9.48	79
12	23.11	29.00	5.89	25.48	79
13	34.00	32.89	-1.11	-3.27	73
14	26.78	25.67	-1.11	-4.15	73
15	25.67	28.78	3.11	12.12	68
16	25.44	27.56	2.11	8.30	64
17	29.00	30.33	1.33	4.60	63
18	21.56	23.89	2.33	10.82	63
19	23.83	22.67	-1.17	-4.89	39
20	19.00	24.11	5.11	26.90	28

$r = -0.363$

TABLE 9

Comparison of Student Perceptions Toward Writing
Between the Experimental and Control Groups

Item	Control Group		Experimental Group	
	True	False	True	False
I am better at writing now.	22	1	20	1
I enjoy writing more now.	14	9	12	9
Writing is easier for me now.	18	5	20	1
Revising my writing is important.	20	3	14	7
I have learned a great deal about writing during this year.	22	1	16	5
Writing frequently has helped me improve my writing.	20	3	20	1
I make more corrections on my writing now.	13	10	12	8
I have enjoyed my writing assignments.	10	13	9	12
I am more willing to make corrections on my writing now.	17	6	17	4
Writing is an important skill.	20	3	20	1
Correcting mistakes is important.	23	0	21	0
I feel that the length of my writing assignments increased during second semester.	16	7	18	3
I enjoy English.	14	9	10	11
When I have a writing assignment I do it with ease.	6	17	11	10
When I have a writing assignment I enjoy it and do it fairly quickly.	5	18	12	9
When I have a writing assignment I can't do it easily so I don't try.	0	23	1	20
When I have a writing assignment I have trouble doing it and ask for help.	3	20	4	17

TABLE 8 (continued)

Item	Control Group		Experimental Group	
	True	False	True	False
Most students I know like English	5	18	1	20
I feel my writing has improved.	21	2	20	1
When I am writing I feel good.	16	7	11	10

CHAPTER IV

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This chapter is organized into six divisions: (1) the restatement of the problem, (2) a summary of the methods and procedures employed in the study, (3) a statement of the major findings, (4) the conclusions, (5) added observations, and (6) recommendations.

Restatement of the Problem

The primary purpose of this study was to determine if there were significant differences between the growth in writing performance of seventh-grade students who received computer-assisted instruction and the growth in writing performance of seventh-grade students who did not receive computer-assisted instruction. More specifically, the researcher sought to determine the difference in the students' growth in the general, mechanical and total writing performance between the two groups.

In addition, this study was designed to:

1. Ascertain the total, general, and mechanical writing performance of those students who experienced writing with word processors.

2. Ascertain the difference in the total, general, and mechanical writing performance between male and female students who experienced writing with word processors.

3. Compare the total language percentile scores on the Comprehensive Tests of Basic Skills with the percentage of growth for

those students who experienced writing with word processors.

4. Compare the perceptions toward writing between the students who experienced writing with word processors and those students who wrote with pen and paper.

Summary of Methods and Procedures

A pretest-posttest control group design that involved two seventh-grade English classes of twenty-three students each was employed in this study. The students were randomly assigned to these classes; they were found to be comparable in ability according to standardized test scores. The same amount of time was spent in the two classes during the second semester on writing instruction. The students in the experimental class wrote their assignments on word processors, while the control group students wrote with pen and paper during the sixteen-week semester. Students in both classes wrote three pretest essays and three posttest essays.

At the end of the experimental period, a team of three trained raters scored the essays, using the Diederich Composition Rating Scale. The rating mean scores for these essays provided the basic data used to test the hypotheses in this study. The hypotheses, stated in null form, were tested for statistical significance at the .05 alpha level. A *t* test was computed for the first three hypotheses and the fourth hypothesis was tested by using the Pearson product-moment coefficient of correlation. The findings of these statistical analyses were presented in Chapter III.

Summary of Major Findings

The major findings of this investigation were as follows:

1. Seventh-grade students successfully utilized and completed their writing assignments with computers used as word processors.

2. The students who wrote with word processors experienced greater total writing growth than the students who wrote with pen and paper; however, this difference was not statistically significant.

3. The students in the experimental group who wrote with word processors experienced consistent growth in their total, general, and mechanical writing performance; however, the results were not statistically significant.

4. Of the students who wrote with word processors, the female students experienced greater growth in writing than the male students. This difference was not statistically significant.

5. There was no significant correlation between the percentage of writing growth scores as measured by the Diederich Rating Scale and the students' total language percentile scores on the Comprehensive Tests of Basic Skills for students who used the word processor.

6. The students who wrote with word processors experienced writing growth in all eight areas of the Diederich Rating Scale, i.e., ideas, organization, wording, flavor, usage, punctuation, spelling, and handwriting.

7. The students in the experimental group experienced the greatest mean growth in the areas of organization, usage, and ideas.

8. The students in the experimental group experienced the least amount of growth in the areas of handwriting, spelling, and punctuation.

9. Contrary to what might have been expected, the students in the experimental group experienced greater growth on the general merit portion of the Diederich Rating Scale than on the mechanics portion of this scale.

10. Contrary to the findings in the literature, there was no discernible difference between the experimental group and the control group in their perceptions toward writing.

Conclusions

From the findings of this study, the investigator concluded:

1. There was no conclusive evidence that seventh-grade students who wrote with word processors experienced significantly greater writing growth than the seventh graders who wrote with pen and paper.

2. There was no conclusive evidence that the seventh-grade students who wrote their essays with word processors experienced significant writing growth.

3. Of the seventh-grade students who wrote with word processors, there was no conclusive evidence that one sex experienced significantly greater writing growth than the other.

4. Of the seventh grade students who wrote with word processors, there was no conclusive evidence that the poorer language

students experienced significantly greater growth in writing than the better language students.

5. There was no conclusive evidence that seventh-grade students who wrote with word processors exhibited more positive perceptions toward writing than did those seventh graders who wrote with pen and paper.

Added Observations

Although the results of this study were not statistically significant, they were generally favorable to the students who experienced writing with word processors. As stated earlier, these seventh-grade students were able to successfully complete their writing assignments on the word processors; overall, the experimental group experienced greater writing growth than those students who wrote with pen and paper. It did appear that having students write with the word processor, with the ease of the word processor to change text, promoted greater attention to the revision process. However, the data collected in this study suggested that most of the revision done by the students involved corrections in word changes. In fact, the students in the experimental group tended to revise the wording of their writing more than they tended to correct spelling and punctuation errors.

To this investigator, one of the most important elements in this study was not the computers but the classroom teacher. The computer was merely a tool and its success depended on the teacher using the tool. The investigation did, however, provide evidence that

computers can be of considerable assistance in the English classroom. The results of this study were supportive of continuing the use of computers in the writing phase of the English curriculum. While further research is needed in this area, it appears that this method of writing instruction can be used successfully with junior high-aged students.

This investigator made several other undocumented observations during the course of this study. Foremost was the ease with which the seventh graders could operate the word processors. Most of the students were able to quickly learn the word processing program (Bank Street Writer) chosen for the study. The students appeared to use the word processors as they would use pen and paper. According to the teacher, they seemed to enjoy their writing experience on the computers, stayed on the task longer, and wrote more than those students who wrote with pen and paper.

As might be expected, this experience was not a universally smooth one. A few students experienced frustration at one time or other. This occurred most often early in the study when they needed help changing the modes while making corrections in their text. However, this problem lasted only a few days before the students appeared to be comfortable revising their texts. Since this study, a new version of the Bank Street Writer program has been developed which further simplified its operations for the students.

It appeared to the investigator that providing writing instruction with the aid of computers was not necessarily easier for the

classroom teacher. There were times during the semester when the teacher also experienced frustration with the procedure because this approach placed a greater demand on the instructor. Most of the demands were in the form of questions which the students had regarding both their assigned tasks and those related to the operation of the computers. However, most of these demands were resolved early in the semester and in the end, the students and teacher generally felt positive about the experience.

Recommendations

Based on the findings and conclusions of this study, the following recommendations are made.

1. Teachers should continue to provide opportunities for students to write using word processors.

2. The number of students in classes writing on word processors should be kept small in order to enable the classroom teacher to provide needed individual help.

3. It would have been preferable, although not necessary, to have the students skilled in keyboarding in advance of beginning their writing assignments.

4. There should have been enough computers available to readily provide all the students adequate "hands-on" time.

5. Further research is needed in the area of student writing using word processors. More extensive longitudinal studies would be desirable.

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APPENDIX A

Writing Dates and Writing Topics for the Study

Pretest Dates

Wednesday, January 25, 1984
Friday, January 27, 1984
Tuesday, January 31, 1984

Posttest Dates

Wednesday, May 23, 1984
Friday, May 25, 1984
Tuesday, May 29, 1984

Topics for Pretests

"What I Want in a Friend"
"The Best Way to Forget My Problems Is _____"
"Discuss a Certain Rock Star, Athletic Star, Movie or T.V. Star"

Topics for Posttests

"I Find It Hard to Get Readjusted to School in September"
"Discuss a Current Fad or Craze"
"What My Family Does on Weekends"

APPENDIX B

Diederich Composition Rating Scale

APPENDIX C

List of the Professional Jury and the Trained Raters Used in the Study

Professional Jury Used in Selection of Writing Topics

Ed Howe

Van Lorenzen

Ed Mansur

Sarol Wiltse

Trainer Raters

Kathy Blecha

Florence Dean

Betty Morey

APPENDIX D

Student Perception Survey

Student Perception Survey

Date _____ Class Period _____ Sex _____

Please answer the following questions on how you feel now as compared to you you felt at the beginning of the semester.

Answer the following statements true or false.

1. ____ I am better at writing now.
2. ____ I enjoy writing more now.
3. ____ Writing is easier for me now.
4. ____ Revising my writing is important.
5. ____ I learned a great deal about writing during this year.
6. ____ Writing frequently has helped me improve my writing.
7. ____ I make more corrections on my writing now.
8. ____ I have enjoyed my writing assignments.
9. ____ I am more willing to make corrections on my writing now.
10. ____ Writing is an imoprtant skill.
11. ____ Correcting mistakes is important.
12. ____ I feel that the length of my writing assignments increased during second semester.
13. ____ I enjoy English.
14. ____ I enjoy mathmeatics.
15. ____ I enjoy science.
16. ____ I enjoy social studies.
17. ____ When I have a writing assignment I do it with ease.
18. ____ When I have a writing assignment I enjoy it and do it fairly quickly.

19. ____ When I have a writing assignment I can't do it easily so I don't try.

20. ____ When I have a writing assignment I have trouble doing it and ask for help.

21. ____ Most students I know like English.

22. ____ I feel my writing has improved.

23. ____ When I am writing I feel good.

APPENDIX E

National Percentile Scores on the Comprehensive Tests of Basic Skills for the Control and Experimental Groups

National Percentile Scores

Student I.D. Number	Comprehensive Tests of Basic Skills Total Language	Total Battery
Control Group		
007383	99	99
006635	99	99
007427	99	99
007275	98	96
006770	95	96
007013	91	96
007387	88	95
006454	85	87
007614	85	87
006873	83	75
006760	79	93
006652	77	87
007979	76	96
007034	72	72
007419	72	73
007560	70	71
007529	68	73
007403	64	53
007562	53	45
022573	45	27
Average	1598	1619
	79.90	80.95
Experimental Group		
002926	99	97
008000	98	92
008294	96	99
007420	95	84
007599	94	90
006443	92	98
006735	88	86
007535	85	90
007973	85	95
007417	82	88
007366	79	86
000161	79	82
007390	79	86

Student I.D. Number		Comprehensive Tests of Basic Skills	
		Total Language	Total Battery
007569		73	81
008280		73	66
006824		68	69
006360		64	73
007989		63	77
008049		63	49
007991		39	44
006915		28	28
	Average	1622	1660
		77.24	79.05