The effects of the computer in the writing process

Wade S. Anderson

University of Northern Iowa

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Abstract
Since the early 1970's, composition theory has shifted from writing as a product to writing as a process (Costanzo, 1990). Instead of focusing on problems and triumphs of the completed paper, teachers work with students on the act of composing essays from beginning to end. Strategies for prewriting, writing, revising, editing, proofreading, and publishing are emphasized. Teachers also stress that these activities occur recursively and not sequentially (Costanzo, 1990).
THE EFFECTS OF THE COMPUTER IN THE WRITING PROCESS

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Wade S. Andersen
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Wade S. Andersen

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August 21, 1995
Date Approved

Sharon E. Smaldino
Graduate Faculty Reader

August 21, 1995
Date Approved

Leigh E. Zeitz
Graduate Faculty Reader

August 21, 1995
Date Approved

Peggy Ishler
Head, Department of Curriculum and Instruction
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CHAPTER I

INTRODUCTION

"There is a sort of secret and tacit compact among the learned, not to pass beyond a certain limit in speculative science. The privilege of free . . . thought has at no time been held in actual practice, except within this limit; and not a single stride beyond it has ever been ventured without bringing obloquy to the transgressor," Coleridge, Biographic Literaria, 95-96.

Richard Young used this quotation from Coleridge to explain how paradigms can result in a narrowing of vision (Selfe & Wahlstrom, 1988). Young insisted that paradigms are a way of seeing and of not seeing, that such structures can limit the nature and direction of research and theory in a field. Young used the limitations of paradigms to call attention to the creative investigations being done by process-based researchers in the late 1970’s. Young asked professionals in the field of English composition to view this discipline from a process-based vantage point.

Since the early 1970’s, composition theory has shifted from writing as a product to writing as a process (Costanzo, 1990). Instead of focusing on problems and triumphs of the completed paper, teachers work with students on the act of composing essays from beginning to end. Strategies for prewriting, writing,
revising, editing, proofreading, and publishing are emphasized. Teachers also stress that these activities occur recursively and not sequentially (Costanzo, 1990).

At the same time the concept of writing as a process was being introduced, the term word processing was also being introduced (Costanzo, 1990). For some, the term conjured up images of language being diced, blended, whipped, and pounded into shape like food or crude petroleum. For some, the mechanical metaphor was troublesome. For many, the idea of processing language more efficiently was quite attractive. Gula (1983) insisted it was foolish to waste time copying and revising by hand if an easier and more efficient method was available. Gula argued that the word processor was this method.

Two conditions began to change the way teachers were teaching writing (Withey, 1983). The first was a writing model based on process rather than on product. The second condition was the advent of the microcomputer. "Real writing, then - the kind that real writers do - must take into account not only the process, but also the computer as an aid in the process" (Withey, 1983, p.25).

As the computer became involved in the writing process, researchers and theorists claimed various
approaches to using the computer in writing instruction. Withey (1983) identified three uses of the computer in writing instruction. First, the computer could be seen as a tutor in discrete skills and the student as a responder to questions having with very little feedback. Second, the computer could be used with interactive programs requiring dialogue and active participation from the student. Finally, the computer could be used with interactive programs in which the computer performs tasks programmed by the student. Knapp (1986) suggested that the computer be seen as a writing tool. Proponents of writing as a process began to see the computer as a blank page on which the student could write, revise, and edit with no advice given by the computer program unless requested (Withey, 1983).

The process approach to writing is far from mechanical, yet its proponents were among the most enthusiastic users of word processing (Costanzo, 1990). They recognized that word processing involves students in significantly new ways. Early on, the enthusiasts of word processing insisted that the word processor could be used in the entire process of typing, editing, storing, printing, and communicating the written word (Watt, 1983). They believed that the word processor would enhance the creativity and productivity of
writers. Supporters of word processing in the classroom argued that students would find writing faster, easier, and less time consuming (Gula, 1983).

At the same time, critics warned against the use of the computer in writing instruction. Oliver (1984) warned that the computer, when it assumed the role of evaluator and tutor, suffered from so many deficiencies that it was more apt to be a monster than a mentor. He argued that the computer could not consider coherence, logic, complexity of ideas, ambiguity, or word choice in addressing readability or style. The computer, he insisted, is restricted in its ability to apply most of the fundamental rules of grammar and usage. He asserted that most sixth graders could do a better job at locating and correcting the errors in grammar and punctuation in the following sentences:

- Flying, the plane was an easy target.
- Flying, the plane was an exciting experience.

Oliver also concluded that the computer might make unnecessary and damaging revisions (or at least suggestions). He pointed this out by using the following example:

- "Four score and seven years ago . . ." would be changed to "87 years ago, our grandparents created a free nation here."

As adults continue to debate the issue of computers
in the writing process and how they should be used, an overwhelming majority of students report that they like using computers (Lapointe and Martinez, 1988). This attraction to computers could be for several reasons including the level of challenge, involvement of fantasy, the game format the computer lends, and perhaps even a sense of control over the computer (White, 1983). Particularly when using the computer in writing, students' attitudes toward writing improve and with it, the quality of writing (Gula, 1983). Clements (1985) suggested that students gain a sense of power when working with a computer that lends itself to self-confidence and self-esteem.

It is evident that children like using computers and, despite the debate of the place of computers in the writing process, computers will be part of the classroom (Mecklenburger, 1988). Teachers will need to know how to manage information and how to develop that ability in the children they teach. They will also need to be comfortable in the use of electronic technology - to control it and not be controlled by it (Waack, 1990). Unfortunately, there is little research regarding how the computer as a writing tool will affect students' writing (Watt, 1983; Knapp, 1986).
Purpose of the Paper

It is evident that children enjoy using computers. It is also evident that some teachers use computers at one or several points in the writing process (Costanzo, 1990; Withey, 1983; and Knapp, 1986). As Hofmeister, computer coordinator for the Cincinnati Country Day School, has warned, "It is very tempting to use computers, but if you aren't doing something you couldn't do without the computer, then think again" (Burroughs, 1989, pp. 39-43). The purpose of this paper is to analyze and synthesize the literature related to the role of the computer in the writing process. Specifically, it will address four questions: Do students write better when using the computer as a word processor? Do students write more when using the computer as a word processor? Are students' efforts when using a computer as a word processor better than those who use paper and pencil? Is there a difference between the same students' writing when using the computer compared with when they use pencil and paper?

Significance of the Review

There is surprisingly little definitive research available that could explain how the computer affects students' writing. Rather than learning how to prepare
students to enter the Industrial Age, today's teacher must learn how to prepare children to leave it (Waack, 1990). In order for teachers to meet the challenges of computer technology, they need to know how and if its presence could affect how they teach the writing process.
CHAPTER II
REVIEW OF THE LITERATURE

As mentioned in Chapter I, this review will address views of the question of the role of the computer and writing instruction.

Gula (1983), making informal observations, found that when his own students used the computer as a word processor, their writing was faster, easier, and less time consuming. He found that students' attitudes towards writing improved and with it, the quality of writing. Gula noted that when students used the computer, teachers could be more demanding. He also noted that time and quality were not a function of each other, but that thought and quality were. Gula noted that using the computer as a word processor was not a substitute for hard, rigorous thinking, but would be a way to facilitate the expressing of those thoughts.

Watt (1983) also found that students' work began to improve while using the computer as a word processor. He found that students' stories grew in length, sophistication, and impact. Watt also noticed that students' confidence increased. He did warn, however, that these successes as writers could not be ascribed solely to the computer, but that the computer played a role as a tool to make writing easier. He also
warned that research had barely begun to judge the effects of using the computer in the writing process.

In a study involving one hundred thirty students in grades one, three, and six, Larter (1987) examined and compared writing with and without the computer in the elementary school. The researcher wanted to see how products of writing instruction with the computer differed from traditionally taught writing. She randomly assigned half of the students to the experimental group (computers) and half of the students to the control group (paper and pencil). Her findings showed that elementary school children (especially first graders) increased and improved their organization, spelling, punctuation, and capitalization by using the computer.

Steelman (1991) conducted a study in which two experimental groups and one control group were used. The study was controlled for the teacher, time on task, student gender and race. The study was designed to evaluate and implement an instructional program combining the writing process and the computer to improve writing quality, writing quantity, and the apprehension of middle level students toward writing. The computer was used to facilitate revision strategies.

The study lasted twenty-eight weeks (from September to
April) within two of the sixth grade classrooms in a relatively small rural school system.

The two experimental groups were involved in a newspaper writing program two days a week for two hours a day for a total of four hours. The first experimental group received instruction on how to use the computer. The same group received instruction in keyboarding and on how to use Bank Street Writer II. The second experimental group wrote their newspaper without the computer. Instead, the second experimental group used only paper and pencil techniques and were taught revision strategies using the cut and paste method on paper.

The control group received traditional writing instruction from the same regular classroom teacher for two days a week for two hours a day for a total of four hours. Students were exposed to some process strategies, but these were not done systematically. The control group did not use the computer for writing and did not contribute to the development of a school newspaper.

Steelman adapted a holistic scoring guide from previous guides used by researchers at North Carolina State University. Two pretest and two post test writing samples were taken on different days from all students.
in each group. Three experienced teachers rated each writing sample to determine its rank. The two scores in agreement were considered to be the student’s score. A significant difference was found between the three groups. The least significant difference group comparison confirmed that the group using computers to write the newspaper and the group writing the newspaper using paper and pencil performed significantly better than the control group. Inter-rater reliabilities ranged from .88 to .94.

Daly’s Writing Apprehension Test was administered to students both pretest and post test. Results from both tests were compared to determine whether the activities provided had an effect on student attitude toward writing. Daly’s Writing Apprehension Test consists of twenty-six questions answered using a five point scale ranging from “strongly agree” to “strongly disagree”. The writing apprehension score may range from 26 to 130 with a higher score indicating lower anxiety. In analyzing the scores, no significant differences were revealed between the three groups. The mean writing apprehension scores of the sixth grade students in the study ranged from 93.231 to 98.708.

The number of words for each writing sample determined an average number of words for pretest and
post test. The means were compared for each group to see if there were significant differences in the amount of writing produced by the students in each group. Analysis of the writing quantity scores showed a significant difference between the experimental groups and the control group. Further analysis revealed that the group using the computer to write the newspaper differed significantly from the control group. Students who used the computer throughout the year to compose text became more willing to produce larger amounts of text. The experimental group using computers also had higher mean scores than the other two groups and differed significantly from the control group with respect to writing quality. Steelman concluded that the computer may have a freeing affect, allowing students to gain fluency, but warned that in order to gain the fluency, students should receive instruction in use of the word processing program as well as keyboarding skills. Students cannot produce a product if they are in a stressful environment of trying to learn new technology.

Sommers (1985) reviewed eight studies and found that there was disagreement between researchers on the effectiveness of computers in a writing program. Most of the studies found that, by using the computer, the
process of writing and revising was easier (Bridwell, Nancarrow, and Ross, 1984). Other researchers found that young writers were more willing to experiment when using word processing and made more comprehensive revisions (Daiute, 1983). Other researchers also emphasized the value of microcomputers as tools (Schwartz, M., 1982; Schwartz, H., 1984). Shostak (1984) and Schwartz (1983) found that writers were more willing to revise when they used computers.

Collier (1983) and Woodruff (1982), however, found that writing quality declined when students used the computer. Collier hypothesized that writers at varying developmental levels would revise more skillfully on a word processor. Their writing, however, did not improve.

Sommers (1985) agreed that if computers are to become permanent writing tools in classrooms, as they are quickly becoming in our society, they need to be integrated into the classroom based upon research. She concluded that writers are likely to benefit from using computers if four points are taken into consideration:

1. The writing teacher is indispensable as a collaborator and audience, as a facilitator, and an assignment maker. Computers alone cannot teach writers why revision is important or how to bring a first draft to full meaning.
2. Writers learn best when writing is taught as a process in a decentralized classroom. The "conference" method of instruction is most reliable. CAI can help, but cannot take over the central role played by the writer and the people responding to the writing.

3. The computer is most valuable as a writing tool enhancing our writers' abilities to explore, articulate, and reshape. Whatever part of the writing process is emphasized, teachers should be aware that writers learn to write holistically and computers should enhance this.

4. Computers are counter-productive when used in a theoretical vacuum. Great care needs to be taken when computers are integrated into the classroom. Software that concentrates exclusively on subskills or isolating them prematurely should be avoided. Software which neglects or fragments the holistic process is unacceptable.

Hult (1985) analyzed papers of experimental (computer) and control (pencil and paper) groups for nine types of errors: sentence fragments, run-on sentences/comma splices, faulty subject-verb agreement, faulty modification, faulty use of possessive, faulty use of parallelism, spelling errors, punctuation errors, and wrong words. She found that both groups were nearly alike in all correctness features except spelling (42 errors in the control group and 7 errors in the experimental group). This difference was to be expected since the experimental group had access to a spelling
checker. The two groups, however, were similar in total occurrence of editing errors other than spelling. Eighty-seven errors were found in the control group and eighty-three errors were found in the experimental group. This was an average of 2.8 and 2.7 errors per sentence respectively. Hult concluded that the use of word processing in and of itself does not produce writing which is correct. She warned that educators should not be seduced by a bite of the "Apple" and insisted that it was not fair to assume that student writers would improve their writing simply by using computers for word processing. Hult also emphasized that grammatical and usage errors did not magically disappear and that errors made using the computer were the same errors made while using pencil and paper. She did concede that as computer programs might be written that provide good, interactive writing instruction, positive results might be seen.

Dean (1986) used six experimental (use of computers in writing) sections of a college freshman English composition class and six control (paper and pencil) sections of a freshman college English composition class. Approximately twenty-five students were assigned to each section. Sections were established using a matched-subjects technique. This was done to ensure
that all sections were balanced with regard to general writing skills at the beginning of the experiment.

All sections used the same course syllabi and all papers were required to be typed. Although the control group participants were not prohibited from using word processing equipment, few students elected to do so. Each of the six instructors involved taught one experimental and one control section of English composition. Pretests and post tests for general and specific writing skills were administered to all sections.

At the beginning of the semester, the experimental group received training in the use of the microcomputer lab facilities. The control sections spent additional time in discussions of course goals and objectives, grading policies, and correction symbols.

In order to assure minimum interruption in the use of the computer lab, a lab assistant was always on duty to assist with technical problems. In addition, the experimental group students were given first priority in the use of the computer lab over other students.

General composition skills were determined by using pre- and post administration of a holistically evaluated criterion-referenced essay writing assessment test.

The specific composition skills were measured by a
standard college English placement exam published by Houghton-Mifflin. The exam consisted of 106 questions paralleling the usual steps in writing a composition. At the time (1986), it was widely used to reliably and quickly measure a student’s ability to use the English language efficiently.

An examination of pretest and post test results of the Writing Skills Assessment and the college English placement exam showed that the control and experimental groups experienced a significant gain over the duration of one semester. However, when both groups were compared to each other, no significant differences were found.

Green (1989) compared the rough and final drafts of students who used the computer as a word processor with those who did not use the computer. He looked for the number of substantial revisions and the quality of essays and analyzed them using Pearson’s product moment coefficient of correlation and found .07, .08, and .09 correlations. No pattern of improvement based on the amount or substance of revision was found for the experimental group. Green did find a positive attitude in the control group, but did not find a great deal of improvement in writing.

Laidley (1991) randomly assigned sixth grade
students to either a paper and pencil (control) group or a word processing (experimental) group. Students were surveyed to assess their computer experience and specifically their word processing experience. This was done to determine technical training necessary before beginning the study. All students had used a computer and 81% of the students had used word processing software.

The instrument used was an original story, The Secret Whale by Ed Gueble, which contained three different types of built in errors and which required the subject to write an ending. The built in errors were mechanical, grammatical, and conceptual. There were five occurrences of each type of error for a total error count of fifteen built in errors.

The instrument was administered in three sessions. The first session was used for introducing the research project, collecting parent/student permission forms, distributing the student computer survey, and introducing the writing task to the students. The writing task was introduced with an explanation of the three types of the fifteen errors embedded in the story. Students were also given encouragement in creating an innovative ending to the story. The researcher read the story to the whole class while students illustrated the
story as they listened. This was to give students a prewriting experience to make the story more familiar when they encountered it for the first time on the computer screen or in print.

In the next two sessions, each group was given the opportunity to make corrections in the existing part of the story and create their own endings. The word processing group was given the instrument on disk and allowed to work in the school's computer room. The paper and pencil group used a printed copy of the story. Both groups were given thirty minutes for each session to complete the writing task.

Student work from the paper and pencil group was entered into a computer and printed out so that all papers would have a standard appearance and presentation. All papers were then given to two teachers for grading. The teachers graded these papers as they would any creative writing assignment by focusing on content with little emphasis on mechanical or grammatical corrections. Both teachers basically read the student supplied endings, ignoring the built-in error corrections of The Secret Whale. Both teachers commented that the papers conformed to the range of work normally received from their students.

The researcher then scored the students' stories
for five error measures and the subject supplied endings for length. The five error measures scored were:

1. Mechanical errors-those dealing with spelling, capitalization, and simple punctuation. The mechanical error score was the number of mechanical errors corrected.

2. Grammatical errors-those dealing with subject-verb agreement, modifier-noun agreement, syntax, etc. The grammatical error score was the number of grammatical errors corrected.

3. Conceptual errors-those resulting in conflict between the main idea and supporting details, narrative consistency, and logical sequences. The conceptual error score was the number of conceptual errors corrected.

4. Incorrect corrections-The number of built-in errors incorrectly corrected.

5. Total Number of Edits-the number of editing changes.

The scale range for each measure was zero through six for Mechanical, Grammatical, and Conceptual error scores and zero through the highest frequency count for Incorrect Corrections and Total Number of Edits. Length was a measure of the number of idea units in the new ending related to Logan's communicative units.

A second scorer was trained on the measures and scored approximately one-third of the papers, randomly selected, to establish agreement on scoring. If a discrepancy occurred, the difference was discussed and
resolved. The two scorers agreed approximately 90% of the time.

After analysis of the results, no significant differences were found in the mechanical, grammatical, and conceptual error scores of the paper and pencil group and the word processing group. The paper and pencil group made more incorrect corrections than the word processing group, however. The paper and pencil group also made more edits than the word processing group. Laidley found that the word processing group provided longer endings than the paper and pencil group. There was no significant difference between the two groups in grades received from the teachers who graded the papers. The word processing group received approximately a "B" average while the paper and pencil group received approximately a "B-" average.

Phenix and Hannan (1984) observed twenty-eight first graders. Each first grader was given a writing folder and expected to write each day. Their writing was to be placed in the writing folder. Different kinds of paper and writing materials were provided for each student. In addition, each student was involved with both individual and group conferences with the teacher to discuss the completed writing and how to improve it. Invented spellings were encouraged. In addition,
classmates and teacher aides would transcribe a child's words onto paper.

In mid-November, a word processing program, developed for use with first grade children, was introduced to the classroom for six weeks. By this time, there was a wide range of writing ability exhibited by the different students in the class. Some students were revising their writing and publishing it in a class book. Others had barely begun to understand the writing process. All of the children were given the opportunity to write using the computer as a word processor. The researchers observed several different effects.

Children would revise or continue to work on a piece that had been begun the previous day rather than start a new piece, as had been their habit. The enjoyment of using the computer resulted in more time being spent on the computer. It was observed that as the students' pieces became longer, there were more conferences with the teacher. More detail could be seen in the children's writing as well as more revisions. Children were also more critical of their work. As children printed each draft and could see the changes in their writing, they began to understand the writing process and what was involved. Finally, the children's
confidence in their writing abilities grew.

Kurth (1987) studied twenty-eight sophomores and juniors in high school enrolled in a special class for interested students at a university writing center. The class was an elective course and part of the extracurricular program at their school. It is probable that the subjects were more interested in writing and better at writing than their peers. Permission to leave the high school building to come to the university campus may have also been a motivating factor.

Kurth assigned each student to one of two groups. Fourteen students were randomly assigned to an experimental group and given composition instruction and the opportunity to use the computer as a word processor. Fourteen students were randomly assigned to a control group and given instruction without the use of a computer as a word processor. The experimental group met on Mondays and Wednesdays for sixty minutes in a computer lab. The control group met Tuesdays and Thursdays for sixty minutes in a regular classroom. The course lasted for twelve weeks and students were given twenty-four hours of instruction. Neither group was told the activities of the other group. Each class had the same instructor who was a secondary English teacher from another high school in the area.
The major focus for the course was on expository writing. Prewriting skills, draft writing, revising, and editing were taught in both classes and students were encouraged to use them. Revision emphasized global revision rather than sentence or word level revision. No high school course credit or grades were given for the course. Students were assigned seven composition assignments which were evaluated and critiqued. Students also formed revising and editing groups in which they could consult with one another. The same instructional objectives and instructional methods were used for each class. The experimental group, however, had access to Apple IIe or IBM computers with Word Perfect software. A spell checker was also available. Word Perfect was used because of its availability and its ease of use.

The experimental group received a short introduction to the use of the software in the course introduction. Only word processing features were emphasized since the researcher wished to concentrate only on writing skill, not on word processing skill. Students were encouraged to do their writing during the sixty minute class time. Students in the experimental group were guided through a keyboarding practice program to develop some facility with keyboarding.
All drafts and the final paper from four of the seven assignments were analyzed for both groups. The mean number of words for the experimental group was 189.2 with a standard deviation of 75.2. The control group had a mean number of words of 182.2 with a standard deviation of 73.8. The researcher believed that this showed that the purpose and type of composition assignment had more influence on length than did the computer as a word processor. There was much variation within each group, but there was no significant difference found between groups. Students in the experimental group did not write longer compositions.

The number of revisions between the first rough draft and the final submission was also counted. Every change that was made was counted. Then the revisions at the phrase or sentence level were identified and counted. Finally, the global revisions (those affecting two or more sentences) were identified and counted. Substantial revisions were made in both groups. No significant differences were noticed between the two groups when papers were analyzed for the numbers and types of revisions. When analyzing quality, it was found that changes made increased the quality of the composition. Instruction in global revision, it is
believed, did more to stimulate the quality of compositions than did the computer as a word processor. The control group made just as many revisions as the experimental group.

The researcher did find significantly fewer misspelled words in the experimental group. This was undoubtedly due to the availability of a spell checker. Kurth concluded that there was little support for believing that the computer, when used as a word processor, would automatically increase the quantity and quality of student compositions.

**Summary**

As may be synthesized from the preceding review, there is disagreement as to how the computer affects the quality and quantity of writing. There is also disagreement as to whether students' efforts at the computer are better than those who use paper and pencil.

Gula (1983), Watt (1983), Larter (1987), Steelman (1991), and Phenix and Hannan (1984) concluded that students using the computer as a word processor made significantly more gains in quality and quantity of writing when compared with students who used traditional methods. Sommers (1985) agreed with these researchers, but addressed areas of concern for educators wishing to
introduce computers into the writing program.

Hult (1985), Dean (1986), Kurth (1987), Green (1989) and Laidley (1991) concluded that students using the computer as a word processor did not experience significantly different gains than those students using traditional methods. They concluded that there was not enough evidence to believe that the computer might improve the quality and quantity of writing.

Problems and Concerns
The purpose of this literature review was to analyze and synthesize the literature related to the role of the computer in a writing program. Specifically, two views of the computer's role were addressed. As was evidenced by the preceding discussion, the results of the research on the effectiveness of the computer in a writing program are contradictory. Although the research is not conclusive, computers will still be a part of the school for the foreseeable future.

There are, however, areas of concern that remain for educators. The first area of concern is that of actually integrating the computer into a writing program. There are many issues in this area which need to be dealt with by educators. One of these issues is one of choice. As discussed earlier, Hult (1985) cautioned that not all students would benefit by using
the computer in the writing process. Some students prefer to use traditional methods rather than use the computer. Nicholson (1989) also found that choice may be a more powerful variable than challenge or control in understanding key attitudes and behaviors in using the computer to teach writing skills. The choice to use computers in the writing process is related to the students' attitude and behavior concerning technology.

A second issue concerning integration of computers into the writing program is that of how the teacher structures the writing instruction (Greenleaf, 1991). Greenleaf found that the way the teacher structured the instruction of writing had a profound impact on both student writing and the way the computer entered into the writing. In her study, Greenleaf showed that the computer enhanced a teacher's process-based, collaborative learning approach to teaching writing. Computers were used only for those writing practices which formed the core of the curriculum. Formal peer review sessions were changed into informal instruction at the computer. The teacher began collaborating with the students more and what used to be separate components of the writing process became blended together. Other changes which occurred were an increase in the frequency of reading and writing in the
classroom, increased student expectations, and a diversification of the curriculum through many activities happening concurrently in the classroom.

As the teacher's classroom became more flexible, Greenleaf observed that different student strategies for learning and interacting with others worked more successfully. Students were eager to collaborate at the computer. They voluntarily came in outside of class time to write. Papers increased in length when students wrote using the computer, although they did not revise and edit their writing with the computer. Only when the teacher changed the organization of the writing activities did students begin revising and editing their work. She emphasized the importance of studying the context into which computers are placed. She stressed that computers do not function as independent variables in the classroom, but rather as part of a complex network of pedagogical and social interactions.

If teachers are to structure writing instruction correctly when computers are used, a third issue in integration of computers into the writing program must be addressed. That issue is one of staff development. Selfe and Wahlstrom (1988) and Gunn (1990) were supportive of the use of computers in the writing program. They also warned that staff development in the
use of computers and how best to use them was crucial if such a program were to succeed.

A fourth issue regarding integration of computers into a writing program is that of keyboard knowledge. Gula (1983) and Steelman (1991) stressed the importance of keyboarding instruction before a program integrating computers was begun. They found that students were more successful writers if they had been properly instructed in the use of the computer keyboard.

A fifth issue in the area of the writing program and integrating computers into it is one of time. Wheeler (1985) stressed that students need adequate access to computers. They need time and guidance to become as efficient at using the computer as a word processor as they are at using a pencil and paper. Tone and Winchester (1988) echoed this conclusion and stressed that until students have enough access to computers to practice and become comfortable with word processing while they are learning to process written language, it was too early to judge the effectiveness of computers in improving student writing. Tone and Winchester insisted that even with the influx of computers into schools, students are not assured of sufficient time to learn to work with them. Usually
students have limited time - thirty minutes a week - to use the computer.

A sixth in the area of integrating computers into the writing program is one of need. As Joe Hofmeister, computer coordinator for the Cincinnati Country Day School warned; "It is very tempting to use computers, but if you aren't doing something you couldn't do without the computer, then think again." (Burroughs, 1989, pp. 39-43). Newman (1984) cautioned against using technology for what we have been doing, only more efficiently. Newman warned against substituting electronic worksheets for paper ones. She also warned against using computers for simple drill and practice, tutorials and on-line testing.

Another concern which remains for educators wishing to use computers in a writing program is the educational limit of technology (Frase, 1987). Frase pointed out the lack of standardization in the computer technology field. Gains by one computer manufacturer are rarely, if ever, shared with another. He also suggested that computer manufacturers should design the hardware of today to fit the hardware of tomorrow. He insisted that at that time (1987), less than 30% of commercial educational software in the United States met minimal standards of acceptability. The concerns of educators
center around not only that statistic, but also reliability, accessibility, economy, and computability of systems. Frase argued that if computer manufacturers worked together, many of the concerns of educators could be eased.

A final concern for educators wishing to use computers in a writing program is that little research has been conducted to prove the effectiveness of the computer in such a program. Frase (1987) warned that little research had been done on the application of computers to writing. As Frase argued, much of the research that had been done confounded the causes. The research that has been done and the research reviewed in this paper has not been longitudinal. As Steelman (1991) suggested, students involved in a writing program in which the computer is utilized should be involved in such a program for at least one year. Much of the research that has been conducted has been done so for periods of a few weeks up to one year. In order to determine the effectiveness of the computer in a writing program, research should be conducted over a period of several years (Selfe and Wahlstrom, 1988). The findings of research are also based on different machines, software configurations, assignments, vocabulary, rhetorical assumptions, and theories (Selfe and
Wahlstrom, 1988). Thus, we are given a dim vision of a larger whole. As Sommers (1985) insisted, integration of computers into classroom writing programs needs to be done based on research. Since much of the research done thus far either is contradictory or inconclusive, educators should use care and a great deal of thought when integrating computers into the writing program.

Future Research and Trends

Preliminary research suggests that computers have had a profound impact on writing, language, and thinking (Selfe and Wahlstrom, 1988). They have altered the very nature, content, and form of human communication. Education is guilty of having a limited view of computers and its effects on writing. This is due to past experiences with writing. More research needs to be conducted to discover how or if computerized word processors affect invention, recursiveness, planning, goal setting, arrangement, task constraints, reading and rescanning, drafting and revising or editing, and proofreading. Selfe and Wahlstrom insisted that writers must be observed in naturalistic and lab settings. Experienced and neophyte computer users should be compared. Questions need to be asked such as: Are computers used differently for writing tasks with
different aims, audiences, or organizational structures? Do word processing applications affect writing processes? Do different types of software have an impact on how people use computers to compose? Do computers affect writing when they are only used at specific points during the composing process (first draft, final draft, etc.)? Such research could give a clearer sense of how computers are best integrated into the writing program and how they affect a student's composing process.

Neuwirth (1989) and Chapelle (1989) insist that in the future, Intelligent Tutoring Systems (a type of Artificial Intelligence), will be used to help students in the writing process. Both insist that the ideal ITS for language instruction would combine a micro world or grammar checker with an expert system which encoded decision-making procedures and the instructional strategies of an experienced teacher. Neuwirth and Chapelle warn that the use of Artificial Intelligence alone does not guarantee that programs will be beneficial for teaching. Educators and researchers, however, must pinpoint areas in which AI techniques can tackle more important aspects of teaching with greater success than what can be attempted with simple, intelligent programs or classroom instruction. Neuwirth
described research on a program known as "Parnassus", an intelligent tutoring system for writing. The focus of "Parnassus" is to teach students to write effective sentences appropriate to the context in which they are written. The project's goal is to have students learn by doing. Thus far, researchers involved in the project have only been able to have "Parnassus" work with a subset of the process of writing. Due to the state of the art of technology, the whole writing process is unable to be "taught" to "Parnassus". Researchers are confident that in the future, "Parnassus" will be able to assist students in the entire writing process.
Chapter III

CONCLUSIONS

The purpose of this literature review was to analyze and synthesize the literature related to the role of the computer in a writing program. This literature review has only shown what exists. As can be seen in the preceding review, there are many issues educators must take into account when choosing to use computers in writing programs. The research on the effectiveness of the computer in a writing program is contradictory. In addition, there are many areas of concern educators should consider if they choose to use computers in writing programs. These include staff development, time, need, training for students, actual integration into the current classroom setting, standardization of software/hardware, and knowledge of current research.

It is known that computers are neither panacean nor pernicious (Clements, 1987). Students do not need computers any more than they need any other potentially valuable learning material. There is nothing to lose and potential for rich benefits to acquire through informed use of computers in the writing program. It must be informed use since inappropriate or unwise uses will have little or no benefit. Research needs to
evolve beyond the effects of computers in the writing program.

Guidance and forethought is needed to develop and use effective programs. Educators need to be flexible and ready for change. In the National Education Goals declared by Congress, the Nation's teaching force is to have access to programs for the continued improvement of their professional skills and the chance to acquire the knowledge and skills needed to instruct and prepare all American students for the next century. One of the objectives of this particular goal is that all teachers will have continuing opportunities to acquire additional knowledge and the skills needed to teach challenging subject matter and use emerging new methods, assessments and technologies.

The aspect of computer technology is changing every day. Teachers of the future need to be active in determining what could be and what should be. One aspect, however, will remain constant; the teacher must still focus on the human element of teaching. This is evident in a letter from a first grader to her teacher (Wallace, 1985):

I liket the tipe riter Best of all and I like to work with you. And I likt lisoning to the story's But best I like working with you.
REFERENCES


