The Effect of Word-processing Experience on Editing while Composing.

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We accept this thesis as conforming to the required standard

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Abstract

This study investigated the implications of using computers in the writing process. The purpose was to determine whether there was a difference between two groups in their editing and revising techniques and their attitude towards writing. It was hypothesized that students who had had three years experience with computer writing would use more sophisticated forms of editing and would feel more positive toward writing than those students who had only a single year of writing with the computer.

Two groups of seventh-grade students were identified: the One-year Group consisted of students who had one year of keyboard training and one year of experience with a word processor; the Three-year Group consisted of students who had a minimum of three years of keyboard training and a minimum of three years experience with a word processor. The students had all attended schools within the same district for the past three years.

A group of grade-six students were trained as observers. They were given two training sessions, first observing a
videotape and then observing another student. About 150 students were trained and the best 60 were used to observe the grade sevens for the study.

Each writing group spent one forty-minute period composing an essay on the computer while being observed by the grade-six students. The observers tallied the editing and revising actions that were employed by the two writing groups. The editing activities of the two groups were compared. The grade-seven students were also given a writing opinion survey.

Both groups had a positive attitude but there was no significant difference in their attitude toward writing. Three levels of editing are normally discerned (Kurth and Stromberg, 1987; Hillocks, 1987): surface, lexical, and phrase/sentence. The One-year Group made significantly more typing corrections but there was no difference in overall surface editing. The Three-year group did significantly more lexical and phrase/sentence editing. In this way, students with more word-processing experience exhibit an editing style that is characteristic of better writers.
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Chapter 1

Introduction

For decades the young children entering the school system were introduced to the 'proper' methods of holding and using the pencil. They were then taught the symbols that allowed them to create words and eventually the syntax to develop sentences. In writing classes they received instruction in editing and proofreading. As the child progressed through the grades these skills were developed and improved. George Hillocks (1987) noted that revision and editing with the traditional pen and paper medium had been a concern of many studies.

Over the past ten years in British Columbia, elementary school students have been introduced to writing on the computer. Computer writing – any piece of writing produced with the aid of a computer – has allowed the young child to compose, edit and publish without a pen or pencil. The introduction of the computer in the school has created a writing medium that calls for the students to learn unique skills such as keyboarding, word processing, computer related vocabulary and printer manipulation. A command of this technological tool
allows the students to edit and revise their writing with ease. The literature available on computer writing is extensive and varied; however, research examining the ways in which long term computer writing affects a student's editing and revision skills is sparse.

The skills needed to use a computer proficiently for writing are more demanding than the psycho-motor skills needed for the traditional pen and paper (Balajthy, 1988). Furthermore, the knowledge needed to turn a piece of paper to review a previous page is distinctly unrelated to the knowledge needed to achieve the same effect with a word processor. Once writers have acquired sufficient skills to use a computer adequately for writing, the benefits appear significant. Kleiman and Humphrey (1982) stated that

it eliminates the typewriter, pens, scratch paper, erasers, cut-and-paste tools, and possibly even dictionaries, moreover, the simplification of storing, editing, and revising text leaves students free for higher order processing. (p. 97)

If students are given the keyboarding skills necessary to use the computer beneficially and adequate
opportunity to use word processors, what then are the differences we may expect? Are students who have been using the computer as a word processor better editors? There is a need to look closer at the revising and editing techniques experienced computer writers utilize.

The approaches that school districts have taken to assist the child in using the computer as a writing tool vary. Some schools have placed students with little or no experience in keyboarding in front of the computer. Others have spent a great amount of time and effort in teaching and establishing proper keyboarding skills. The methods of introducing and using word processing programs are also treated in an *ad hoc* manner. There has not been a curriculum set in British Columbia to guide the elementary schools in computer writing; however the Ministry has recently produced a resource manual for elementary keyboarding.

The literature supports the need for the acquisition of skills related to computer writing. Leuhrmann (1984) recommends that keyboarding should be a pre-requisite before a student enters a computer class because time at
the computer is wasted if it is spent hunting for keys on the keyboard. Wetzel (1985) states that "students who have adequate keyboarding skills use their time at the computer efficiently - that is, they can concentrate on problem solving, rather than on the mechanics of typing". (p. 15)

Other studies have indicated the need for word processor awareness. Collier (1983) noted that the word processor his grade 5 students used was so difficult to master that much of their energy and time was spent learning to manipulate the word processing system itself. On the other hand, Morton, Lindsay and Roche (1989) concluded that "Introducing systematic word processing practices to elementary school settings, would seem to herald positive effects". (p. 156)

Keyboarding lessons and word processor usage have been reported in classes as early as Kindergarten (Morrison 1986). There are students who have had numerous years experience with computer writing and developed the skills necessary to use a word processor proficiently. If word processors make editing and revising easier what differences can we then expect between those students with little computer writing experience and those who have acquired proficient computer writing skills?
An investigation into the literature surrounding editing with pen and paper revealed a comparative scale that researchers have developed. Hillocks' (1986) meta-analysis of the research on writing with pen and paper reported the results of Bridwell's study (1980) and those of Calkins (1980) and the National Assessment of Educational Progress (1977). Hillocks (1986) states that research has discovered that a majority of editing took place at the surface and lexical levels. The studies revealed that experienced writers often circled back in their writing and edited at various levels throughout the writing process. Researchers have also noted that editing styles appear to be developmental and that student writers revision skills improve over the course of their educational experiences (Stallard 1974; Liner, 1978; Calkins 1980).

Collier (1983) found that the use of a word processor increased the number and complexity of revision operations and encouraged greater manipulation of material at the lexical and phrase/clause level. The study, however, did not indicate the keyboarding experience of the students involved and it is noted that
the students had difficulty managing the word processing program. Morton, Lindsay and Roche (1989) found in their study that the eighth-grade students made changes at the "meaning-changing revision stage" allowing them to conclude that "this sophisticated aspect of word processing may reflect a developmental maturity factor". (p.160)

This study has been designed to investigate the implications of using computers in the writing process. The purpose of this study was to determine whether there was a difference between two groups in their editing and revising techniques and their attitudes towards writing. Considering the research in editing and revising with pen and paper, what affect has the computer had on students' writing? Is greater experience with writing on the computer a factor in the editing techniques that students display? If students have had three years' experience writing with the computer do they have a more positive attitude towards writing than those students who have had only one year's experience? It was hypothesized that students who had had three years' experience with computer writing would use more sophisticated forms of editing and would feel
more positive toward writing than those students who had only a single year of writing with the computer.

**Study Summary**

The author conducted a survey in April, 1990, which asked seventh-grade students what experience they had with writing with the computer. A number of indicated they had three years' experience with computer writing. Additionally, a second group was identified that had only a single year of experience with both keyboarding and word processing.

Each group had already been exposed to one of two distinct time periods of instruction, one and three years. This difference in time served as the comparative variable in the analysis of data. Although the instructors of the two groups were different, the instructors had all been trained in using and teaching keyboarding programs and use of word processors (FrEd Writer, Appleworks and Multi-Scribe). The study was designed to have students write a descriptive story while being observed for editing and revision techniques. The means and standard deviations for the
two groups were calculated from the observational data collected. The difference between the two means of the two groups was tested and the z-value was used to indicate level of significance.

Summary of Chapters

The review of the literature in Chapter Two discusses the research that has been conducted on written expression with pen and paper and the results of observations with a focus on editing. The chapter also contains a synthesis of the literature that exists concerning the benefits of computer writing in terms of keyboarding, editing, and students' attitudes.

Chapter Three provides a description of the study that was conducted and the selection process of the writing participants. The method used to train the keyboarding teachers and the structure of the keyboarding lessons is detailed. Chapter Three also contains an account of the selection process used for the observers and their training along with some observations made during the training period. A description of the actual writing period and the form of the attitude questionnaire are
also discussed. The chapter ends with a description of the method used to analyze the data.

Chapter Four provides an analysis of the data collected from the observational sheets and attitude surveys. The data is examined using means, standard deviation, and testing the difference of means for the two groups for each of the ten observational categories and the attitude survey. The chapter also includes observations that were made while the study was being conducted.

A summary of the study is provided in chapter five. The chapter includes findings, recommendations, limitations, and suggestions for further research.
Chapter 2

The Review of the Literature

Research on Editing Processes While Using Pen and Paper

According to King (1978), the composing process in writing includes whatever occurs between the intention to write and the completion of the writing task. Included in this process are three stages: pre-writing (preparing to write), articulation (production of the text), and post-writing (evaluation and editing of the text). This is not a linear process, as writers are constantly planning and revising while they compose (Flower and Hayes, 1981). The National Assessment of Educational Progress (1977) proposed the following definition for revision and editing:

...substituting more appropriate words or phrases for preliminary attempts in the first draft, adding relevant and deleting irrelevant information, and attending to capitalization, punctuation and other mechanical conventions. (p. 27)

Hillocks' (1987) review illustrated that the amount of editing found by researchers was directly dependent upon
the classification system used. Stallard's (1974) study into the revision methods of "good student writers" looked at five categories (spelling, syntactic, multiple word, and paragraph changes). In contrast is the schema developed by Sommers (1978) and later refined by Bridwell (1980), which focused on operations (addition, deletion, substitution and reordering) subclassified by levels (surface, lexical, phrase, clause, sentence, multi-sentence, and text). Stallard's (1974) students made an average of twelve revisions per composition while Bridwell reported over sixty-one per student.

The purpose of the Sommers (1978) study was to compare the revision methods of two groups, college freshman and experienced writers. The results indicated that there were significant differences between the two groups. The experienced writers made revisions that were in the sentence level far more frequently than the student writers who predominantly made lexical and phrase changes. Bridwell's (1980) study of twelfth graders' revision styles found that students made more than 25 revisions to their first drafts and most of them (56 percent) were in the surface and lexical level. The National Assessment of Educational Progress (1977) study
prompted students to edit their writing in contrast to the self editing seen in the Bridwell (1980) study. Although the criteria and research methods of the two studies differed, the results were similar. However, as Hillocks (1986) states:

The high incidence of lower-level revisions does not necessarily demonstrate a preoccupation with the trivial; there are simply more opportunities for revision at those levels than at the sentence or multi-sentence levels. (pp. 41-42)

Researchers have also noted that students' editing abilities appear to be developmental. Stallard (1974) studied the writing behaviors of two groups of twelfth graders, "good student writers", and a randomly selected group. Although the categories are not as extensive as those developed by Sommers (1978) and Bridwell (1980), the results indicated a developmental difference. The National Assessment of Educational Progress (1977) investigated the revision abilities of fifth, ninth and twelfth graders. The older students made decidedly more stylistic and informational changes than the younger students who largely made mechanical alterations. Liner (1978) looked at the revisions of twenty five sets of papers from students in grades 9, 10, 11, and 12. The
results indicated a significant difference from grade level to grade level. As in the aforementioned studies, most editing took place at the surface and lexical levels.

Further evidence editing abilities are developmental can be found in Calkins' (1980) study. She reviewed the revisions of seventeen third graders and classified them into four groups she viewed as developmental: random drafting, refining, transition, and interacting. Calkins reported that the interacting students were more likely to add or delete information throughout their papers. In contrast the random drafting writers wrote successive drafts without examining earlier drafts. She concluded that the students developed higher standards of editing for themselves as their writing abilities developed.

The research studies that were reviewed (Sommers, 1978; Liner, 1978; Bridwell, 1980; Calkins, 1980), indicated that editing can be seen in levels. Bridwell (1980) developed a revision classification scheme which focused on operations (addition, deletion, substitution and reordering) subclassified by levels (surface, lexical,
phrase, clause, sentence, multi-sentence, and text). Stallard (1974) and Liner (1978) reported the differences between the kinds of revisions made at different times. Finally, the majority of studies reviewed reported developmental differences.

The studies indicate that student writers display a variety of editing skills ranging from lower-level (surface, lexical) to higher-level (sentence, text). Experienced writers were reported to be capable of editing in both levels, whereas basic writers tended to deal with surface and lexical editing. These findings provide supporting research for studies investigating writing on the computer.

Research on Computer Writing

When students began writing on the computer in the late 1970s and the early 1980s, a number of writers and researchers praised its capabilities to improve children's writing skills (Choate, 1982; Daiute, 1983; Green, 1984; Kane, 1984; O'Brien, 1984; Palmer, Dowd and James, 1984). Furthermore, many proposed that word processors could be useful in helping students revise
more readily and skillfully (Daiute, 1982; Bean, 1983; Schwartz, 1984). These authors have cited the computer's value in helping students revise by reducing the frustrations of recopying; by facilitating the reading of text during stages of the writing process; by producing neat, publishable copies from the printer; and by making possible the reproduction of drafts of compositions for easy sharing with teachers and peers throughout the whole process.

**Keyboarding Skills**

Two obstacles in computer writing are lack of knowledge of and skill in efficiently using the computer keyboard as it relates to typing skill and the ability to employ the power of the word processor affectively. Many authors are emphatic in their acclams for the benefits of learning keyboarding and effective word processing (Dacus, 1983; Varwood, et al, 1985; Daiute, 1986; Cameron, 1986). Students who type better are more enthusiastic about using the computer for writing (Daiute, 1981).
In his review of the literature, Cameron (1986) found that in almost every instance, children completing a keyboarding course made significant gains in Language Arts over control groups which did not take part in the program. Similarly, Boles and Jensen (1984) found their fifth-grade students reading ability improved, averaging up to sixteen percent over the control group after two years of keyboarding lessons. Dacus (1983) indicated that failure to include keyboarding in the elementary curriculum would severely limit the usefulness of a powerful educational tool. It is important for students to use computers more efficiently through the use of keyboarding instruction. Wetzel (1985) states that "students who can't type have a hard time using the word processor". (p. 15) The hunt and peck technique of typing may occasionally be adequate for microcomputer operation but will not be suitable for later applications, such as typing text (Stewart & Jones, 1983).

Wetzel (1985) noted, following the learning of keyboarding skills, typing speed and accuracy should continue to improve, as students use the computer for academic tasks. The literature supports such a theory.
Maintenance of touch keyboarding skill declines to the point of atrophy if continuous and consistent reinforcement of keyboarding instruction is not included (Warwood et. al., 1985). Schmidt (1983) expressed a similar concern about keyboarding when he stated that if children of the elementary age did not get continual use of word processors the retention of keyboarding skills would be doubtful.

Research studies have indicated the benefits of learning keyboarding (Daiute, 1986; Cameron, 1986). The effective use of keyboarding allows the student to concentrate on the task of writing (Dacus, 1983). Without continual use of word processors students' proficiency with keyboarding will diminish (Warwood et. al., 1985).

**Editing Research**

Research on computer word processing in elementary schools provides some evidence that it is beneficial for writing instruction. There are longitudinal studies on the use of word processing in specific grade levels and on the impact that word processing has had on an
individual student's writing (Daiute, 1982; Collier 1983, Levin and Boruta, 1983; Schwartz, 1985; Kahn, 1987). When compiled the research points to two areas in which the word processor has benefitted the student in the writing process: editing and revising and students' attitudes toward writing.

The research in editing and revising with word processors can be divided into two categories, general and specific. The studies considered general reported students made fewer errors with a word processor and that the subjects enjoyed the ease of editing provided by the computer (Bean, 1983; Kurth and Stromberg, 1984; Daiute, 1984). Specific research studies investigated the editing operations students used and reported the results with a focus towards levels of editing (Levin, Boruta, and Vasconcellos, 1983; Collier, 1983; Harris, 1985; Gerlach, 1987).

General Research Studies

Daiute (1984, 1985, 1986) examined the writing processes of junior secondary students and younger children, and found that, on post tests, students not only corrected
more errors when working with the computers but also made fewer mistakes than with the conventional methods. Duling (1985), similarly, noted that when the ninth graders she studied revised their hand-written drafts with word processing, few errors remained in their final drafts. Her study concentrated on word processing primarily as a revising tool, for she required students to write all drafts by hand.

Schwartz (1984), in his study of the word processor and Grade 3 children, found that the students had a good understanding of the editing stages and were enthusiastic about their stories. He reported finding that the students circled back in their writings to add phrases or whole sentences, revising as they composed. Kurth and Stromberg (1984) maintained that students were able to eliminate errors because it was not the long laborious task it was when they used pen and paper. Daiute (1982) and Bean (1983) contend that with word processing, students have a record of each of their drafts, a concrete reminder of the writing process and can therefore make their own discoveries about their writings.
Kurth and Stromberg (1984) observed that when using word processing to write, students stayed with a piece of writing, adding, deleting, moving text, longer than they did with paper and pencil and seemed to develop a better sense of writing to an audience. They reported that students using word processing felt that they had written longer compositions and personally felt they could write successfully. The word processor, according to Bean (1983), allows the emergent writer the luxury of maneuverability without tedium.

Some research studies looked beyond using the computer as an "electronic pencil" and prompted the students to edit various features in their stories. Daiute (1982) conducted a year-long study with grade-six students working with a word processor which provided prompts and, through limited textual analysis, gave suggestions for revision. She found that both the word processor and other revision prompts led to more frequent and varied revisions. The program, an adapted version of Word Story, required the students to be familiar with more than the average ten function keystrokes that most current word processors use. Although Daiute (1982) found her students had difficulty mastering the
necessary keystrokes to perform the additional prompts, they did not resent the on-screen editing the programme suggested. Collier (1983) supports this by concluding that his students carried over what they had learned about style and applied this to texts not written on a word processor.

A program that includes a spelling checker can help students compose more freely in the first stages of their composing, permitting them to concentrate on issues besides spelling as they compose (Marcus, 1987). Spelling checkers will not find errors with homonyms but the search-and-replace function of the word processor helps a writer who can identify his characteristic misspellings. The student can concentrate on one error at a time (Schwartz, 1984).

**Specific Research Studies**

Harris (1985) studied the effect of word processing on the habits of six university freshmen. Her subjects were required to write four papers, two using a word processor and two by hand. She had the students submit each draft of their papers along with the final
products. In addition she observed the students at work on their revisions and interviewed them regarding their attitudes and perceptions about writing. All six of the participants were proficient typists and had numerous years experience with writing on a computer. Her findings do not support the assumption that using a word processor encourages more meaningful revision. Harris found that:

the majority of the revisions made by the writers involved minor changes in surface features of the text rather than changes in the macrostructure. (p. 328)

It must be noted, however, that the results of this study agree with the findings of Bridwell (1980) and The National Assessment of Educational Progress (1977) when they found that a majority of the changes with pen and paper were at the surface and lexical levels.

Levin, Boruta, and Vasconcellos (1983) developed a writing environment that not only provided word processing capability for its users but also maintained a record of the keystroke actions taken by the writers. An analysis of these keystrokes allowed them to study both the changes in product made in the course of a writing episode and the trace of the writing process
used. They found that the majority of deletions involved the use of the delete key for single character erasures during the entry of new text. Collis (1988) states that the power of the word processor is being employed primarily to correct superficial errors of spelling, capitalization, or punctuation rather than to facilitate a more creative approach to the writing process. (p. 124)

A similar finding was reported by Collier (1983). He found that the use of a text editor increased the number of surface revisions but little whole-text revision was accomplished by the students observed. The quality of the student essays was not affected by the revision efforts of the students. However, Collier (1983) noted that the word processor his fifth-grade students used was so difficult to master that much of their energy and time was spent learning to manipulate the word processing system itself.

Gerlach (1987) reported finding no evidence that keyboarding skills insure that students will write longer papers, nor that students would make a significantly greater number of revisions. Her study
investigated fourth-grade students and the effect typing skills had when using a word processor for composition. Half of the students were given an eight week session with keyboarding skills. Both groups received an hour and half lesson on the use of a word processor. Gerlach's (1987) study was unique in that it looked at how keyboarding may affect students' editing; however, she warns that

the students may have not reached proficiency with keyboarding, the word processor or the revising skills needed for application. (p. 11)

Students' Attitudes

Observations of students and attitude questionnaires have confirmed the motivational value of using word processing (Bean 1983; Kurth and Stromberg 1984; Kurth, 1987). Schwartz (1984) noted that a room full of word processing computers not only brought writers together but it also encouraged a sense of enterprise and accomplishment among the users and that this community of writers provides a nearly ideal setting for collaborative learning. Wetzel (1987) interviewed one
hundred third, fourth and fifth graders and found that most students preferred to use a word processor for writing. However he does caution that some students stated that they found the computer helpful only during the revising and editing stage and not during their first draft, where they preferred pencil and paper.

Woodruff, Bereiter and Scardamalia (1982) asked sixth-grade students who had received instruction in the use of a word processor to compare writing done on a word processor with writing done using pencil and paper. The students indicated that using a computer made writing easier, better and more enjoyable than using a pencil and paper. In a second study, thirty-six eighth-graders reflected the same attitudes. The researchers concluded that using text-writing programs fostered students' positive attitudes toward writing (Woodruff, Bereiter, Scardamalia, 1982).

In her classroom experience, O'Brien (1984) reported that the fascination of writing with the computer is that tasks once dreaded by a writer, for instance the radical reshaping and editing of a long text involving cut and paste techniques, become enjoyable. Daiute
(1984, 1985) and Curtiss (1984) state that students display more positive attitudes toward the activity of writing than classmates working with conventional tools.

Larter (1987) investigated the attitudes of first, third and sixth-grade students towards writing. She reported that sixth-grade students felt that writing was "less difficult" and "more useful" when they used the computer. Calkins (1987), however, also indicated that these feelings were not as widespread amongst the first- and third-grade children. This finding may be attributed to the keyboarding capabilities of the younger students (Daiute, 1981). Robinson-Stavely and Cooper (1990) uncovered similar findings in their study of English composition college students, but this study involved students who had little or no previous experience with word processing.

Adams (1985) found that secondary-level English students showed a decline in motivation toward using word processing after their initial interest rapidly subsided. She cites lack of typing skills, insufficient equipment, problems with software and hardware, and inappropriate writing assignments as reasons why her
students felt overall that "computers took too much time out of the course" (p. 18) after a year's worth of use.

Daiute (1982) and Bean (1983) concluded that students found the computer to be a catalyst to writing. They reported that students said they enjoyed writing because of the technology used to perform the task. Robinson-Stavely and Cooper (1990) stated that

The use of a computer on an ongoing basis in a writing course has a positive effect on attitudes toward computers and has no effect on attitudes toward the course or toward writing. (p. 47)

Robinson-Stavely and Cooper (1990) conclude that their results point to the value for continued research into "the exact nature of the computer's effect on composition". (p. 47)

Summary

Research into editing and revision with pen and paper indicates that student writers editing abilities are developmental (Stallard, 1978; Liner, 1978). However, editing for experienced and basic writers takes place at the surface and lexical levels due to the frequency of opportunities for editing at these levels (Hillocks,
Experienced writers were found to revise more frequently in the sentence and text levels than basic writers.

Writing on the computer has been heralded by researchers as being beneficial and motivational (Daiute, 1983; Kane, 1984). The acquisition of proficient keyboarding skills was an area of concern in some literature (Wetzel, 1985; Warwood et. al., 1985). It was also reported that unless students are given ample opportunity to use word processors, retention of the keyboarding skills would be doubtful (Schmidt, 1983).

In reviewing the literature surrounding editing and revising with the computer, it became evident that two styles of research studies have evolved, general and specific. The general studies reviewed indicated that writing on a computer allowed the students greater ease in editing and that writers made less errors when using a word processor. They did not however, detail the types of errors that students corrected. Harris (1985), Collier (1983) and Gerlach (1987) reported on specific
levels of editing and concluded that a majority of editing took place at the surface and lexical levels. The issues surrounding the importance of keyboarding skills and proficiency with word processors were raised by Gerlach (1987) and Collier (1983).

The motivational aspect of word processors is very evident and is hailed as the major factor in the improvement of young writers (Schwartz, 1984; Curtiss, 1984). As Suttle (1983) states, "With a text-editing system to overcome the mechanical barriers of writing, student motivation will be high". (p.34) There is an indication in the research that inadequate keyboarding skills and unfamiliarity with a word processor can affect students' attitude (Adams, 1985; Larter, 1987). Robinson-Stavely and Cooper (1990) raised the issue that students' positive attitudes towards writing on the computer are directed to the computer not writing.

In conclusion, the research indicates that although computers have motivational factors and allow for greater ease in editing, the editing which students do is still regarded as lower-level when compared to Bridwell's (1980) scale. However, researchers also
state that proper keyboarding skills and proficiency with word processing may directly affect the students' editing abilities. Furthermore, the literature also noted that the positive attitude students have about writing on the computer may be centered around the technological tool they use rather than the actual writing.
Chapter 3

Methodology

This study involved two groups of seventh-grade students. The One-year Group consisted of students who had one year of keyboard training and one year of experience with a word processor. The Three year Group consisted of students who had a minimum of three years of keyboard training and a minimum of three years' experience with a word processor. The students had all attended schools within the same district for the previous three years. These two groups spent a forty-minute period composing on the computer while being observed by grade-six students. The grade-six students recorded the editing and revising techniques that were employed by the two groups. The data for the two groups were then compared to determine if there was a difference in editing techniques. The seventh-grade students were also given a writing opinion survey which attempted to discover an attitudinal difference between the two groups.
Student identification.

The seventh-grade teachers of the thirty-six elementary schools in the district were asked to identify students who fit either of the following categories: 1) three or more school years in which they had received keyboard training and frequent use of a word processor, 2) one school year in which they had received keyboard training and frequent use of a word processor. Final identification of potential candidates was done by the school-based computer resource person. The computer resource teachers had been at their respective schools for more than three years and verified the computer instruction that had been available to students.

Three schools reported students in group one, and two schools reported students in the second group. All students who were initially identified in either category received a questionnaire that asked:

1. How many years have you attended elementary school in this district?
2. Do you have a computer at home?
3. Do you use the home computer for word processing?
4. How many years have you been using word processors?
5. How many years of formal keyboard training have you had?

The questionnaire was included to ensure that the One-year Group contained only those students with one year's experience. The final population of the One-year Group was fifty-six students and of the Three-year Group sixty students. There were no circumstances where an entire class was used. Students were taken from their regular classes in groups no larger than fifteen and worked in the computer lab.

Writing is an integral part of all classes in the district. The teachers within the district had received inservice in the teaching of the writing process. Writing activities are generated around the Whole Language/thematic approach. The writing process includes three stages: prewriting (preparing to write), articulation (production of the text), and post writing (evaluation and editing of the text). Writing lessons focus on the integration of language arts and content areas, on the use of quality reading materials, on modelling, and on the creation of dynamic classroom
language communities centered on the child. Because all students had attended district schools for the past three years they were products of this training in writing.

To insure that the writing students within the study represented a spectrum of the students in grade seven throughout the district, the Language Arts letter grades for the fifth, sixth and seventh-grades were recorded and statistically compared. The students' sexes were also recorded.

Treatment

Keyboarding and word processing is normally provided by the district and was not a part of this study. Teachers are given inservice in both keyboard training and word processor usage.

Keyboarding Programs

In the district two typing programs, *All the Right Type* published by Didatech Inc., Burnaby, B.C. and *Microtype*, *The Wonderful World Of Paws* published by Southern
Publishing Co., Cincinnati, OH. have been in use for the past three years. These tutorials include 18 lessons which involve learning to touch type all letters of the alphabet and some special computer keyboard keys. The programs also include speed tests which are normally administered at the end of the second, fourth and sixth weeks.

**Training of Keyboarding Teachers**

Computer teachers would normally be given a full day in-service on the programs. They were shown how to conduct the individual lessons found with the software and the necessary methods of record keeping. The keyboarding trainer would teach the initial three classes to the students at the individual schools while the teacher observed. The fourth and succeeding classes would be taught by the teacher. The keyboard trainer would observe the teacher and give appropriate feed back and assistance.
Student Keyboarding Lessons

The keyboarding classes would take place over a six-week period, with a total of no less than 15 hours' instruction. The lessons were forty minutes in length and conducted daily. The time during the school year in which the students received keyboarding generally varied according to the individual teacher's schedule. The teachers of the Three-year Group of students usually taught the same lessons themselves in the second and third years.

Word Processors

FrEd Writer, Appleworks and Multi-Scribe word processors were used by all students. FrEd Writer is a simple word processor with seven built-in editing commands. Appleworks and Multi-Scribe are more sophisticated word processors with more than twenty editing commands.

Observational Sheets.

After personal observations of a range of students using the computer as a writing tool and a review of the
literature, a list of the most frequently used methods of editing and revising was created. In consultation with members of the B.C. Writing and Reading Assessment Committee, Burnaby and Richmond Computer Specialists and classroom teachers the final observational sheet was developed.

The review of the literature revealed various levels of editing. Surface editing, lexical editing and phrase/sentence editing were the most frequently employed by student writers (Bridwell, 1980; Faigley and White, 1984 and Kurth and Stromberg, 1984). The categories used on the observational sheet are related to these three levels.

Observers were not aware of the intent of the study in order to guard against their observations being biased towards editing and revising. The last four of the categories are included to disguise the purpose.

The categories were:
1. Student deleted a sentence.
2. Student corrected a simple typo with the delete key.
3. Student made a spelling correction.
4. Student made a punctuation correction.
5. Student inserted a word.
6. Student deleted a word.
7. Student moved cursor.
8. Student used built-in editing commands.
9. Student stopped typing and paused for more than 30 seconds.
10. Student was continually typing for more than 30 seconds.

The categories required the observers to determine whether the alteration was due to a spelling error, a punctuation correction or a typing mistake. A spelling error was to be recorded when a subject completed a word, indicated when a space was placed after the word, and then returned to alter the spelling. A typo was recorded whenever the student used the delete key to correct an error due to a keyboarding mistake (an alteration before indicating characters were a word). A tally was recorded for sentence deletion when more than five words were deleted at one time. The study did not ask the observers to differentiate between a phrase and a sentence.

To evaluate the revisions, a taxonomy modeled on the studies of Kurth and Stromberg (1987) and Hillocks
(1987) was developed (Table 1). The three levels (surface, lexical and phrase/sentence) were considered. Multi-sentence editing and paragraph editing were not used because the research indicated students at the grade level used in this study rarely deleted more than one sentence at one time (Kurth and Stromberg 1987; Bridwell, 1980).

Table 1
A Taxonomy of Editing Levels

<table>
<thead>
<tr>
<th>Levels</th>
<th>Categories Observed</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Surface</td>
<td>Delete Typo</td>
</tr>
<tr>
<td></td>
<td>Spelling Correction</td>
</tr>
<tr>
<td></td>
<td>Punctuation Change</td>
</tr>
<tr>
<td>2. Lexical</td>
<td>Delete Word</td>
</tr>
<tr>
<td></td>
<td>Insert Word</td>
</tr>
<tr>
<td>3. Phrase/Sentence</td>
<td>Delete Sentence</td>
</tr>
</tbody>
</table>

Observers.

The observers' tasks were to watch the computer screen and record a tally on the observational sheet whenever
the writing student performed one of the ten operations listed on the sheet.

The observers were grade-six students from the same school. One week before the study a training session was held for grade-six students. They were all given a copy of the final observational sheet and the various terms were defined and discussed. The class was shown a seven minute video of a student composing on the computer and they were asked to complete the observational sheet. All of the observational sheets were taken in and the data recorded. The video was replayed for the students and the instructor indicated when the students should have recorded an incident on the observation sheet. The same procedure was conducted two more times. During a second period, the students were divided into groups of two and the pair observed a student composing on the computer. An observer was placed on either side of a screen and their results were compared and discussed. A final video was shown and the students recorded their observations.

Each video was viewed by five elementary teachers who then developed an answer guide to assist in the grading
of the four videos. The observational sheets were graded and the four marks were compared. Students who had achieved 70 percent or more correct on the first three sheets and at least 90 percent correct on the final video were selected as potential observers. On the day of the study the names of observers required were drawn at random from the group of candidates.

During the training of the observers three indicators of observers skills became apparent: observer's experience with computers, observer's experience with word processors and observer's ability to discriminate between correction of typos, spelling correction and punctuation correction. There appeared to be a high correlation between the three factors. Those students with computer experience were more successful on the first three sheets than those students with little experience.

The observers were given a questionnaire to determine their levels of computer writing experience. They were asked the following questions:

1. Do you have a computer at home?
2. Do you use the home computer for word processing?
3. How many years have you been using word processors?
4. How many years of formal keyboard training have you had?

The students who indicated they had two or more years of keyboarding and word processor use were more successful in completing the observational sheets. Grade-six students with less than two years of writing on the computer scored an average of 68.2 percent on the first three observational tests and 82.3 percent on the final test. In comparison, grade-six students with more than two years of computer writing experience scored an average of 75.7 percent on the first three observational tests and 90.3 percent on the final test.

Both groups had difficulty differentiating between typo corrections and spelling errors on the first three video tests. During the second period, when the students were divided into groups of two and the pair observed a student composing on the computer, they appeared to overcome this difficulty and were more successful on the last video test. The errors made in distinguishing
between typos and spelling errors decreased for the observers with less than one years' experience by 35 per cent and 42.5 per cent for the observers with two or more years' experience.

Writing periods.

The seventh-grade students were asked to use the computer to compose an expository paper discussing the merits or disadvantages of having seventh-grade students attend elementary schools. A thirty minute pre-lesson in brainstorming and webbing was conducted the day before the students entered the computer lab. The students were given forty continuous minutes to compose their initial drafts on the computer.

During the forty-minute period of writing, each student was observed by three different students. The purpose of the observations was to determine what editing and revision techniques were employed by the students. The observers watched the computer screen and recorded the revision strategies of a single student for seven minutes and then moved to another. It was felt that sixth-grade students would have difficulty focusing
intently on one screen for twenty-one minutes. This observational approach was chosen to allow the students the chance to refocus on a new situation. Each grade-seven writer was observed by three students for a total of twenty-one minutes.

The observational periods did not begin until the ten-minute mark of the writing period. This was done to allow for last-minute classroom management instructions from the teacher and to allow the student time to adjust to the writing environment. The last seven minutes of class consisted of disk management and writing generally did not occur. The observers had one minute travelling time between observations.

**Attitude Questionnaire.**

One week after the writing session, the seventh-grade students were given a questionnaire (Appendix 1) to determine whether there was a difference in attitude towards writing between the two groups. The opinion questionnaire was developed for the B.C. Assessment on Reading and Writing for 1988. It was designed by Jeroski (1982) and was used in both the 1984 and 1988
British Columbia Ministry of Education Written Expression Assessments. The attitude questionnaire does not contain any reference to computers.

The purpose of the questionnaire was to determine whether those students who had been using the computer as a writing tool for three years had a more positive attitude towards writing.

A five minute discussion was held with the students concerning personal opinion and the questionnaire was handed out. Any terms referred to in the opinion survey that were not understood by the students were defined and discussed. The students were given twenty minutes to complete the questionnaire.

Method of Analysis.

The minimum, maximum, range, mean, relative frequency and standard deviation of each of the ten observation categories were generated. The null hypothesis \( H_0 \) was; there would be no difference between the editing abilities of the two groups. The alternative hypothesis \( H_1 \) therefore was; there would be a difference between
the editing abilities of the two groups. It was not known in advance which group would demonstrate the greater events in each editing category, so two-tailed tests were used.

The means would normally be compared using a t-test. However, this test requires that the variance of the two groups be the same (the variance is pooled). This assumption is not warranted here. Therefore, the means are compared by calculating the z-score of the difference between the means and calculating the probability of that z-value on the normal curve. From tables (Walpole, 1983), a z-value of less than -2.58 or greater than 2.58 is significant at the 0.01 level.
Chapter 4

Analysis of Results

In this chapter the results of the statistical analysis of the data are reported. An individual comparison of the means recorded for the ten categories was conducted. The means, standard deviation, difference of means, z-value and probability factor are recorded in table formats. The statistical data received from the attitude survey is discussed. The third section of this chapter deals with the observations made while the study was being conducted. A summary of the results from the statistical analysis closes the chapter.

The One-year Group is defined as those students who had a maximum of one year of keyboard training and a maximum of one year of experience with a word processor. The Three-year Group is defined as those students who had a minimum of three year's of keyboard training and a minimum of three year's experience with a word processor.
The students represent a spectrum of children currently enrolled in the seventh-grade. The letter grades are based on a seven-point scale (A=1, E=7). The means and standard deviations for both groups were tabulated (Table 2). A t-test showed that there were no significant differences between the two groups. The academic achievement of the students was not an interfering factor.

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Letter Grades for Language Arts of One-year Group and Three-year Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One-year Group (n=56)</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The population distribution of males and females is listed in Table 3. The ratio of male to female is relatively equal within the individual groups. Furthermore the ratios are fairly equal for the whole population.

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Sex Distribution of One-year Group and Three-year Group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>One-year Group (n=56)</td>
</tr>
<tr>
<td></td>
<td>Male</td>
</tr>
<tr>
<td></td>
<td>25</td>
</tr>
</tbody>
</table>
The minimum, maximum, range, mean, relative frequency and standard deviation of each of the ten observation categories were generated. Two-tailed tests were conducted on each category grouped by years of experience, and the results are presented in Table 4. The two-tailed tests compared the means of the One-year Group and the Three-year Group scores. In these comparisons, a z-value of less than -2.58 or greater than 2.58 was considered significant at the 0.01 level.

As seen in Table 4, all categories but one, "Spelling Correction" were, considered significant at the 0.01 level of significance. The z-value for the Spelling Correction category was, however, outside the critical value (±1.69) for the 0.05 level of significance. The One-year Group recorded means that were lower than the Three-year Group in eight of the ten categories that were observed. Category 2, "Delete a Typo", and Category 9, "Stopped Typing", were the only categories in which the One-year Group recorded greater means.

Although the last four categories were not considered forms of editing and therefore not used in Table 5, their results are worth noting. The z-values for these categories are all well outside the critical value ±2.58
Table 4

Frequencies of editing activities - One-year Group vs. Three-year Group

<table>
<thead>
<tr>
<th>Description</th>
<th>One-year Group (n=56)</th>
<th>Three-year Group (n=60)</th>
<th>Difference of Means</th>
<th>z-value</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
</tr>
<tr>
<td>1 Delete sentence</td>
<td>0.25</td>
<td>0.51</td>
<td>4.33</td>
<td>2.66</td>
<td>4.08</td>
</tr>
<tr>
<td>2 Delete a typo</td>
<td>15.21</td>
<td>7.13</td>
<td>10.23</td>
<td>4.67</td>
<td>-5.02(a)</td>
</tr>
<tr>
<td>3 Spelling Correction</td>
<td>4.27</td>
<td>3.11</td>
<td>5.73</td>
<td>5.03</td>
<td>1.46</td>
</tr>
<tr>
<td>4 Punctuation Change</td>
<td>1.07</td>
<td>1.02</td>
<td>2.23</td>
<td>2.08</td>
<td>1.16</td>
</tr>
<tr>
<td>5 Inserted Word</td>
<td>1.30</td>
<td>1.09</td>
<td>6.33</td>
<td>4.15</td>
<td>5.03</td>
</tr>
<tr>
<td>6 Deleted Word</td>
<td>2.14</td>
<td>2.47</td>
<td>9.73</td>
<td>5.85</td>
<td>7.59</td>
</tr>
<tr>
<td>7 Cursor Movement</td>
<td>3.82</td>
<td>4.24</td>
<td>8.05</td>
<td>4.61</td>
<td>5.23</td>
</tr>
<tr>
<td>8 Built-in Commands</td>
<td>0.5</td>
<td>0.89</td>
<td>6.15</td>
<td>3.18</td>
<td>5.65</td>
</tr>
<tr>
<td>9 Stopped Typing</td>
<td>7.62</td>
<td>4.74</td>
<td>2.47</td>
<td>1.85</td>
<td>-4.85(a)</td>
</tr>
<tr>
<td>10 Continual Typing</td>
<td>1.82</td>
<td>2.17</td>
<td>5.75</td>
<td>3.69</td>
<td>3.93</td>
</tr>
</tbody>
</table>

Note: \(a\) = The One-year Group recorded a higher mean than the Three-year Group.

\(**\) = \(P<0.01\)
for the 0.01 level of significance. The results for Category 8, "Built-in Commands", indicates the Three-year Group accessed the powers of the word processor more frequently than the One-year Group.

In Category 9, "Student stopped typing and paused for more than 30 seconds", and Category 10, "Student was continuously typing for more than 30 seconds" the observers were trained to record a tally when the student was either pausing or typing for 30 seconds or more. Any shorter time period was not recorded. Therefore the z-values are accurate only for a period of time greater than 30 seconds. Furthermore, the actions of the students during their pauses was not recorded.

The categories were grouped according to the taxonomy suggested in chapter three and the means, standard deviations, difference of means and z-values were calculated (Table 5). There was a significant difference between the two groups at the lexical and sentence/phrase levels, but no significant difference found at the surface level. The difference of means of the three levels for the One-year Group is 6.65 in comparison to the 2.5 recorded for the Three-Year Group.
On the average, students in both groups edited at the surface level more frequently than the other two levels.

### Table 5

Levels of Editing - One-year Group vs. Three-year Group

<table>
<thead>
<tr>
<th>Level</th>
<th>One-year (n=56)</th>
<th>Three-year (n=60)</th>
<th>Difference of Means</th>
<th>z-value</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>6.8 7.4</td>
<td>6.1 4.0</td>
<td>-0.3</td>
<td>0.16</td>
<td>0.71</td>
</tr>
<tr>
<td>Lexical</td>
<td>1.7 0.60</td>
<td>5.7 2.4</td>
<td>4.0</td>
<td>-7.23**</td>
<td>0.003</td>
</tr>
<tr>
<td>Sentence</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phrase</td>
<td>0.25 0.51</td>
<td>4.33 2.66</td>
<td>4.08</td>
<td>-10.91*</td>
<td>0.002</td>
</tr>
</tbody>
</table>

Note: a = The One-year Group recorded a higher mean than the Three-year Group. 
** = p< 0.01  * = p< 0.05

Figure 1a, Comparison of Means for Individual Editing Categories, and Figure 1b, Comparison of Means for Levels of Editing, illustrate a different perspective on the study's results. Figure 1a graphically demonstrates the differences that were found between the two groups, in particular the extensive use of the delete key by the
Figure 1a
Comparison of Means for Individual Editing Categories

![Bar chart showing means for individual editing categories (Del. Sent., Del. Typo, Spelling, Punctuation, Inserted Word, Del. Word) for One-Year and Three-year Groups.]

Figure 1b
Comparison of Means for Levels of Editing

![Bar chart showing means for levels of editing (Surface, Lexical, Sent./Phrase) for One-Year and Three-year Groups.]

- One-Year Group
- Three-year Group
One-year Group. Furthermore, Figure 1a illustrates a relatively evenly balanced editing style by the Three-Year Group. Figure 1b indicates that when viewed in levels, both groups edited at the surface level the most, then the lexical level and finally the least amount of editing occurred in the sentence/phrase level.

Student's Attitude Towards Writing

Results of the opinions about writing survey are listed in Table 6, Student Attitude Survey. The survey was grouped into two sections, positive questions 1, 4, 5, 7 and 9 and negative questions 2, 3, 6, 8 and 10. The categories, "strongly agree", "agree", "can't decide", "disagree" and "strongly disagree" were given the numerical rating of 1 to 5 (1 = strongly agree) for the positive questions. This procedure was reversed for the negative questions (5 = strongly agree). An overall mean was calculated for each group and independent t-tests, grouped by years of experience, were conducted. The t-tests yielded the t-value for the means between the One-year Group and the Three-year Group scores.
### Table 6

#### Student Attitude Survey Results for the One-year Group and the Three-year Group

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>SD</th>
<th>Difference of Means</th>
<th>t-value</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
<tr>
<td>One-year Group</td>
<td>2.43</td>
<td>1.46</td>
<td>0.24</td>
<td>-0.98</td>
<td>0.11</td>
</tr>
<tr>
<td>Three-year Group</td>
<td>2.67</td>
<td>1.89</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The results of this attitude survey show that there was not a significant difference between the two groups. Experience with writing on the computer does not appear to affect the students' attitude towards writing. It must also be noted that the scores for both groups indicate a positive attitude towards writing.

**Observations During Writing Periods**

Students in the One-year Group and the Three-year Group displayed contrasting characteristics throughout the study. The actions of the One-year Group students were consistent in all schools. The classroom resource teachers of the One-year Group students indicated that their students were hesitant and often reluctant to start their computers without assistance. Some of the students indicated they had completed the paper after twenty minutes and needed prompting in order to remain
working for the required time period. There was constant discussion and the noise level was much higher than that heard in the labs of the Three-year Group.

The Three-year Group entered the lab and loaded their word processing programs immediately. The students who used Multi-Scribe spent the initial moments designing their files with personally preferred fonts and document format. The computer resource teachers of the Three-year Group reported that they rarely dealt with student problems concerning the management of the word processor and that they felt their students were able to employ the capabilities of the program adequately.

Summary

The two groups were significantly different on every editing category except Category 3 "Spelling Correction". There was no difference between the groups on surface editing, but the Three-year Group did significantly more lexical and phrase/sentence editing. Both groups had a positive attitude but there was no significant difference in their attitudes toward writing.
Chapter Five

Conclusion

This study was conducted to determine if there was a difference in editing skills between those grade-seven students who had three years of experience with keyboarding skills and a word processor and those who had one year's experience with keyboarding skills and a word processor. The study also compared the attitude of the students towards writing.

Before discussing the results, it should be restated that the students had relatively similar writing experiences but they differed in keyboarding skills and word processor experience. Any findings do not necessarily indicate that one group of students were better editors or writers. Rather, when using a word processor there may be a difference in editing techniques between those students with experience in writing on the computer and those students who have just begun using the computer as a writing tool.
The taxonomy put forward in chapter three is used as a method of evaluating the results. The findings of this study were divided into three sections: surface editing, lexical editing and sentence/phrase editing. Deleting a typo, making a spelling correction or punctuation change were considered in the surface level. The insertion and deletion of words were thought of as lexical editing strategies. The only category considered for the sentence/phrase level was Category 1, "Deletion of a Sentence".

Both the One-year Group and the Three-year Group produced results that showed editing at the surface level was the most frequently used method. Bridwell (1980) reported similar findings in her study of students writing with pen and paper. In this study the only category that did not show a significant difference was in spelling correction. The fact that this category was not significant supports the findings of Liner (1978) and Sommers (1978) when they reported that spelling correction was an editing method commonly used by all levels of writers. Although two of the individual categories for surface editing indicated significant differences between the two groups, the
combined means failed to show a difference when tested with a two-tailed test. This result is in agreement with those found in the studies of Bridwell (1980), Sommers (1978) and Morton et al. (1989). These studies reported surface level editing as the most commonly used technique in all levels of writing experience.

The One-year Group produced an average of 15.21 for the category "Deleted a Typo". This was the largest mean reported for any group in any of the categories. The result was expected because the students in the One-year Group would have greater difficulty applying the newly learned skill of keyboarding. Levin, Boruta, and Vasconcellos (1983) found similar results. The majority of deletions their students made involved the use of the delete key for single character erasures during the entry of new text. Levin, Boruta, and Vasconcellos (1983) did not report the level of experience their students had with keyboarding. The significant difference found in this study suggests that keyboarding skills and word processor experience may affect the students' use of the delete key as the single most used editing technique. The Three-year Group showed a
decrease in the use of the delete key and this may be attributed to their keyboarding abilities.

This study's results for the lexical level indicate that the Three-year Group developed an ability to edit in the lexical level more than the One-year Group. The experienced computer writers seem to display characteristics that the literature equates with experienced writers. Hillocks (1980) points out in his review that "we know that addition of words is a prominent revision strategy, used by Calkins third-grade interacting revisers, Bridwell's seniors, and Sommers's skilled writers". (p. 87) Stallard (1974) furthermore reported that the more experienced writers' most prominent revision strategy was the addition and deletion of words.

Research suggests that editing in the lexical level is considered developmentally more sophisticated in comparison to the surface level. The word processor, however, has made the insertion and deletion of words easier. The fact that the Three-year Group appear to be more proficient at the lexical level may be attributed to their word processing ability. Further support can
be found in the results of the individual category of Built-in Commands. The Three-year Group accessed the built-in commands an average of 6.15 times in comparison to the 0.5 recorded by the One-year Group. The power of the word processor appears to give the experienced user greater opportunity and ease in editing in the lexical level.

Further evidence that proficient command of the word processor has given experienced users greater opportunity to edit in various levels can be found in the results for the sentence/phrase level. Bridwell (1980) and Stallard (1974), found that their advanced writers made more phrase/sentence level changes than their basic writers. Bridwell (1980) reported that revisions at the sentence level occurred 7.8 per cent of the time in all three stages of her study. Once again the ability of the word processor to make the deletion or addition of long passages easy, has affected the editing of experienced computer writers.

The study did not differentiate between phrase and sentence in order to accommodate the observational skill levels of the student observers. The statistical
results, however, do indicate that the experienced computer writers have begun to edit at least at the phrase level. Furthermore, the experienced computer writer utilizes an evenly balanced style of editing (surface, lexical, phrase/sentence) in comparison to the one year students.

The results of this study are in contradiction to Gerlach's study (1987). She found "the typing tutorial group did not make significantly greater number of revisions in any category (surface, lexical, phrase, clause, sentence, multi-sentence, and text) than the no-typing group. Although the students in Gerlach's study used the same keyboarding program as was used in this study (Microtype, The Wonderful World Of Paws), her students had only the eighteen lessons before being tested. The Three-year Group in this study had received the same eighteen lessons for three consecutive years. The length of time that Gerlach allowed for her students to become comfortable and capable with both keyboarding and word processing may have been insufficient. This study demonstrated that a difference does exist in the lexical and, possibly the sentence levels of revisions."
Students' Attitudes Summary

The attitude survey given to the students did not contain any references to computers. This was done to ensure that the students' attitude was not affected by their opinion about computers as reported by Robinson-Stavely and Cooper (1990). This may have been a factor in the results received. The Three-year Group had been doing a majority of their writing on the computer and it was hypothesized that they would have a better attitude. There was no significant difference found. However the results of the analysis showed that both groups were positive towards writing.

Limitations

Formal generalizability is reserved to the district and the seventh-grade students. It is assumed that these students represent average seventh-grade students throughout British Columbia.

This study has some limitations. The initial composing process, which includes editing, was observed and not the remaining stages of the writing process. The
editing patterns may alter when the student follows the paper to the published stage.

Secondly, this study included only surface editing, lexical editing, and limited observations of the sentence/phrase levels. It did not take into account any editing that may have taken place at the multi-sentence or text levels. Observations that include all levels of editing may produce further results concerning the editing techniques of experienced computer writers.

There are further limitations imposed upon this study by the design. The observers were not required to indicate the information that was added, deleted or replaced from the students' paper. This information may be helpful in determining the exact editing techniques students use when composing on a computer.

Furthermore, the specific nature of the built-in commands used by the students was not ascertained. The results of additional information would help clarify what powers of the word processor students are using.
Conclusions

This study has shown that when students are given keyboard training over a three-year period and time to become accustomed to a word processor they appear to perform more sophisticated forms of editing than students with a single years' experience. As the computer becomes more widely used as a tool for writing, educators should be aware of these factors. Students must feel confident in manipulating this new technological writing tool before they can benefit from its abilities.

The word processor has made editing and revising easier for writers. However, the results of this study suggest that adequate experience with both keyboarding and word processing may be necessary before any significant benefits are noted. The Three-year Group students had three years experience with both these skills and the results indicate that the time period has benefitted the students.

This study supports the findings of Morton et al. (1989), in that word processing appears to facilitate
the revision aspects of writing. The experienced students are not as concerned with the mechanics of getting the ideas down and feel more comfortable experimenting (Dacus 1983). As the computer becomes more widely used as a tool for writing, educators should be aware of these factors.

**Recommendations**

Previous studies recommended that keyboarding and constant use of word processors begin around the grade-five level. Research has shown that students at the fifth-grade level are able to manipulate the keys with some proficiency (Morrison, 1986; Hoe, L., Sommers, B. 1987; Grace, 1989) and with continued practice on a word processor their ability to utilize the computer as a writing tool will improve.

The word processor does not teach students to become better writers but provides a means to effect changes more easily. It is recommended that word processing not replace writing instruction. Teachers need to continue to teach the writing process, guide writing of
compositions and provide feedback for revision (Balajthy, 1988).

Further Studies

A replication of this study with a longer time period to include all levels of the writing process would produce additional information into the editing and revision skills of experienced computer writers. Investigating the editing techniques that students use when they are revising a previously composed paper, may reveal a different pattern. A longitudinal study that observed students editing skills from fourth grade to twelfth grade would help clarify the issue of developmental levels. Finally, a study that looked at the quality of writing that experienced computer writers produce would give an insight into the benefits of writing on the computer.
References


Didatech Inc. (1988). *All the Right Type*, Burnaby, B.C.


Robinson-Stavely, K., Cooper, J. (1990). The use of computers for writing: effects on an english


OPINIONS ABOUT WRITING

People have different feelings about writing. We are interested in your opinions. How much do you agree with each of the following statements? (Remember, there are no "correct" answers.) For each of the following statements, circle the letter which is closest to your opinion.

<table>
<thead>
<tr>
<th></th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Can't Decide</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. It's fun to send letters to my friends.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>2. I only write something when I have to.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>3. Almost anything is more fun than writing.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>4. Sometimes, when I'm upset, it helps to put my feelings down on paper.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>5. I feel good when I finish a piece of writing.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>6. Writing a diary or a journal is a waste of time.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>7. The most interesting activities I do in my school classes involve writing.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
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<td>8. Writing stories and reports is usually boring.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>9. Sometimes it's fun to write something just for myself and not show it to anyone.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
</tr>
<tr>
<td>10. I never enjoy writing anything.</td>
<td>A</td>
<td>B</td>
<td>C</td>
<td>D</td>
<td>E</td>
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<tr>
<td>Event Description</td>
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<td>-------------------</td>
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<tr>
<td>Student deleted a sentence</td>
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<tr>
<td>Student corrected a simple typo with the delete key</td>
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<tr>
<td>Student made a spelling correction</td>
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<tr>
<td>Student made a punctuation change</td>
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<tr>
<td>Student inserted a new word</td>
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<td>Student deleted a word</td>
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<tr>
<td>Student moved cursor</td>
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<td>Student used built-in commands</td>
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<td>Student stopped typing and paused for more than 30 seconds</td>
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<tr>
<td>Student was typing continually for 30 seconds</td>
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</tbody>
</table>