AN INVESTIGATION INTO THE USE OF COMPUTERIZED WORD PROCESSING PROCEDURES IN A PROCESS-CONFERENCE APPROACH TO WRITING BY GRADE FIVE STUDENTS

ROBERT GRAEME STEWART

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BY

© Robert Graeme Stewart, B.A., B.Ed.

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Abstract

An investigation was carried out to determine whether ten-year old students who are able to use a word processor and who have been exposed to the process-conference approach to teaching writing do indeed use the capabilities of the word processor to make higher level revisions in their written work instead of superficial revisions.

The level of revisions in three writing assignments was compared to other factors such as age, ability, typing speed, and facility with the use of the Bank Street Writer word processing program in order to determine the relationship of these factors to the extent children revise their written work.

A case study approach involving the observation of thirty-one grade five students was followed. The children's revision strategies were mapped through a focus on one child, a more peripheral study of three other children and informal observations and product analysis of twenty-seven other students.

This study lends support to the findings of others that limited exposure to the use of a word processor does not in itself result in young writers making high level revisions to their written work.

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To the 1985-86 grade five students of Morris Academy, may they some day know the joy of working with such a fine group.

Finally and especially to my wife, Bonnie, thanks for being there.

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CHAPTER 1

INTRODUCTION

The impetus for the study reported in this document came from two recent developments in the teaching of writing skills to children: (a) "the process-conference" approach to writing and (b) the use of a word processor as a writing tool by children. The writings of Donald Graves (1975, 1978, 1979, 1981, 1982, 1984), Lucy McCormick Calkins (1980, 1982, 1983) and Donald Murray, (1978, 1982) among others, have contributed to the interest in "process writing." The author's desire to learn more about what happens when children are exposed to word processors has been kindled primarily by the flood of articles in the educational journals on the topic of using computers as "productivity tools", coupled with a personal interest in the educational use of computers and the writings of Colette Daiute (1985), in particular.

Process Writing

In commenting on his report, Balance the Basics: Let Them Write, for the Ford Foundation, Donald Graves reported, " . . . it was clear that the main emphasis in schools was on the ability of children to receive

information, not to send it" (Graves, 1984 p. 62). Graves' report sought to address the necessity of restoring a balance in communication in the schools, principally through writing. Since that time, Graves and his colleagues (Graves, 1981, 1983, 1984; Calkins, 1983; Murray, 1982; Sowers, 1981; Giacobbe, 1981) have emphasized an approach to teaching writing called "the process-conference" approach--an approach which has seen wide acceptance throughout North America, Australia and Europe.

Teachers using this method help students by initiating brief individual conferences during the process of writing, rather than by assigning topics in advance of writing and making extensive corrections after the writing is finished. The focus is on content, not on mechanics. The student discovers what he or she has to say by putting ideas down on paper. The teacher then provides guidance by specific questioning intended to allow the student to clarify his or her own ideas about the intended meaning of the piece of writing. A great deal of interaction among students is encouraged in this approach. Children read their texts to their peers, receive feedback and revise them. Through such sharing with teacher and fellow students, the writer is thus led through successive drafts until the meaning is clarified and the topic fully expressed. Teachers who

use this method never view the students' writing as wrong--only unfinished.

In the process approach to teaching writing, children's revision of their work is seen as an important component. Revision refers to the act of changing something that is already composed. It may be the simple changing of a letter or the more complex removal, relocation or restructuring of a phrase or sentence. Children show what is important to them in their writing by the revisions they make. Revisions should be their attempt to convey more clearly their intended meaning through written expression; therefore, a major goal of teachers of process writing is to encourage children to make meaningful revisions to their work, to see their writing as something to be reflected upon, reshaped and reconsidered until their intended meaning is expressed fully. The children should be helped to see that their writing should not be considered as permanently fixed, as if it were carved in stone.

Computer as Writing Tool

Daiute (1985) commented that writing has become more changeable with the change in writing tools.

> Writing tools have always affected the process of writing. People have written on cave walls, animal skins, clay stone, papyrus, and paper. They have made their marks on these materials with animal hairs, sticks, chisels, quills, printing presses, pens, pencils,

typewriters and now computers. (p. xiii)

Donald Graves and his colleagues have shown that teachers and children can work together productively in writing classes, and recent work with computers has suggested that, as the computer makes the writing process more public for children, they welcome their teachers into the collaborative process.

Daiute sees the computer as a catalyst for changing the writing classroom from a teacher-centered room with lectures, to a student-centered room with a great deal of writing going on. In such a setting, children and teachers work together; they share tools, and they harness the power of the machine to their own ends.

In using the computer as a tool in the writing class, we exploit its interactiveness and other unique capacities. The "tools" model of computing in education is based on a cognitive-developmental approach to learning. According to this view,

> Writers learn to write by writing--by creating texts, listening to others' reactions to their writing, and revising.
>
> . . . Because we do not have conclusive research indicating that using a word-processing program increases writing quality, computers should be used in conjunction with the more plentiful tools: pencils, paper and dictionaries. Even if word processing were found to be related to better scores on writing tests, the studies would probably show that such improvement takes longer than a school term (Daiute, 1985, p. 18).

Many educators, however, have declared their belief

that the word processor would be an invaluable aid in allowing young writers to more easily make revisions to their work than with pencil and paper, thus making that part of the process of writing less onerous (Daiute, 1983, 1985; Cronnell and Humes, 1981; Bruce et al., 1985; Olds, 1985; O'Brien, 1984; Shostak, 1984; Madigan, 1984; Newman, 1984; Richards, 1985; Withey, 1983; Watt, 1983; Levin and Boruta, 1983; Kurth and Stromberg, 1984; Bradley, 1982; Green, 1984; Collins, 1983; Kane, 1983; Appleby, 1983; Piper, 1983; Schwartz, 1982; Fisher, 1983; and Wheeler, 1985.)

Donald Graves has been quoted as saying:

> The aesthetics of editing really bothers kids, far more than I ever dreamed when I started the last study. . . . The computer helps with this whole process of adding and deleting information--a process that is such a hump for young and old writers to get over. You can take your manuscript and really chew it up without ruining the look of your printed page. At the same time, of course, you can keep files of your old drafts.
>
> From a research standpoint, the marvelous thing you can do with a computer is record on disk all the changes that a kid makes in the process of composing. . . . What you can do is store these changes and also classify the nature of the changes. You'll have a marvelous chance to study a writer's development, to look at the evolution of the kinds of changes he's able and willing to make in his text. . . . You'd get the whole revision profile of the writer over time (Green, 1984, p. 28).

This study explores the propositions of Graves; it investigates the nature of the revisions that a group of ten year-olds made in their writing, having experienced

the process approach to the teaching of writing and having had the opportunity to write with the aid of computers as writing tools.

CHAPTER 2

REVIEW OF RELATED LITERATURE

Writing

A study of the literature has revealed that most of the early research on writing (1955-1972) involved experimental designs seeking to find "good methods" in the teaching of writing. Only twelve percent of the studies were concerned with looking at what children actually did when they wrote (Graves, 1984). Furthermore, much of the descriptive data that have been gathered to date on children's writing has come from analyses of children's written products and not their processes. In the past decade, however, research on composing has shifted from a focus on the written product to one on the writing process. Recent studies have also attempted to document children's composing processes as they write (Lamme and Childers, 1983).

The Writing Process

Early theories of the writing process often described the process as linear, in terms of a three-stage model comprising planning, writing, and revising. But current research indicates that these models are inaccurate because writing is not linear but

recursive (Humes, 1983). Those linear models, "are inaccurate because they actually describe the growth of the written product, not the 'inner process of the person producing the product'" (Flower and Hayes, 1981, p. 369). As more and more such research information on the writing process has become available, teachers increasingly been expected to be aware of and apply this information in their instruction on writing and to provide more writing practice.

The recursiveness of the writing process is also described by Nold (1981) and Perl (1979): "Planning, transcribing, and reviewing are not one-time processes. As their texts grow and change, writers plan, transcribe, and review in irregular patterns" (Nold, 1981, p. 68); "Composing does not occur in a straightforward, linear fashion. The process is one of accumulating discrete bits down on the paper and then working from those bits to reflect upon, structure, and then further develop what one means to say" (Perl, 1979, p. 331).

Case Studies of the Process

Because interest in writing as a process is a relatively recent development, the amount of research is somewhat meager and consists primarily of case studies.

The earliest study of the composing process was conducted in 1946, when John Van Bruggen investigated

the rate of flow of words during composing for 84 junior high students. Van Bruggen found that "good writers" as measured by scores on standardized tests, spent more time in long pauses; less competent writers paused for briefer intervals. Additionally, good writers often paused before they wrote whole segments of text, while poor writers frequently paused before sentence and word-level tasks. Van Bruggen also discovered that students who had mastered the mechanics of writing wrote at a rapid rate between pauses; students who had not mastered these skills wrote more slowly (see Humes, 1983 for a further description).

The next major research was undertaken more than two decades later by Janet Emig (1971). Janet Emig's case study has broadened the context of investigation. Her research and the research of Graves (1975), and Graves, Calkins and Sowers (1978-80) focused specifically on what writers did during the composing process. Descriptions were also given of the contexts in which the data were gathered. Although this is a new research area in terms of a history of writing research, there is growing interest in the data coming from the studies. Emig's study is particularly significant because it has served as a prototype for subsequent projects. Emig found that students did little of their planning before they began translating on paper, and

they seldom outlined. She also found that students' composing processes for self-sponsored writing (i.e., writing students decided to do themselves, such as narrating personal experiences for friends) differed from those for school-sponsored writing (i.e., writing assigned by teachers). The students planned longer and reformulated more for self-sponsored writing, probably because of their commitment to the task, and they showed more instances of clearly discernible starting and stopping behavior. Emig concluded that students should be allowed to do more self-sponsosred writing in order to encourge good writing behavior, such as planning and revising.

Mischel (1974) replicated Emig's design, with similar results, in his study of a seventeen year-old high school student. His subject paid little attention to revising, although he did spend some time on reordering groups of words.

In Stallard's (1974) study, longer planning time distinguished the writing process of good writers. He concluded that "a major behavioral characteristic of the good writer is a willingness to put forth effort to make communication clearer to a reader" (p. 216). This conclusion was predicated on evidence that the good writers planned more, stopped longer and more frequently to review what they had written, and revised more than

did the poor writers.

In her 1979 study, Perl examined the composing processes of five unskilled college writers. These subjects generally revised to fix surface features such as spelling and punctuation.

Revision

Until recently, revision was ignored because it was a component of the writing process that was not available for inspection through traditional research strategies (Murray, 1978). Sommers (1980) suggests that the absence of research on revision is a function of a theory of writing which makes revision both superfluous and redundant. Writers and textbook authors who believed they were dealing with revision often were dealing only with one of its sub-processes, namely editing (Nold, 1979).

Studies of revision in the school setting suggest that methods used to teach revision and audience awareness may be inconsistent with current research on the nature of the writing process in general and on revision and audience in particular. Both teachers and students may have misconceptions about what revison really is, and consequently, students may equate revision with punishment (Emig, 1971; Spear, 1980). Teachers may encourage students to revise at inappropriate points in the writing process (Pferrer,

1980), and students may confuse revision and rewriting (Burnette, 1980). Monahan (1984) reported in his study of the revision strategies of basic and competent writers as they wrote for different audiences, that all the writers in the study made most of their revisions during the productions of drafts. The competent writers, however, were far more likely than the basic writers to revise after a draft was complete.

Three major more recent studies treated only one element of composing--the process of revising. These studies were reported by Bridwell (1980), Faigley and Witte (1981) and Sommers (1980).

Sommers (1980) studied the revising behavior of twenty freshmen college students and twenty experienced adult writers. Each participant produced three essays. All drafts were analyzed for the frequency of revision operations (i.e., deleting, substituting, adding and reordering) and for the levels of these operations (i.e., word, phrase, sentence, theme).

Analysis of the revisions indicated that the student writers did not employ either reordering or adding operations. Rather, they generally viewed revising as a rewording activity, and one of their greatest concerns was word repetition. Although students reported they sensed the need for more global revisions, they had not learned strategies for making them. The

experienced writers revised most frequently by adding and deleting at the sentence level, although as a group they employed all revision operations at all levels.

Bridwell (1980) examined the revising of twelfth-grade students. The analysis of their writing showed that surface and word-level changes accounted for more than half of the students' revisions. When students made any sentence-level changes, they usually made multi-sentence revisions. Furthermore, the most changes were made while students were composing the final draft. The final revised versions were rated higher in quality than were the early drafts, verifying the importance of the revision process.

In a similarly designed study, Faigley and Witte (1981) examined the revising processes of six inexperienced student writers, six advanced student writers and six expert adult writers. Faigley and Witte found that expert writers revised at a higher level than did student writers. The inexperienced students primarily corrected errors and made meaning-preserving changes, most frequently substituting synonyms. Advanced student writers made many similar meaning-preserving changes; however, they also made structural changes that altered the meaning of their text. Although the expert adult writers made a substantial number of meaning-preserving changes, they

also made substantially more changes that affected meaning than did either group of students.

The research provides some important information about the composing process. It indicates that the processes of writing are recursive and that the composing processes of successful writers are different from those of unsuccessful writers. Successful writers spend more of their composing time in the planning process, and they plan at a higher level. Furthermore, successful writers do not consciously attend much to the surface levels of their texts as they compose. Rather, they are concerned more with global aspects and thus work more on these higher-level elements when they revise.

Students need to learn how to get beyond an existing text (Bereiter and Scardamalia, 1982). When students overcome the idea that the first draft is the only draft, they become revisers, as is evident from the previously described research of Donald Graves. Providing feedback on elements in students' text can encourage students to change text and can provide them with insights on how their writing can be improved. Peer critics can also provide feedback that will help students make effective revisions.

Revisions of Younger Writers

Most case study research has been done with older

students, notably the work of Flower and Hayes (1979-80), Sommers (1980), and Perl (1979). Donald Graves (1984) wrote:

> Far more needs to be done with younger children. We need more information on child behaviors and decisions during the process, rather than through speculation on child activity during writing from written products alone. (p. 93)

A study of primary school students was conducted by Graves and his associates Calkins and Sowers (see Graves, 1983, 1984; Calkins 1980, 1983; Sowers 1981). The researchers spent three years (1978-1980) studying the writing of students in grades one to four. These students engaged in extensive writing practice that fostered their composing abilities. Children were observed before, during and after writing activities in their regular classrooms, and the researchers kept detailed records of the students' writing behaviors.

The researchers' reports on the behavior of the young writers in the Graves project provide a rich source of data on the composing process. Redrafting was particularly evident when teachers discussed the compositions with their student authors (i.e., conferencing) and when students were encouraged to read and discuss other students' writing. The focus on revision helped students to develop a sense of audience and of clarity and cohesion as well as to acquire revision skills. The first revision skills that

students mastered were mechanical changes such as correcting spelling and punctuation. As they became more confident with the mechanical aspects of writing, the students revised content, adding information and reformulating whole texts. Furthermore, the more the subjects drafted and revised, the more proficient they became at writing.

R. D. Walshe (1981) reported on Donald Graves visit to Australia and his speech at the Third International Conference on the Teaching of English, August, 1980. He quoted Graves as having said:

> Writing only truly becomes writing in revision. A professional's first draft is often not much better than anyone else's. It is chiefly in revision that the professional's experience and craftmanship show. . . . Young writers need to learn a whole repertoire for messing up their first drafts as they change pieces, insert, take out, reorganize. When children stop erasing and instead cross out, draw lines and arrows, or change handwriting from careful printing to a functional scrawl (knowing this to be only a draft) they show awareness that draft writing is temporary, malleable, meant to be changed. (p. 13)

Revision, however, presents an aesthetic barrier. The reason most children erase is to preserve the appearance of the paper. This occurs even in rooms where teachers stress lining out or drawing arrows as a revising procedure. Children erase because they want the text to be right the first time.

The following summary of the Graves' team's preliminary findings on revision may prove to be

useful to some readers as background information for this study (see Walshe, 1981, p. 62).

1. Children revise in other media forms such as block building, drawing and painting before they revise in writing. Children who demonstrate an overall learning stance toward revision in one area are more likely to demonstrate it in another such as writing.
2. When children try a new approach to writing, other areas in which they have been competent may suffer temporarily.
3. Beginning writers do not revise. Getting the new step down is enough.
4. Early writing is often impressionistic. Children put words down for a certain feeling. Feelings are revised only if the child senses the feeling is not accurate.
5. Invented spellings go through stages of development along with the child. They fall into different classifications--first inventions, words in transition, stable inventions, sight words. Words that are more stable, as in stable inventions and sight words, are more likely to be revised.
6. Toward the end of the primary years many children reach a point of equilibrium when

handwriting and spelling problems are behind them and messages flow easily onto the paper. Children do not revise these messages.

7. Eight-year-old children find it easier to revise topics about personal experiences than the experiences of others. They find it easier to recall their own experiences than the experiences of others.
8. Revision begins when children choose their own topics. Children who quickly arrive at a number of topics, learn to exclude some topics and write on others, are learning to revise.
9. Children who can quickly list personal topics for writing, and write a series of leads about the same subject, demonstrate a strong capacity for revision.
10. Peer audiences have an effect on children's revision and their use of new approaches to the writing process.
11. Teachers can play a significant role in releasing a child's potential for revision.
12. When children no longer erase, but cross out, draw lines and arrows for new information arrangements, or change their handwriting to a scrawl, they indicate a changed view toward words. Words, for these children are now

temporary, malleable, or clay-like. The words can be changed until they evolve toward the right meaning for these children.

13. Children who write rapidly are more likely to revise in larger units and sustain a single composition for a longer period of time than those who write slowly.

Computers as Writing Tools

The study of children's interactions with computers is a relatively recent phenomenon. The assertion of Papert (1980) that the computer environment may enhance logical thought sparked much of the current research on the impact of the computer on children's cognitive development. This research was aided by the introduction of such computer software as Bank Street Writer, which eased the child's access to the computer.

Wolf (1985) wrote that researchers working on computer learning have had to reexamine questions about the focal or generalizable nature of human thinking skills by asking whether an ability, such as computer programming, is an isolated skill or a fact of some broader planning ability. Wolf proposed that certain characteristics of word processing, such as easy, rapid input and cut-and-paste options may release writers from drudgery and in so doing reveal dimensions of the writing processes that were almost invisible in the

past.

Benefits of Writing with a Computer

Daiute (1982) identified several reasons why writing on computers seems to benefit children:

1. Less concern about making mistakes
2. Texts look better
3. Fewer motor-control problems
4. Students produce longer papers
5. Students revise more

Piper (1983) pointed out several qualities of writing with the microcomputer which make it a viable tool for writing instruction. Among these qualities are the following:

1. Enhanced student motivation and interest
2. Enhanced student awareness of the manipulative quality of language
3. Increased likelihood of student revision of writing
4. The provision of immediate feedback through print-outs and spontaneous interaction with video display
5. Easy stotage and ready availability of actual student writing samples

Cronnell and Humes (1981, p. 2) wrote, "What's especially valuable about a word processor is all the things you can do with your text after you've typed it

(or while you're typing it)."

> You can delete text--from a single letter up to a page or more. When you've deleted something, the text closes up so that you can't even tell there's been a deletion. Similarly, you can insert any amount of text, and the word processor accommodates the added text. You can also rearrange text. For instance, you decide that you want to move a paragraph; with a few simple operations; you can move that paragraph anywhere you want it (even into the middle of another paragraph). With a word processor you can also do minor things like change capitals to lower-case and vice versa. Then after you've made your changes you can print out your final text the way you want it. If you don't like what comes out, you can go back and change some more. In other words, the word processor is a great machine for revising (Cronnell and Humes, 1981, p. 2-3).

In his now classic Mindstorms, Papert (1980) wrote:

> For most children rewriting a text is so laborious that the first draft is the final copy, and the skill or rereading with a critical eye is never acquired. This changes dramatically when children have access to computers capable of manipulating text. The first draft is composed at the keyboard. Corrections are made easily. The current copy is always neat and tidy. I have seen a child move from total rejection of writing to an intense involvement (accompanied by rapid improvement of quality) within a few weeks of beginning to write with a computer. (p. 30)

Writing with a word processor has many advantages (Newman, 1984). It allows writers to become more willing to take risks, to be tentative about meaning for longer, to consider organization and word choices more freely than ever before. What this means is that children (and adults, too) can learn a great deal about language and the writing process each time they engage

in writing.

Revision

Considerable research (reviewed in Gentry, 1980) has indicated that revision is one of the most important parts of the composing process. But research has also indicated that students do not receive very much instruction on the revising process and that they do not revise very much (Applebee, 1981; Bamberg, 1978; Hoetker and Brossell, 1979; Murray, 1978). One reason that students do not revise is that it is a lot of work. It is easy enough to mark up a paper with all the changes--crossing off, drawing lines to move pieces, and inserting new information. But it is quite another matter to recopy the whole paper. It is a very time consuming, tedious and unrewarding task.

Revising with a Word Processor

Schwartz (1982) stated that word processing programs help alleviate the painful process of rewriting because revisions, deletions, general corrections and even movement of blocks of text are made with relative ease.

> By allowing learners to generate language without the penalty of recopying or retyping, teachers can encourage students to be more reflective and to employ more decision-making about how to communicate ideas. The writing act no longer need be largely a mechanical one. With the mechanical process made easier by the microcomputer, students can afford to become more creative and discriminating in the generation and expression of ideas (Schwartz,

1982, p. 27).

With a word processor, the work of revision is much easier. Major and minor changes can be made without having to recopy. The changes take place right before your eyes, and you can read your clean revised text immediately. In fact, with a word processor, revision can be fun.

Piper (1983) indicated that in order for the computer-tool to be used most effectively, it is important that students understand the processes behind the revisions they make. "Without proper instruction, student papers may improve mechanically . . . but may not improve in content (Piper, 1983, p. 5). Schwartz (1982) called this phenomenon "smokescreen revision" and cautioned that teaching students to strive for substance in content is a role the teacher must fill.

Word processing is being used to free people from the laborious revision and cleanup work needed in writing and thus to encourage them to focus on ideas and the playful use of language rather than on the mechanical aspects of written language (McWilliams, 1982; Paisley and Chen, 1982).

Microcomputers may prove extremely useful in the study of writing precisely because of their power to reveal editing behaviors (Daiute, 1984; Papert, 1980).

> Because electronic text is endlessly fixable, writing at a microcomputer can occur in a

> climate of risk taking. Since nothing a writer does is irreversible, it is safe to try a new word or to attempt a rephrasing. Moreover, microcomputer software makes text not only fixable but flexible. Unlike static text, in which large-scale editing is clumsy, electronic text can be reshuffled, expanded, or contracted with relative ease. . . . Thus, microcomputers make it possible for fairly young writers to attempt radical forms of editing on their own works in progress. In this way, microcomputers create the opportunity to analyze a very revealing level of editing behaviors even in relatively young writers (Wolf, 1985, p. 39-40).

The Study of Revising with Computers

Daiute (1984) commented:

> Revising is an interesting cognitive activity to study because it is difficult, and many writing researchers and teachers have found it to be important. Children's revising behaviors offer evidence of cognitive processes. As children revise their writing, we can see evidence of their intellectual development, such as the ability to reflect on their own thought processes, and evidence suggestive of effective writing instruction models.
>
> The computer seemed to be an appropriate tool for stimulating revision because word processing programs allow writers to change their texts by giving commands rather than by recopying. Young writers usually report that writing is easier on a computer because "You don't have to recopy"; "recopying hurts your hands and is boring." (p. 132)

The interactiveness of program commands and messages heightens writers' sense of the audience (Daiute, 1983). Some researchers have reported that displaying word processing commands for deleting or moving text can suggest to young writers that they revise. (Daiute, 1984).

In a study involving eleven and twelve year-old writers as well as thirteen to fifteen year-olds, Wolf (1985, p. 45) reported that the younger writers made revisions only when they came upon "glaring errors or discontinuities." Furthermore, Wolf commented that without explicit revision time or prompting, "line editing" (Graves, 1978) was the rule. Even when proofreading their narratives, both groups of writers confined themselves largely to upgrades at the level of individual words or phrases. The older writers in that study also made two other types of minor revisions. First, they deleted words and phrases in order to make their writing more compact and second, they attempted some within-sentence reorderings.

The research on writing and revision indicates that a major difference between skilled and unskilled writers lies in the way in which they edit their texts (Beach, 1976; Sommers, 1978). Poor writers appear to make changes only at the word level, whereas better writers consider the overall effect of their document, inserting and deleting large segments of text before combining the sentences for word-level errors (Wolf, 1985).

Wolf also pointed out that when young writers are asked to insert additional story material, they typically add material at the beginning, at the end, or at subdivision boundaries within their narratives.

Moreover, they usually add new events or dialogue instead of expanding on existing events. In contrast, adolescent writers were found to add material at any number of points within the text. Older writers insert text that thickens the portrayal of individual events and that often multiplies the ties to earlier portions of the text.

The tendency of many students to concentrate their revision efforts at surface and word levels has been confirmed by studies of the writing process (Bridwell, 1980; Perl, 1979).

Bruce, Michaels and Watson-Gegeo (1985), in their research involving the QUILL writing software, reported on the value of word processing as a factor in learning to write insofar as it allows ease of revision and the ability to read printed output easily. They also comment on what appears to be another very important factor in the writing process:

> The most important impact of microcomputers on writing may be changes in the larger classroom writing "system" rather than changes in the technology of writing (e.g., speed, printed output, ease of revision). In "milling around" the computer waiting for their turn to get on, students read each other's writing and interacted over it. These interactions affected both the content and form of student writing. Similarly, peer interactions during writing on the computer, student access to other students' work stored in the computer, and programs like "Mailbag" in which students send messages to each other, can affect students' understanding of purpose in writing, and their sense of audience. (p. 147)

Madigan (1984), in drawing from some of his earlier writing, summarized the case study research that had been done on the composing process as he saw it when students compose with pencil and paper.

> When given topics under in-class conditions, students start writing within 2-3 minutes, plan and revise text during pauses while they write, and afterwards minimally correct grammar, mechanics, punctuation, and spelling before recopying. The visible, larger stages of their composing process appear as a linear series of steps, and the products emerge sequentially. What they compose first generally appears first in their final drafts; what they compose last generally appears last. Student writers do not generally reorganize or rethink their text. They complete a paper in 30-50 minutes.
>
> When revising, students usually work at the sentence level. They correct spelling. They substitute words and insert or delete phrases and punctuation marks. Occasionally they insert or delete whole sentences. Sometimes they rearrange sentences. Seldom do they insert, delete or rearrange blocks of text, paragraphs or larger. Almost never do they re-think a paper, re-see it in the sense of re-vision, and change their text accordingly (Madigan, 1984, p. 145).

When students get on a computer, at first they seem to do what they have always done. Initially they think of the computer in traditional terms. In one study (Kane, 1983), eighth graders changed spelling, added, deleted or substituted words and phrases, and altered punctuation. They spent more time on their papers but did not change their revision strategies. The first paragraph they composed appeared first in their final drafts; the last paragraphs appeared last.

The process was linear and the product sequential. Changes were initially cosmetic.

But as students discover what word processors can do, their processes start changing. The tools shape them further (Madigan, 1984).

Kane (1983) noted that all five eighth grade pupils deleted sentences and paragraphs. That kind of revision is unusual for school writers. Kane inferred that the pupils felt their prose was more transient on a word processor than in handwritten copy. While all the pupils reported that they never voluntarily reorganized their handwritten texts, four of the five redefined or rearranged paragraphs. Bradley (1982) noted similar results. Children aged seven to sixteen first wrote more often and wrote longer papers, then edited surface features, then edited and reorganized to clarify meaning.

It is important to remember, however, that students' composing processes vary with a number of factors: (i) the time they have for writing, (ii) who decides they will write, (iii) how intellectually mature they are, (iv) what they have written before, (v) what they are to write now and (vi) what the teacher does to help (Madigan, 1981). Like their pen and paper processes, students' computer processes will sometimes be productive, and sometimes not.

The motivational aspects of writing with a computer reported by Bean (1983), Bradley (1982), Daiute (1983) and Schwartz (1982) were confirmed by the questionnaire responses of the students in the class studied here.

Madigan wrote that computers contribute "physical distance" to the students' more extensive revision strategies. That physical distance then contributes to aesthetic distance. Since the computer-produced text is less part of us, we feel freer to critique and revise it. "So rather than text as stone or quickdry cement, it's more like wet sand, ready to change with whatever electronic wave we may send its way" (Madigan, 1984, p. 146).

It has been found that learners seem to have had little difficulty in learning how to use a word processor when the emphasis has been on exploring the meaning of what is being written and not on the technology itself (Newman, 1984).

Writing on the microcomputer seems to cause the elimination of the "end-of-the-paper, end of the story syndrome" since there is no visible end of the paper. Since they see no paper, they are not cued in for closure. This is probably one reason why children write longer text (Jacoby, 1984).

Kleiman and Humphrey (1982) reported that learning disabled children seven to sixteen years of age, many of

whom had refused to do any kind of writing, began writing enthusiastically when permitted to use word processors.

> The most immediate result is that students want to write more often and produce longer compositions. Teachers of young children have reported that the length of the average essay doubles. The next change occurs when the children become familiar with the editing capabilities of the word processor. First they start being more careful to correct typing, spelling, and punctuation errors. Then they begin to change words and sentences. Finally they learn to reorganize the material, moving adding, and deleting large sections of text. They no longer just edit for details, but also pay more attention to the meaning of ideas and the order of presentation (Kleiman and Humphrey, 1982, p. 96).

Daiute wrote that computers could help reduce the constraints faced by writers because of the ability of the computer to store lots of information, correcting spelling, recopying and reformatting text. Letting computers do this type of work, writers free themselves for thinking (Daiute, 1983).

Collins (1983) reported on a study done involving fifth-grade children. It was found that children using a word processor paid more attention to low-level editing skills such as punctuation, capitalization, and spelling, and made greater use of the dictionary. This was especially striking among children with spelling difficulties. Students noticed errors more when the printing is on a screen rather than hand written. It

was also reported that the children who benefited most were the ones who had problems with neatness and spelling. It is not the children who are most gifted that benefit most; rather it is the ones who have the most difficulty in learning to write that benefit most.

Teachers Make the Difference

Kane (1983) points out that unless students have standards of good writing and can evaluate and revise their own work in terms of these standards, changes will not be improvements. A major conclusion of Kane's study of eighth-graders who used word processors was that initially students assimilate the technology to their model for composing. They use it as they use paper and pencil. Production is primarily linear and sequential. Most revisions are corrections in spelling and punctuation, though occasionally a single word or phrase is inserted or replaced. Kane (1983) suggested that although writing skills develop as students communicate through writing, the word processor may prove to be a useful curricular tool. With a tool that eliminates the tedious recopying that is now part of revising, students may be eager to develop strategies to evaluate and improve their texts.

Appleby (1983) wrote that it is in revision that the microcomputer offers most to us in the teaching of writing. Being able to rework materials without

retyping each time allows a writer to come closer to seeing the words as a reader sees them while still working as a writer and this is a major goal of all of us who teach writing (Appleby, 1983).

In commenting on current research, Wheeler (1985, p. 58) wrote:

> Not surprisingly, current research indicates that without proper teaching, inexperienced writers do not improve their writing by using a word processor. In fact, these writers are somtimes fooled by the illusion of the professional-looking copy. They tend to compose longer documents and revise more frequently. But their revisions focus on making changes at the word level, which don't necessarily add to the quality of the text.

On revision Hocking and Vieniesky (1983, p. 8) wrote:

> Once the revision ball gets rolling, it is catching. When students start to change wording and see how easy it is to move words around, they want to keep going. They get very critical and some, fortunately, end up changing all the wording in a paragraph or completely rethinking the original version. When less motivated students see those around them busily deleting, adding, and moving words, they are prodded by peer pressure to try. Many find that revision is less painful than they thought.

Wilma Bell (1983) wrote that revision means much more than correcting circled spelling errors and rewriting sentences marked "awkward". She believed that revision is the area in which to build skills that lead to clarity, logical development and style, "the sine qua nons of good--not just correct, but effective--writing."

> Correct is not only too low a standard for writing: it engages the writer on too low a cognitive level. Effective writing requires the writer to move up to the highest levels of cognitive activity.
>
> The word processor can be used to free the writer to climb up the cognitive scale; there are word processor utilities that will support the writer's performance at the levels of analysis, synthesis, and evaluation. (Bell, 1983, p. 20)

Word processing programs, unlike either grammar or writing assistance CAL, combine technology with the talents of teachers in fostering the writing craft (Miller, 1984). Authors such as Graves (1983) advocate a master/apprentice relationship between teacher and pupil where the student is led through multiple drafts to a polished piece of writing.

Word processors carry no explicit or implicit theory of how the writing process should be fostered. The word processor would appear to facilitate a whole language approach to writing (Miller, 1984).

If children revise just because they are told to revise, they will not find out what good writing is all about. Successful writing requires a sense of purpose and a vision of an audience. Children should learn to realize that revising is needed because they have not gotten across their ideas to a particular audience. The computer itself does not teach this attitude toward revision, but it does make revising a lot easier. Reaching the stage at which children know what they mean

and want to write it requires a good teacher who creates a sense of audience. The computer is only a tool; the teacher is the guide.

Donald Graves states that the point at which children sense the gap between their words and their intentions is a crucial breakthrough in writing--a breakthrough that a computer can advance.

> Research has for a long time suggested that to improve writing, one needs to write. For several reasons, all of them well known to experienced classroom teachers, it is difficult for students to produce the number and variety of composition assignments necessary. Current reports suggest that the use of word processing in teaching writing is beginning to encourage students to compose more and longer texts. Although there is no clear-cut evidence yet that students are writing better, the motivation to write is high, and students' affective responses to writing assignments are positive (Shostak, 1984, p. 9).

In an interview reported in Classroom Computer Learning, Donald Graves said,

> From a research standpoint, the marvelous thing you can do with a computer is record on disk all the changes that a kid makes in the process of composing. . . . What you can do is store these changes and also classify the nature of the changes. You'll have a marvelous chance to study a writer's development, to look at the evolution of the kinds of changes he's able and willing to make in his text" (in Green, 1984, p. 28).

CHAPTER 3

STATEMENT OF THE PROBLEM AND OVERVIEW OF PROCEDURE

Statement of the Problem

It has been shown that current scholarly writing points to revision as being one of the most important but least taught aspects of children's writing. Even when children do revise their work, research indicates that revisions are generally at only a superficial level. Once a draft is written, changes are difficult to make without tedious recopying. Students tend to see the first draft as the final draft.

Recent reports on the use of word processors in the writing process point out the ease with which students may make higher level revisions such as additions, deletions or rearrangement of material. There has been relatively little research, however, of the revision processes of young writers who use word processors. Even less research has been of the case-study variety whereby individual students are observed to determine writing behavior while they write using word processors. Research to date has been (a) product rather than process oriented, and (b) with older students.

Since relatively little research into the writing process using word processors has been done, especially

at the level of the elementary school, the use of word processing programs on microcomputers to help improve students' writing is an area deserving more attention than is now the case.

A question worthy of further investigation is whether grade five students who have learned to use a word processor, and who have been exposed to the process-conference approach to teaching writing, do indeed use the capabilities of the word processor to make higher level revisions in their written work instead of superficial word level changes. It is this question that is addressed in this study.

The level of revisions was compared to other factors such as age, ability, typing speed, and facility of use of the word processor to determine the relationship of these factors to the extent to which children revise their written work.

Overview of Methodology

The case-study method of research was chosen for this project because of the recent call for more studies of this nature and because it seemed a most effective means for determining the variables that seem to bear upon a child's revision processes.

A pyramid design, similar to that used by Graves and Calkins in their New Hampshire study (see Graves, 1984; Calkins, 1982) was used (see figure 1)

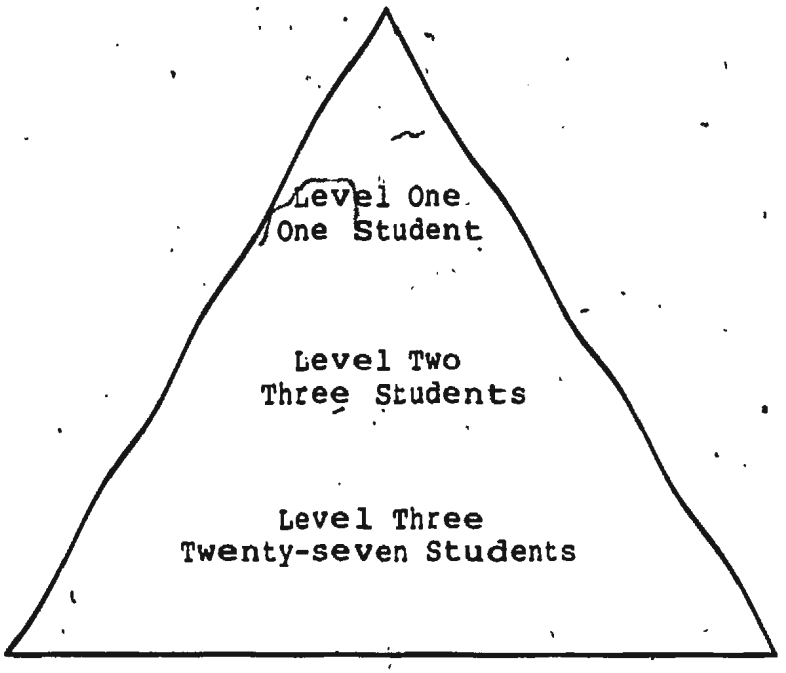

Figure 1

Pyramid design of the study

whereby the children's revision strategies were mapped through a focus on one child (level one of the design), a more peripheral study of three other children (level two of the design) and informal observations and product analysis of twenty-seven other students (level three of the design). From the comparative base of levels one and two, one was better able to interpret and assess the revision processes of the other twenty-seven children studied less intensively.

Data were gathered for this study over a five month period from December, 1985 to April, 1986. Included were data from direct observation, product data and interview-conference data.

First, the children were provided with a minimum of touch typing instruction prior to beginning to use the word processor. Each child received an orientation to word processing by means of the programs's built-in tutorial and researcher-designed activities. For the most part, these activities were designed to facilitate the learning of the word processor's editing features.

In consultation with their classroom teacher, time was provided for the children to complete three pieces of their regularly scheduled writing using their school's Commodore 64 computers and the Bank Street Writer word processing program.

When working on a particular piece, the children

wrote daily in one of four half-hour time slots reserved for them. Printouts were provided for the children each day and these were kept by them in their classroom in individual writing folders. Copies were also made of each child's daily work by the researcher for later analysis.

Information regarding typing speed and the students' facility in the use of the word processor was gathered. A measure of their overall ability was obtained.

At the end of the research period, each child's writing was analyzed and the number and type of revision recorded. This data was then compared to the data on age, ability, typing speed and facility of use of the word processor to determine significant relationships.

CHAPTER 4

DESCRIPTION OF THE PROCEDURE

For this chapter of the report a more anecdotal, narrative style has been chosen in which the use of the first person is intended to make the description of the procedure more meaningful to the reader, to tell the story of the data so that the research information written here might be more easily transferred to the classrooms of interested teachers. It is with the above thought in mind that I embark on the remaining parts of this report, hoping that this information will be able to be used by others eager to investigate the use of computers as writing tools by children.

Procedural Features

The Site

The site for this study was a primary/elementary school housing grades kindergarten to six with a student population of approximately 575 and a staff of twenty-nine. It is located in a fast-growing modern town, whose families are mainly middle class with high educational aspirations for their children.

The school has a very active P.T.A. which has raised money to purchase nearly all the computers used

by the school. The parents have expressed a positive interest in their children's use of computers in the school.

The library in this school is treated as an extension to the classroom and it is the rule, rather than the exception, for children to be seen busily working on various curriculum-related projects at all times of the school day in the library whether they be research-oriented, reading for pleasure, or computer activities.

Equipment

Six of the school's Commodore 64 computers are kept in the library. They are used in conjunction with classroom activities not only to provide a computer literacy aspect to the curriculum but to help meet curricular objectives in the most efficient manner. As well, I provided two other Commodore 64's for the study--my own and one borrowed from the school board's media centre--for a total of eight.

At the present time, one of the major student uses of these computers is for word processing. The word processing program Bank Street Writer was chosen for use by the students because of its ease of use and menu-option editing features. One copy of the program disk was available for each computer as was a data disk for the daily saving of student work. Printouts of the

students' work were made on a dot matrix printer giving acceptable print quality for xeroxing.

Personnel

As librarian I was in a position not only to arrange time for the subjects to write but also to observe the students writing as part of my teaching.

The co-operating classroom teacher in this study was a colleague in the school. Her class was chosen for study mainly because of her positive attitude toward flexible scheduling, use of library facilities and personal interest in the use of computers in education. Her co-operation, keen interest and professional opinion were prerequisites for involvement in the project as it meant a five month commitment.

The Sample

The sample for this study consisted of a heterogeneously grouped class of thirty-one grade five students--sixteen girls and fifteen boys--ranging in age from ten years to eleven years, eight months on January 1, 1986. The average age on January 1, 1986 was ten years, nine months.

The measure of ability used was the language composite score from the Canadian Test of Basic Skills administered when the children were in grade four. The percentile scores ranged from ten to ninety-nine.

As I expected, the attitude toward beginning to

write with the help of a computer was very positive. None of the children had any prior exposure to word processing at the beginning of the project, although eighteen students, some sixty-two percent of the class, had computers of some sort at home. In taped interviews on December 2, 1985 when I asked them if they thought computers would make any difference to their writing, comments such as Paige's, "Yes, because it makes you express your sentences better," or Hilda's, "Yes, because I usually have a problem putting my periods in the right places," were typical. None of the children had had any previous instruction in touch typing at the beginning of the study.

Assignment of Subjects to Observation Levels

In the three-level pyramid design of this study, the entire class of thirty-one students served as the base of the pyramid and is referred to hereafter as the level three group. Much of the data gathered from this large group was product rather than process in nature. Each student's writing was analyzed daily to ascertain the number and type of revisions which were being made from one day to the next. Only informal observations of the writing processes of these students were made.

Four children (three boys and one girl) were chosen randomly from the alphabetic class list using a table of random numbers for level two of the study. After

consultation with the classroom teacher and a period of observation, one child was chosen from the level two group to serve as the subject of most intense observation, a level one. This boy was chosen because he was of average ability and, it appeared, would give more than the usual amount of information about his processes of writing. To protect the identity of the subjects, their real names are not used in this report of the project.

Scheduling Time to Write

It was necessary to divide the original thirty-two students into four groups of eight because of the limited number of computers available. (One student transferred out during the school year and was therefore not included in the final analysis of data.). Because I wanted the children to write daily while working on a piece of work, it was necessary to arrange for some of the children to do their work outside regular school hours. Persuading them to do this was not a problem because of their very high motivation towards doing some of their school work on a computer. This did, however, make it necessary for me to consider such factors as bussing, lunch arrangements and walking distance from school. In consultation with the classroom teacher, four half-hour time periods were reserved for the children to write. One group was to work in a before

school slot--from 8:20 a.m. to 8:50 a.m. (slot A); a second group would write in "class time" during the day (slot B); a third group wrote in the second half of their lunch break from 12:40 p.m. to 1:10 p.m. (slot C); the fourth group wrote after school from 3:30 p.m. to 4:00 p.m. (slot D). Children who lived close enough to walk to school or who could get early rides to school were suggested for time slot A. Those students who stayed in school for lunch naturally fell into time slot C. Students who did not travel by bus and who lived close to the school were selected for slot D. Late afternoon winter darkness was a concern so only those students who got rides home, who lived very close to school and who were not involved in other extra-curricular activities were chosen for slot D. Slot B was reserved for those students who could not come early in the morning or stay after school.

It was arranged for each of the four students in levels one and two to be placed in separate time slots thus making for easier observation of their writing.

Orientation to Typing and Word Processing

Actual work with the students began on December 2, 1985, three weeks before their Christmas break. In that three week period the children each completed the five lesson tutorial that comes with the Bank Street Writer program. That tutorial included lessons on entering

text, cursor movement, erasing and "unerasing" (recovering erased text), moving blocks of text and searching/replacing. I provided exercises designed to have them practice the editing features as well as saving and retrieving their text files to and from their data disks.

The children were briefly exposed to a touch typing tutorial program from which they learned the home row of keys, correct finger placement, and the division of the keyboard into left hand/right hand halves. Time did not permit an extended period of practice with that program but I provided them with cutout paper keyboards on which to practice finger placement.

Teacher as Model

Just prior to the Christmas break, I provided the students with a short "story" which I had written and saved to disk. In a "'round the computer" conference I read them the story from the screen and then prompted the students to ask me questions which would require me to give more detail or make changes in the story to clarify the intended meaning. In this way I introduced them to a) revision as a natural part of the process of writing, b) the ease with which changes could be made with the help of a word processor, c) the conference-process approach to the teaching of writing, d) the importance of having a sense of audience (tried

to impress upon them that other's perceptions of my writing were important to me), and e) the notion that the initial draft was only the first step toward a finished product.

The Writing Folder

After the Christmas break, in the first week of January, 1986, each student was provided with a letter-size file folder computer-labelled in large letters with his or her name. It was explained that they would be provided with a computer printout of each day's writing and that they should keep their work in the folder in their classroom, bringing the folder with them to the library for their writing session. They were told to feel free to pencil in any changes or make any notes they wanted to make on their printout between writing sessions.

I dated the printouts as they were produced and sent them to the classroom where a student prefect sorted them. The students then fastened them in chronological order in their folders. The teacher provided space on a table in her classroom for storage of the folders.

Topic selection

Although I realized that students are more likely to revise personal narratives than either fiction or content area writing, I wanted their writing in this

study to be directly related to writing they would be routinely asked to do in their social studies class. This was partly because "writing across the curriculum", not just in "language arts class", has received recent emphasis in this province.

It was decided in consultation with the co-operating classroom teacher that the first topic of writing would be an entry in the diary of a settler at John Guy's settlement at Cupids in the year 1613. Early explorers and settlers were being studied in grade five at the time and the students had some limited background knowledge of the history of the Cupids settlement.

The topic of session two, written when the students were studying the "grandparent's days" section of the social studies curriculum, was a last will and testament of a Newfoundland outport resident of the 1920's. This was to be written after the students had been on a field trip to the Newfoundland Museum. A major part of the museum's display is made up of household and fishing stage effects from the early 1900's. As well, these children had gathered old items of interest and set up their own classroom museum.

Writing session three, set to begin the day after a visit from local folk musician-story teller Kelly Russell, was a retelling (in writing) of one of Ted Russell's "Chronicles of Uncle Mose" that they had heard

told by Kelly Russell.

Methods of Data Collection

From the middle of January to near the end of April, primary emphasis was placed on gathering case study data on the student in level one of the design and on the three others in level two. Secondary emphasis was placed on gathering data from the larger level three group. Data were collected from a) the naturalistic observation of the four children while they were writing at the computers, b) tape recorded conferences with those four students, c) informal interventions while the children were writing, d) a questionnaire designed to determine attitudes toward writing with computers at the end of the third writing session, e) a test to determine typing speed, f) a test to measure the students' facility in the use of the Bank Street Writer word processing program and g) revision analysis of the writings in the folders containing some ninety pieces of writing produced by the entire group with the help of the computer.

This method of data collection made it possible to follow findings from the larger group to an individual case and, conversely, from the case and/or small group findings to the entire group of children studied.

I assigned each child to a work station and asked that they keep the same computer whenever their group

came to write. In that way I could assign each child in level two to a computer which would allow easiest visual access by a researcher without it being obvious to the students. When observing the children write, I positioned myself sitting about two metres away from the child under observation (see Figure 2). This position allowed me to see not only the level two student's screen, hands and profile, but the screens of four other students at the same time. It was therefore not obvious to the students which of the five monitors I was observing at any one time. I would occasionally circulate around the room in order to observe the other three students' screens.

Observing and recording a revision on a word processor requires a more intense vigil than watching a writer use pencil and paper, that is, one must "be there" at the time the revision is made as there would be no obvious indicator such as an eraser smudge, crossed out words, or arrows indicating insertions on the screen as there would be on paper. However, the vertical orientation of the computer monitor makes it easy to keep one's distance while still observing any changes being made in the text.

I tried to record behaviors associated with the writing process in addition to the actual writing

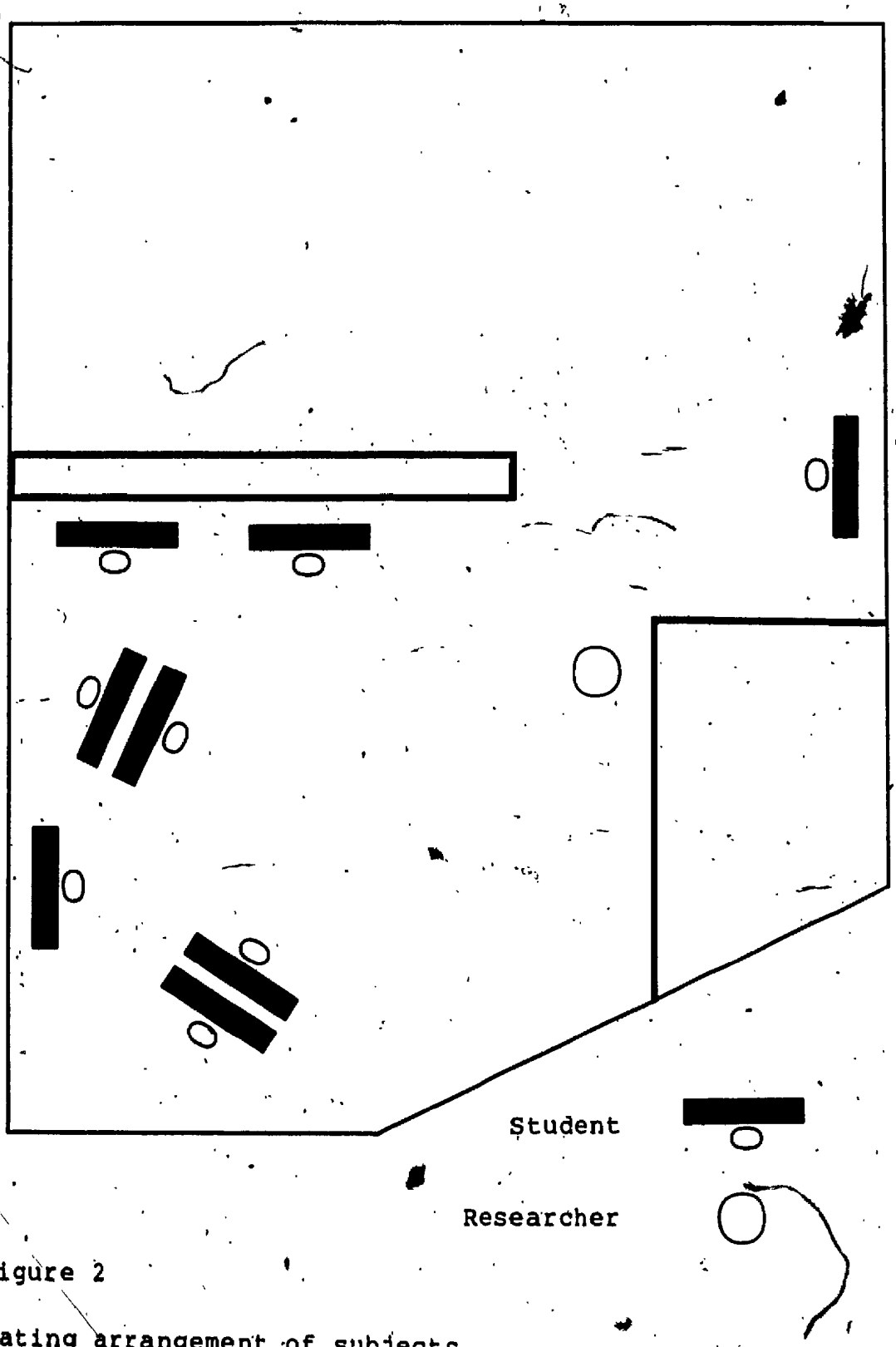

Figure 2

Seating arrangement of subjects

itself. Long pauses associated with rereading or contemplation of ideas, pupil interactions, interruptions, researcher interventions, verbalizations, resource use (dictionary, thesaurus, etc.), and approval solicitation were all examples of observable behaviours.

When a group positioned itself at the computers to write, a few minutes were occupied while they loaded the Bank Street Writer program into the computer and then retrieved their files from the data disks. While waiting for the program to load (about two minutes), the researcher observed pupil interactions and made notes as these interactions related to discussions of their folders, drafts, word processors, topic, story content or revisions. It was in this prewriting phase that many interesting comments were noted.

Field notes were recorded on pages in a spiral notebook ruled horizontally about half way down each page. The name of the student being observed, the date and the time was written at the top of the page. If the student made any revisions to the previous day's writing, these showed up as visible changes on the printout of the current day's work. As circumstances permitted, as the student wrote, I recorded his or her exact words on the top half of my field note page. Because of the rate of typing of most students, about ten words a minute, it was not difficult to keep up with

their text entry. Any changes (additions, deletions, substitutions or reorderings), rereading, interruptions (solicited or unsolicited), resource use, or use of language (eg., whispering), were then numbered at the exact place in the text where they occurred and then numbered reference was made to them on the bottom half of the field note page.

From time to time, the researcher intervened and elicited information from the child when he of she was engaged in a writing episode. The purpose of this procedure was to gain understanding of the child's rationale for a previous operation or insight into his strategies for future operations. These interventions were infrequently employed to minimize the observer's effect on the child's writing.

Each child was asked to save his or her work on a data disk using a common identifier followed by their initials. I had used the letters XX as an identifier for the orientation sessions so my work could easily be identifed by the students on the disk directory. As well, the children liked to use the password protection feature of the Bank Street Writer which prevented unauthorized viewing of their text files. Thus, the three pieces of writing were saved on the data disks using GUY.XX, WILL.XX and MOSE.XX as file names (where XX equalled the child's initials) and FIVEC as a common

password.

At the end of each writing session, there was always a little time while the students were saving their files on their disks for observation of further pupil interactions. Time slots A, C and D permitted this more so than slot B because the students often came earlier than necessary in the morning and lunch time and often stayed later than necessary in the afternoon. The afternoon group often liked to observe their files being printed out on the printer. Since two copies of their writing was printed, a printing session at the end of the day would result in many metres of fanfolded paper being produced. They delighted in seeing how far this would stretch across the library before being separated into individual printouts.

The ~~tape recorded~~ conferences allowed me to accurately record student feelings about how they felt about their own pieces as they were developing, permitted recording of some peer-conferencing as well as some other interesting interactions.

For example, in one recorded conference during the writing of the first piece, when discussing what the settlers may have eaten during the winter, Wanda suggested to Evan that the settlers might have eaten bacon from their pigs. This suggestion then turned up in Evan's next day's printout of his story. When Evan

was asked what time he got up on the morning in his story, he replied, "I didn't have a clock." This led to him attempting to clarify his intended meaning that he, "woke up with the sun shining in the window." When someone asked Mary the same question, it was suggested that she say the leaves blowing in the wind and brushing against the house woke her. She then incorporated this idea into her story. Evan realized after reading his story to his group that he probably wouldn't be planting crops in November. This indicates that peer interaction is an important area of the writing process to observe.

The questionnaire was administered at the end of writing session number three. It solicited from the students opinions about writing with a word processor--their likes and dislikes, ease with which they learned to use the computer, perceptions about their own typing speed, the importance of revisions in the writing process, and their feelings on whether they would like to continue to use a word processor in grade six. An analysis of the questionnaire results is found in Chapter 6.

Two tests of the students' typing speed were administered. The first was given before the first piece of writing in January. The second was given after the third piece of writing in April.

A timed test of the students' facility with the use

of the Bank Street Writer program was administered after the third piece of writing. First, the students were required to retrieve a file from a data disk. They were then asked to make revisions to the text passage which required them to use each of the editing features of the word processor. Finally, they were asked to save the altered file back onto the disk using their initials as an identifying file name. Their completion times were recorded by the researcher.

Method of Revision Analysis

When all students in level three of the design had finished their third piece of writing on the computer, the researcher began analysis of the revisions from one day's printout to the next for each of the three assignments.

A method of analysis adapted from those used by Faigley and Witte (1981) and Sommers (1980) was employed to categorize each revision. No attempt to distinguish between those revisions that affect meaning and those that leave meaning intact is made in this study of younger writers. Although lengthy pauses in writing were noted in the case study of Evan's revision processes, this study does not delve to any great extent into that which Murray (1978) refers to as internal revision. The revisions were categorized as either a) formal changes (i.e., changes

in spelling, tense, number, abbreviation, punctuation), b) additions, deletions, substitutions, or reorderings at the word, phrase or sentence level, or c) textual changes (i.e., major changes in content or direction). In essence, the significance of revision was quantified according to the length of change.

The categorized revisions were then tabulated. For the purposes of comparison, measures such as the number of revisions per hundred words and the percentage of revisions other than at the formal level were calculated.

Gathering the Data: Level 1

The most intense observations in the study were made of Evan, the student chosen for level one. The data included notes not only on his written product and writing processes, but also on his behaviour, attitude toward writing with a computer, interactions with his peers and conversation with the researcher before, during and after the writing sessions.

Evan had been chosen from the level two group as the subject for level one of the design based on observation by the researcher and discussion with the classroom teacher. Evan was a student of at least average academic ability. He seemed eager to co-operate, was receptive to conference suggestions from the researcher and his peers and was not reluctant to

discuss his feelings about his writing. Furthermore, Evan was one of those students who always wanted to help out around the school in whatever way he could--not as solicitation of attention but from genuine caring.

This was Evan's first year at this school and he had fit in right away. He had a witty sense of humour, was emotionally mature in many ways and had none of the "cockiness" associated with some of the older students. He seemed a natural for observation.

When I arrived at school at about eight o'clock, Evan would either be waiting at the front door of the school, offering to help the school's caretaker with his morning duties or just arriving in his dad's truck, having gotten a ride with his dad on his way to work.

Evan, physically small compared to some others in his class, bookbag held securely to his back by two straps over his shoulders, would run over to my car as I parked in my usual spot. He knew that I would often have my briefcase, paper-bagged lunch, printer, computer, disk drive, monitor, box of student folders and other assorted odds and ends to carry into the school, especially on Monday mornings after I had taken my own computer equipment home for the weekend. He would open the rear door, reach in to lift out the nearest item to be carried, give his usual cheerful greeting, and launch into a description of some

earlier morning event or breakfast, often before I had unfastened my seat belt and turned off the morning radio news. Evan always referred to me as "sir". It was "sir's disk" or "sir's printer". I assumed he had acquired this refreshingly respectful salutation at his former more rural school, as it was an unusual practice in the current setting. Until they got used to it, his classmates could often be seen quietly chuckling to themselves when Evan used "sir".

Once inside, Evan would deposit his burden beside my desk and hustle off to his classroom to take off his winter boots and hang up his coat. Just as I was getting things organized, he would often arrive back in time to load all eight program disks into the computers. As he knew where everyone sat in his group, he sometimes would have time to retrieve the entire group's files on the screens before the rest of the group arrived in ones and twos. It had not taken Evan long to figure out everyone's initial-identified file name and common "secret password." The data disks were numbered as were the computer stations, so they were easily matched.

Evan was ten years old in January, 1986. Two others in the class were the same age; none was younger. On the typing speed assessment administered in April, 1986, he scored 14.3 words per minute, the fastest in the class. On the test used to determine their facility

with the use of the Bank Street Writer program, it took Evan three minutes fifty seconds to complete the requirements, again the fastest in his class. On the measure of ability, Evan had scored in the top twenty percent.

It quickly became evident that Evan enjoyed using the computers. During the course of the study, he became a whiz at using all of the features of Bank Street Writer and often was called on by members of his group to be the resident word processing consultant. He liked the role.

Evan was scheduled to write in time slot A--the before school group. However, he also was one of students who stayed at school for lunch. Whenever, one of the slot C students was absent, Evan would volunteer to "fill in" for that person.

Evan began working on his first writing assignment in slot C on January 14, 1986. The first session's observations are documented below:

The Badest Winter (1) Ever
One day in cu Cupids (2) a big storm came (3) up (4, 5). It killed eight people and the (6) horse, cattle and (7, 8)

THE BADDEST WINTER EVER (9)

(10) One day in Cupids a storm came (11) giant storm came up. It was terrible it killed eight people (12) and all the sheep, cattle and pigs John B (13) Guy brought over from England. (14) In between all this (15) a baby (16) was born at the same time. (17) After

that horrible winter we planted potaes (18) potaoes and other kinds of vegtetables. (19, 20)

Researcher's notes:

1. changed lower case "w" to upper case "W" in title
2. deleted "cu" and writes "Cu" for Cupids
3. note that he is typing with two hands, two fingers
4. paused about 60 seconds thinking
5. decided to end sentence here
6. looked around at what others are writing
7. moved cursor back to erase "horse"--verbalized ERASE commands while going through the ERASE procedure
8. decided to start from beginning without erasing previous text
9. typed title in all capitals
10. skipped line and indented paragraph
11. deleted "storm came" to inserted "giant" storm came
12. stopped and rocked chair back and forth for about 15 seconds
13. deleted "B" and typed "G"
14. stopped, looked around--appeared to be thinking
15. paused for about 15 seconds appearing to search for correct wording
16. asked researcher when the baby was born i.e., if it was in the winter. Researcher suggested winter
17. distracted by sound of melting ice dripping on an outside vent hood and heard through the library

ventilation duct--commented to Edward about the sound it makes

18. deleted "es" and adds "oes"

19. Told Scott how to get to the transfer menu to save his work on the data disk

20. After saving his own work to disk, he asked if he might "see if it is on the catalog" and called up the catalog of files on that particular disk to see if his had actually been saved

[End of Writing Session One, Assignment One]

A group conference was held prior to the next writing session on January 15 in slot A. The group members read what they had written thus far and suggested how they were going to proceed with their stories. As a result of the conference, Evan decided to concentrate on giving the details of one day's activities at Cupids instead of a general view of the whole winter. It was also in this conference that Evan received the suggestion from a classmate that he should write what time he got up in the morning. Evan replied that he would not have had a clock. He provided the requested information by indicating that he woke up because of the sun shining in a window.

The writing phase was rather short because of the time taken up by the first conference. Evan retrieved

his file and used the ERASE function to erase all that he had written to that point. His draft now began:

THE BAD DAY IN CUPIDS

One day I woke up with sun shining on me.

[End of Writing Session Two, Assignment One]

Evan's third writing session was on January 17 in slot A. He retrieved his file and added:

So I decided to work out in the field. About noon a huge storm came up. (1) I had a great piece of bacon from a pig. Then I took a nice hot bath. After he (2) I (3) heated 7 pots of water. I got out and driied (4) myself (5) with a rough towel
Then I decided to do my winter chores. Go out and cut down ssom (6) trees

Researcher's field notes:

1. Intervention by researcher:

Researcher: Evan, what did you do just after you were awakened by the sun shining in through your window.

Evan: I guess I had breakfast.

Researcher: If you were going to tell something in your story about your breakfast, where would you put it?

Evan: (indicates by pointing to screen)

2. changed he to I

3. paused to look at printout in folder

4. deleted one "i" from driied

5. solicited information from researcher about whether they would have had towels

6. corrected spelling of "some"

[End of Writing Session Three, Assignment One]

On January 20, Evan added:

After my fifth tree the sky turned (1) black as tar. All of a sudden a storm swarmed up. (2) It killed one (3, 4) person some of the animals. Everybody shut their shutters and stayed (5) Everybody rushed into their home shutting their shutters. (6) For super (7) supper we had meat from a cattle. ah that was great. Then I took my mind off the storm and went to bed.

Researcher's notes:

1. reread using finger on screen as guide

2. went over to Melanie to help her insert a word, told her she forgot to space

3. turned around to look at the fish in the aquarium

4. paused to listen to others interact

5. said, "Must get them home before they shut the shutters." Deleted "shut their shutters and stayed" and continued

6. said, "Now suppertime. Did I skip dinner?"

7. changed "super" to "supper" after telling difference between the two words

[End of Writing Session Four, Assignment One]

Evan had another opportunity to write in slot C on

January 20. In an effort to gain more background information for his story, he read a chapter about John Guy's settlement from Fourteen Men. As he read, he exclaimed, "Goats!" in a surprised tone as if he intended to insert it into his story. He read about the pirate Peter Easton's role in terrifying the settlers, commenting aloud as he read, "We read about Peter Easton in geography." In his reading, Evan came across the word "severe" and commented, "Severe. . . s-e-v-e-r-e. . . I knows how to spell severe now."

At that point Evan retrieved his file from the disk and changed his title to:

THE TERRIBLE WINTER IN CUPIDS COVE

[End of Writing Session Five, Assignment One]

In slot A on January 21, Evan reread what he had written to date then erased a sentence telling about the animals and people being killed and inserted in its place the sentence:

> I dropped the axe and ran as fast as I could. I fell down where I had no snowshoes on. I had seen everybody rushing into their home and shutting their shutters.

He then reread again and deleted the phrase "from a pig" from the beginning of his story and inserted "The wind blowed harder and harder."

[End of Writing Session Six, Assignment One]

January 24 was Evan's final session working on the first piece of writing. He felt that his story was finished and felt quite proud of his first story written using the computer. Because of an interruption, I was not able to directly observe Evan's final editing but any changes were noted on the final printout.

[End of Assignment One]

Work on the second assignment did not begin until March 10. Evan began writing in slot A on that day:

To my oldest son,Jake (1) I shall leave my fishing boat (2). TOmy (3)
To my (4) second son,Fred shall (5) leave (6) all of my fishing gear.

Researcher's notes:

1. changed lower case "j" to upper case "J"
2. paused, thought, rubbed hands together, turned around to look at me and paused a further 30 seconds before continuing
3. deleted "TOmy" and started new paragraph
4. said, "I want to change oldest." He went back and changed oldest to eldest.
5. said, "Wait I got to have a house. I know, I'll give the third son the boat and the first son ~~the house.~~"
6. verbalized text as he wrote

[End of Writing Session One, Assignment Two]

On March 11 Evan reread his text and commented, "I've got too many shalls, maybe I'll put in a will." He changed "shall" to "will" in Fred's sentence. He continued to write:

To my fifth son, (1) Garry I will leave all the furniture down stairs of the house. (2)
To my only daughter I shall (3, 4) Donna I shall leave the three rooms of furniture upstairs of the . . .

1. stopped to consider another name
2. stopped to help Gail and Paige
3. deleted "I shall" to insert a name
4. reread, rocked on chair, looked around, looked at keyboard 30-45 seconds and said, "Got it!"

[End of Writing Session Two, Assignment Two]

After a conference on March 12, Evan decided that he would like to make changes which would leave furniture to different people rather than all to two people. He changed Garry's bequest to tables and chairs. He then reread his text and inserted commas to separate the names from the rest of the text.

Evan then declared that his will was complete.

At this point Helen was overheard to say, referring to the edit mode menu, "I want to fit a word in but there's no fits on here."

[End of Assignment Two]

Writing on the third and final assignment began on April 16 in slot A. Evan wrote:

Babysittin'

One joy that I will never forget is babysittin'. (1) One night Suz, x, z (2) went to the (3) wanted to go to the Woman's Aso (4)

Researcher's notes:

1. paused to think
2. decided to use x and y for names of characters and to use the REPLACE function later to change them
3. deleted "went to the"
4. went to dictonary to look spelling of association

[End of Writing Session One, Assignment Three]

On April 17 Evan first used the REPLACE function to change x and z to Aunt Sophie and Grandma Walcott. Then he continued:

Liz was the baby sitter but she would come over and chew bubble gum and play her dumb records (1)

1. checked to assure he had left two spaces between sentences

[End of Writing Session Two, Assignment Three]

During his April 23 writing session, Evan decided to use "xx" for "Grandpa Walcott" and "qq" for "the

baby". At the end of the session he made the appropriate replacements before saving his work.

[End of Writing Session Three, Assignment Three]

On April 25 Evan asked the researcher, "Should I put in the part about the formula? I think it goes before the fat." He then thought aloud, "What was the formula they knew?" Again when finishing up this final piece of work he thought aloud, "I've got to replace one thing," and replaced an overlooked "zz" for a commonly used name.

[End of Assignment Three]

I believe late in the period of this study, it became clear that Evan had begun to revise internally. His drafts were fewer in number. The first drafts were of higher quality and he began to be able to articulate more about the composing process. A summary of Evan's revisions obtained from analyzing his writing from day to day is shown in Table 1.

Table 1

Summary of Evan's Revisions

Assignment 1

	Formal	Word	Phrase	Sentence	Text
	8				1
Additions		0	4	5	
Deletions		0	1	2	
Substitutions		4	1	3	
Relocations		0	0	0	

Assignment 2

	Formal	Word	Phrase	Sentence	Text
	6				0
Additions		1	0	2	
Deletions		0	0	1	
Substitutions		3	2	0	
Relocations		0	0	0	

Assignment 3

	Formal	Word	Phrase	Sentence	Text
	0				1
Additions		0	1	3	
Deletions		0	0	0	
Substitutions		4	0	0	
Relocations		0	0	0	

Gathering the Data: Level 2

The level two group of students consisted of three children (Hilda, John and Howard). The small size of this group allowed for their writing processes to be observed and noted in more detail than those of the large level three group. In addition, interactions with their peers, and analysis of their written products also contributed to the data.

Hilda

Hilda's first piece of writing began on January 15 in slot C. It went as noted below:

"THE WORSE DAY OF MY LIFE ON MY" TRIP

Well every thing was all right when that day came. I was out getting wood for the wood stove and I met the biggest hairyest bear in the world. I (1, 2, 3) took off leaving all of my chopped wood behind. Then I never went that way (4) trail again.
Researcher's field notes:

1. inserted comma between "biggest hairyest"--reread
2. inserted "cold and wet" after "that" line 1
3. inserted "black dusty" before "wood stove"
4. deleted "way"

Hilda's day two was on January 16. The session began with a group conference where the pieces were read aloud to the other members of the group and plans for continuing discussed. Hilda described how she was going to say that it was cold in the morning because the fire was out.

It was so cold in my feathered sleeping bag that I woke up (1). I new that i had to perk it up even though it was so (2) misherble (3) out side (4).

1. paused to reread and asked the researcher how she should proceed. I suggested that she consult her folder for any ideas she might have noted. She remembered the "fire out" idea and wrote "the fire must have been out" after "I woke up". She then paused and reread again.
2. noticed the lower case "i" and changed it to upper case. She asked how to spell "miserable"
3. paused and reread

4. inserted "when water and snow fell on top of my head" then deleted "my head" reread and put it back again

Hilda began session three by rereading and immediately making some revisions.

1. inserted "red and wite", erased "wite" and wrote "white" then paused to reread
2. erased sentence and substituted, "When I was running back to my hut I met my Indian friend Kowosoki," then paused and reread several times.
3. verbalized that she doesn't want the story to get dull
4. deleted "Indian friend Kowosoki" and wrote "my Capton Jhon Guy"
5. paused to help Gregory read his story and suggested that he "fix his spelling"
6. expressed concern about how her ending is less interesting than the beginning

A summary of Hilda's revisions is represented in Table 2.

John

John began writing on January 17 in slot C but I was unable to observe him directly because of requests for help by several other children. As it turned out, John tended to revise externally very little. He typed with two fingers and wrote for longer periods without pausing to reread than the others. On January 21 John

wrote,

> . . . then you would have to find food for your family and that would (1) be hard in winter because the deer would be inland. And the fish would be gone south for the winter, and the birds would be gone south to. After you got home it would be dark and you . . .

1. paused to reread

Table 2

Summary of Hilda's Revisions

Assignment 1

	Formal	Word	Phrase	Sentence	Text
	2				
Additions		1	3	3	
Deletions		0	0	2	
Substitutions		1	2	0	
Relocations		0	0	0	

Assignment 2

	Formal	Word	Phrase	Sentence	Text
	0				0
Additions		0	0	0	
Deletions		0	1	0	
Substitutions		1	0	0	
Relocations		0	0	0	

Assignment 3

	Formal	Word	Phrase	Sentence	Text
	0				0
Additions		0	0	1	
Deletions		0	0	0	
Substitutions		0	1	0	
Relocations		0	0	0	

On January 20 John read his story to me. When he came to the part about the fish going south for the winter he commented that he "put that in for fun" because he couldn't think of anything else. I made a mental note to see if he kept it in his final draft. He did.

A summary of John's revisions is shown in Table 3.

Table 3

Summary of John's Revisions

Assignment 1

	Formal 1	Word	Phrase	Sentence	Text 0
Additions		0	2	0	
Deletions		0	0	1	
Substitutions		0	1	0	
Relocations		0	0		

Assignment 2

	Formal 0	Word	Phrase	Sentence	Text 0
Additions		0	0	0	
Deletions		0	0	0	
Substitutions		1	0	0	
Relocations		0	0	0	

Assignment 3

	Formal 16	Word	Phrase	Sentence	Text 0
Additions		0	0	0	
Deletions		0	0	0	
Substitutions		7	0	0	
Relocations		0	0	0	

Howard

Like John, Howard too wrote for longer sustained periods than either Evan or Hilda. Furthermore, Howard had acquired the writing skill of trying a variety of lead sentences. On January 17 he wrote:

When I Lived in 1613

When (1) It all started 50 days ago (2) DAY 1, I just finished (3) About 5 minutes ago we hit land. The men are still getting the animals off the boat. We brought, sheep, goats chickens, cows (4)

1. deleted "When" to begin again

2. deleted this sentence and tried another

3. deleted this and tried again

4. Howard was called away to help another member of his slot D group

A summary of Howard's revisions is shown in Table 4.

Table 4

Summary of Howard's Revisions

Assignment 1

	Formal 2	Word	Phrase	Sentence	Text 0
Additions		0	0	0	--
Deletions		0	0	0	
Substitutions		0	0	0	
Relocations		0	0	0	

Assignment 2

	Formal 0	Word	Phrase	Sentence	Text 0
Additions		0	2	0	
Deletions		0	0	0	
Substitutions		0	0	0	
Relocations		0	0	0	

Assignment 3

	Formal 0	Word	Phrase	Sentence	Text 0
Additions		0	0	0	
Deletions		0	0	0	
Substitutions		0	0	0	
Relocations		0	0	0	

Gathering the Data: Level 3

Level three data came from the entire class, from which level one and level two children were selected. Some interesting revisions were recorded either through informal observation of these subjects or through product analysis of their work. A few are reported below:

Tracy

Tracy's first assignment began on January 15, 1986 as follows:

Dear Louise,

We are haveing a sevor winter.- The wind is very cold and there are people dieing.We met some Iandians.The Iandians were animal skins for there clothing and use there own homemade tools.I will be sending you an Iandian vase.We are scracely running out of food.We will be comeing back in a matter of weeks.

PLEASE WRITE
YOUR, FRIEND
TRACY

P.S. Our ship is being repaired.

The second day's writing included adding new information and some revisions to the previous day's work.

Dear Louise,

We are haveing a sevor winter here at Cupids cove. (1) The wind is very cold and there are people dieing.We met some Iandians.The Iandians were animal skins for there clothing and use there own homemade tools. I will be sending you an Iandian vase. We are scracely running out of food.We will be comeing back in a matter of weeks.When I got up this morning there was a knock at the door.It was my best friend Dana,she had come to tell me there was a baby boy born to a (2)

PLEASE WRITE
YOUR FRIEND
TRACY

P.S. Our ship is being repaired.

Researcher's field notes:

1. inserted "here at Cupids cove"

2. inserted two sentences

Day three's sessions produced additonal material and more revisions to the previous day's work:

Dear Louise,

We are haveing a sevor winter here at Cupids cove. The wind is very cold and there are people and animals (1) dieing.We,v (2) met some Beothic (3) Indians.s. (4) (5) I will be sending you an Indian (6) vase. be sending you an Iandian vase.
We are scracely running out of food.We will be comeing back in a matter of weeks.When I got up this morning there was a knock at the door.It was my best friend Dana,she had come to tell me there was a baby born to a

PLEASE WRITE
YOUR FRIEND
TRACY

P.S. Our ship is being repaired.

Researcher's field notes:

1. inserted "and animals"

2. changed "We" to "We,v"

3. inserted "Beothic"

4. changed "Iandians" to "Indians.s"

5. deleted sentence "The Iandians were . . . tools."

6. changed "Iandian" to "Indian"

Day four produced the following revisions:

Dear Louise,
When I got up this morning there was a knock at the door.It was my best friend Dana,she had come to tell me there was a baby boy born. (1) (2) Well anyway. (3)
We aare haveing a sevor winter here at Cupids cove. The wind is very cold and there are people and animals dieing.We,v met some Beothic Indians. (4) I will be sending you an Indian vase. (5) We are scracely running out of food.We will be comeing back in a matter of weeks..

PLEASE WRITE
YOUR FRIEND

TRACY

Researcher's field notes:

1. moved two sentences to beginning of story

2. deleted "to a"

3. inserted "Well anyway."

4. changed "Indians.s" to "Indians"

5. deleted extra "be sending you an Indian vase"

The fifth day of writing for Tracy resulted in a major change in her story .

Dear Louise,
When I got up this morning there was a knock at the door.It was my best friend Dana,she had come to tell me there was a baby boy born. Well anyway.
We are haveing a sevor winter here at Cupids cove. (1) Last year at cupids was very mild and there are not as many people dieing.In case you did not know we did not have any animals at that time. The third winter was an unpredictable.We all ran out of food so we had to trap fox and muskrat.The winter was so severe that people began to catch scurvy and pneumonia.Allthe animals died.

Researcher's field notes:

1. major change in direction of story

Day five resulted in a title being added and other revisions:

A HORRIBLE WINTER AT CUPIDS (1)
When I got up this morning there was a knock at the door.It was my best friend Dana,she had come to tell me there was a baby boy born. Well anyway.
We are haveing a severe winter here at Cupids cove. (2) Last (3) winter was unpredictable.We all ran out of food so we had to trap fox and muskrat.The winter was so severe that people began to catch scurby and pneumonia.All the animals died.We will leave for home

tomorrow and we will never leave our home town ever again.Oh, by the way the baby's father is Nicols Guy.

Researcher's field notes:

1. added title

2. deleted two sentences

3. changed "the third" to "last"

Day six of Tracy's writing resulted in her final product for the first assignment.

A HORRIBLE WINTER AT CUPIDS
by Tracy (1)

When I got up this morning there was a knock at the door.It was my best friend Dana,she had come to tell me there was a baby boy born. (2)
We are haveing a severe winter here at Cupids cove .Eight of my people have died. (3)

Last winter was unpredictable.Wwe all ran out of food so we had to trap fox and muskrat.The winter was so severe that people began to catch scurvy and pneumonia. All the animals died.We will leave for home tomorrow and we will never lave our home town ever again.Oh, by the way the baby's father is Nocols Guy.

Researcher's field notes:

1. added byline

2. deleted "Well anyway."

3. added "Eight of my people have died."

Helen

Helen's first assignment contained many examples of revisions at the word, phrase and sentences levels. The product of the first writing session follows:

A DAY IN THE CUPIDS

One day while John Guy was in the garden picking vegetables a real bad storm came up.This storm was the storm of 1613 and was the first very bad storm.John Guy was about 40 when this happened.

On day two Helen added new material and made one revision to her previous day's work.

A DAY IN THE CUPIDS

One day while John Guy was in the garden picking vegetables a real bad storm came up. (1) When John Guy relized the storm was getting worse,he went home and closed the shuters. (2) This storm was the storm of 1613 and was the first very bad. John Guy was about 40 when this happend.8 people died of food shortage and some of the animals died. Although this was the worst winter ever,it was good to because a baby boy was born.

Researcher's field notes:

1. Inserted extra space between words
2. Inserted sentence, "When John . . . shuters."

Day three saw the addition of new material to the end of her previous day's work and two word additions:

Researcher's field notes:

1. Inserted "October" before 1613
2. Inserted "one" after "first very bad"

On day four Helen added more new material to the end of her writing and made two revisions at the word level to her previous day's work.

Researcher's field notes:

1. Inserted "third" before "storm"
2. Inserted "1612" to become "1612-1613"

On day five Helen made one word substitution in her previous writing.

Researcher's field notes:

1. Changed "bad" to "severe"

On day six Helen made several revisions to her previous day's writing.

Researcher's field notes:

1. Changed "garden" to "field"
2. Deleted "picking vegetables"
3. Changed "October" to "December"
4. Changed "40" to "forty"
5. Changed "8" to "eight"
6. Changed "3" to "three"

On day seven a by-line was added along with some new material.

Day eight saw two revisions to earlier work.

Researcher's field notes:

1. Changed "born" to "delivered"
2. Inserted "to the wife of Nicholas Guy"

Helen's finished product (after twelve writing sessions) appears below:

A DAY IN CUPIDS

One day John Guy was in the field and a real bad

storm came up. When John Guy relized the storm was getting worse, he went home and closed the shuters. This storm was the third storm of December, 1612- 1613 and was the first very severe one. John Guy was about forty when this happened. Eight people died of food shortage and some of the animals died. Although this was the worst winter ever, it was also a good winter because a baby boy was delivered to the wife of Nicholas Guy. The storm lasted 3 weeks and John Guy stayed in the house. This was going to be boring staying in the house all three weeksso John Guy made some town rules. EXAMPLE:No person was permitted to light a fire in the woods. 2. No ship captain was permitted to receive deserters from the colony. 3. No damage to stages, flakes or cook-rooms would be tolerated. Then John Guy called the people to a meeting and they talked over the rules. As they were talking the rules over, the wind died down. John Guy looked out the window and saw the storm lowering.John Guy called out to his people and told them that the storm was lowering. When his people heard the news, they shouted for joy! Then in March, John Guy left for England. John Guy's crowd began seperating because they couldn't work without him. Then another person came to control them, but he couldn't do it. That was starting to be the end of Cupids.

Darrell

Darrell's first day of writing on assignment number one produced the following text:

We have come over from England. We have only 1 house, 2 or 3 storage buildngs and 2 or 3 boats. The fish are good, the soil is not. In a year we returned to England for wemen and livestock.

Day two on assignment one saw some new material added to the end as well as a couple of revisions to the previous day's work:

John Guy (1)

We have come over from England. We have only 1 house, 2 or 3 storage buildings and 2 or 3 boats. The fish are good, the soil is not. In a yar we returned to England for women (2) and livestock.The winter of 1613

was the worst ever. 8 of our men died. That winter the first Europen baby was born on the island. After 4 years Guy went back to England. The new leader was Captain John Mason but because of his lack of leadership the colony failed.

Researcher's field notes:

1. Added title

2. Changed "wemen" to "women"

Below is the text after the third day of writing on assignment one:

John Guy

We are settlers and (1) have come over from England. Our leader is John Guy. (2) We have only 1 house, 2 or 3 storage buildings and 2 or 3 boats. We have called tis place Cupids. (3) The fish are good, thesoil is not. In a year we returned to England for women and livestock.The winter of 1613 was the worst ever. 8 of our men died. That winter the first Europen baby was born on the island. After 4 years Guy went back to England. The new leader was Captain John Mason but because of his lack of leadership the colony failed.

Researcher's field notes:

1. Inserted "are settlers and"

2. Inserted "Our leader is John Guy."

3. Inserted "We have called this place Cupids."

At the end of day four, Darrell's text had taken on a new look. He had inserted seven sentences and added an "epilogue."

John Guy

We are settlers and have come over from England. Our lader is John Guy. We have only 1 house, 2 or 3 storage buildings and 2 or 3 boats. We have called this place Cupids. The fish are good, the soil is not. My

job is to patrol the island. Today we found natives. THEY WERN'T FRIENDLY!!!!!!!! They are going to be a problem. It is very cold. We have to sleep on straw beds. We're homesick. (1)

Epiloge: (2)
In a year we returned to England for women and livestock.The winter of 1613 was the worst ever. 8 of our men died. That winter the first Europen baby was born on the island. After 4 years Guy went back to England. The new leader was Captain John Mason but because of his lack of leadership the colonly failed.

Researcher's field notes:

1. Inserted seven new sentences

2. Added "Epiloge" heading

Day five saw significant revisions to Darrell's previous day's work:

John Guy

We are settlers and have come over from England. Our leader is John Guy. We have only 1 house, 2 or 3 storage buildings and 2 or 3 boats. We have called this place Cupids. The fish are good, the soil is not. (1)
My job is to patrol the island. Today we found natives. THEY WEREN'T FRIELDNLY!!!!!!!! They are going to be a problem.
As for food, we have only what we brought with us. We are hoping to start agarden in the spring. There are also a lot of fish and wild animals. (2)
It is very cold. We have to sleep n straw beds. We're homesick. It would be nice to go home for a while. Someday. (3)

Epilogue:
In a year we returned to England for women and livestock. The winter of 1613 was the worst ever. Eight of our men died. That winter the first Europen baby was born on the island. After four years Guy went back to England. The new leader was Captain John Mason but because of his lack of leadership the colony failed.

Researcher's field notes:

1. Made paragraphing changes
2. Inserted three sentences
3. Inserted two sentences

CHAPTER 5

ANALYSIS OF RESULTS

Analysis of Revisions

Total Number of Revisions

The total number of revisions made during each piece of writing by each student was calculated (see Table 5). On the first assignment, the number of revisions ranged from 1 to 66 with the mean being 16.7 revisions. On the second piece of writing the number of revisions ranged from 0 to 19 with a mean of 5.2. On the final writing assignment the number of revisions ranged from 0 to 23 with a mean of 5.7 revisions.

Revisions Per Hundred Words

Because of the nature of the assignments, the first piece written by each student tended to be the longest. The number of revisions per hundred words was calculated for each assignment of each student (see Table 5).

On the first assignment the number of revisions per hundred words ranged from Tracy's 21.4 to Scott's 0. The mean number of revisions per hundred words for the first assignment was 8.6. The second assignment showed the number of revisions per hundred words ranging from Adam's 14.3 to several cases of 0 giving a mean of 2.8. The third piece of writing revealed a range of from Sandy's 11.4 to several cases of 0 revisions per hundred

Table 5

Total Number of Revisions and Revisions Per 100 Words on Each Assignment

	Assign. No. 1		Assign. No. 2		Assign. No. 3	
Name	Total Rev.	Rev. Per 100 Wds.	Total Rev.	Rev. Per 100 Wds.	Total Rev.	Rev. Per 100 Wds.
Adam	27	6.5	13	14.3	7	2.0
Ben	31	7.9	5	1.7	3	0.7
Bob	15	6.9	13	6.9	4	1.0
Brenda	25	19.2	3	1.7	3	1.2
Brian	2	1.6	0	0.0	1	0.4
Bridget	6	5.0	7	4.5	7	2.6
Colin	3	2.5	0	0.0	1	0.0
Crystal	22	15.0	7	3.4	1	0.5
Darrell	13	6.6	0	0.0	4	1.6
Douglas	2	2.0	3	2.0	6	3.2
Edward	11	14.3	1	0.8	0	0.0
Evan	29	16.6	15	6.1	9	2.1
Gail	6	2.9	3	1.2	12	3.2
Gloria	1	0.7	0	0.0	1	0.4
Heather	8	3.7	0	0.0	1	0.3
Helen	19	7.0	17	7.6	8	3.1
Hilda	14	8.3	2	1.2	2	1.7
Houston	9	7.1	1	0.8	0	0.0
Howard	2	1.0	1	2.5	1	0.2
John	5	4.0	1	0.5	23	8.4
Mary	20	14.3	6	3.3	16	5.9
Melissa	24	10.7	8	4.8	11	3.7
Paige	21	9.7	7	2.2	8	3.8
Paula	18	14.3	3	2.1	0	0.0
Rebecca	35	14.7	19	9.0	5	1.5
Sandy	66	15.2	3	1.6	20	11.4
Scott	0	0.0	1	0.4	0	0.0
Sean	2	0.3	4	1.0	0	0.0
Tammy	11	6.8	0	0.0	8	2.7
Tracy	24	21.4	4	1.7	4	1.1
Wanda	48	19.0	10	5.3	11	4.1

words resulting in a mean of 2.2. As a summary measure of the number of revisions per hundred words, the average number over all three assignments was computed for each student. This calculation saw a range of from Scott's 0.1 to Wanda's 9.5 revisions per hundred words giving a mean of 4.5 for the class.

Revisions at Various Levels

The revisions made by the children in their writing were categorized as either a) formal changes (i.e., changes in spelling, tense, number, abbreviation, punctuation), b) additions, deletions, substitutions, or reorderings at the word, phrase or sentence level or c) textual changes (i.e., major changes in content or direction).

Revisions at the Formal Level

The number of formal revisions on assignment number one ranged from 0 to 57 resulting in a mean of 8.8 formal revisions (see Table 6). On assignment number two the range was from 0 to 12 resulting in a mean of 2.2 formal revisions. On the third assignment the range was from 0 to 16 giving a mean of 2.2 formal revisions.

For each piece of writing the percentage of revisions at the formal level was calculated (see Table 6). For assignment number one the percentages ranged from Sean's and Gloria's 0 to Howard's 100 resulting in a mean of 46.3 percent. In assignment number two the

Table 6

Number and Percentage of Formal Level Revisions on each Assignment

Student	Assignment No. 1 Number Formal	Assignment No. 1 Percent Formal	Assignment No. 2 Number Formal	Assignment No. 2 Percent Formal	Assignment No. 3 Number Formal	Assignment No. 3 Percent Formal
Adam	14	51.9	3	23.1	1	14.3
Ben	28	90.3	0	0.0	0	0.0
Bob	12	80.0	8	61.5	0	0.0
Brenda	21	84.0	0	0.0	2	66.7
Brian	1	50.0	0	0.0	0	0.0
Bridget	2	33.3	4	57.1	1	14.3
Colin	2	66.7	0	0.0	0	0.0
Crystal	12	54.6	5	71.4	1	100
Darrell	3	23.1	0	0.0	1	25.0
Douglas	1	50.0	3	100	6	100
Edward	1	9.1	0	0.0	0	0.0
Evan	8	27.6	6	40.0	0	0.0
Gail	1	16.7	0	0.0	1	8.3
Gloria	0	0.0	0	0.0	0	0.0
Heather	5	62.5	0	0.0	1	100
Helen	1	5.3	7	41.2	0	0.0
Hilda	2	14.3	0	0.0	0	0.0
Houston	7	77.8	0	0.0	0	0.0
Howard	2	100	0	0.0	0	0.0
John	1	20.0	0	0.0	16	69.6
Mary	7	35.0	3	50.0	9	56.3
Melissa	15	62.5	4	50.0	1	9.1
Paige	12	57.1	2	28.6	1	12.5
Paula	7	38.9	3	100	0	0.0
Rebecca	26	74.3	12	63.2	1	20.0
Sandy	57	86.4	2	66.7	17	85.0
Scott	0	0.0	0	0.0	0	0.0
Sean	0	0.0	0	0.0	0	0.0
Tammy	8	72.7	0	0.0	5	62.5
Tracy	4	16.7	2	50.0	1	25.0
Wanda	14	29.2	3	30.0	4	36.4

range was from several cases of 0 to Paula's and Douglas' 100 giving a mean of 33.3. For the final assignment the percentage of revisions at the formal level ranged once again from several cases of 0 to several cases of 100 with a mean of 32.2 percent.

Again, as a summary measure of the percentage of revisions at the formal level, the average percentage of revisions at the formal level was calculated (see Table 7). The average ranged from Gloria's, Scott's and Sean's 0 percent to Ben's 90.3 percent with a mean of 39.6 percent for the class as a whole. For twenty-one of the students, the average percentage of revisions at the formal level was less than 50 percent. Indeed, for 18 students that average was less than 40 percent.

Revisions at the Word Level

The number of revisions at the word level for assignment number one ranged from zero to 18 giving a mean of 2.2 word level revisions (see Table 8). Assignment number two saw a range of from 0 to 5 word level revisions resulting in a mean of 1.1. The third assignment resulted in a range of from 0 to 7 word level revisions giving a mean of 1.7.

For each piece of writing of each student the percentage of their revisions which were at the word level was calculated (see Table 8). For assignment number one, that percentage ranged from several cases of

Table 7

Average Percentage of Formal Revisions Over the Three Pieces of Writing Showing Number of Students at Each Level

Average Percentage	Students
0-10	6
11-20	1
21-30	4
31-40	7
41-50	3
51-60	2
61-70	3
71-80	2
81-90	2
91-100	1

Table 8

Word Level Revisions on each Assignment

	Assignment No. 1		Assignment No. 2		Assignment No. 3	
	Number Word	Percent. Word	Number Word	Percent. Word	Number Word	Percent. Word
Student						
Adam	7	25.9	3	23.1	4	57.1
Ben	1	3.2	0	0.0	2	66.7
Bob	1	6.7	4	30.8	2	50.0
Brenda	1	4.0	0	0.0	0	0.0
Brian	1	50.0	0	0.0	1	100
Bridget	1	16.7	1	14.3	1	14.3
Colin	1	33.3	0	0.0	0	0.0
Crystal	4	18.2	0	0.0	0	0.0
Darrell	0	0.0	0	0.0	2	50.0
Douglas	1	50.0	0	0.0	0	0.0
Edward	0	0.0	1	100	0	0.0
Evan	4	13.8	4	26.7	4	44.4
Gail	1	16.7	0	0.0	7	58.3
Gloria	0	0.0	0	0.0	0	0.0
Heather	0	0.0	0	0.0	0	0.0
Helen	13	68.4	4	23.5	4	50.0
Hilda	2	14.3	1	50.0	0	0.0
Houston	0	0.0	0	0.0	0	0.0
John	0	0.0	1	100	7	30.4
Mary	0	0.0	0	0.0	3	18.8
Melissa	2	8.3	0	0.0	2	18.2
Paige	0	0.0	3	42.7	4	50.0
Paula	0	0.0	0	0.0	0	0.0
Rebecca	6	17.1	5	26.3	4	80.0
Sandy	1	1.5	0	0.0	3	15.0
Scott	0	0.0	0	0.0	0	0.0
Sean	0	0.0	4	100	0	0.0
Tammy	2	18.2	0	0.0	3	37.5
Tracy	2	8.3	0	0.0	0	0.0
Wanda	18	37.5	3	30.0	0	0.0

zero to Helen's 68 percent giving a mean of 13.7 percent. For assignment number two the range was from zero to 100 percent with a mean of 23.7 percent for the class. For assignment number three the range again was from zero to 100 percent giving a mean of 29.6 percent revisions at the word level.

The average percentage of revisions at the word level was calculated as a summary measure (see Table 9). The range was from zero to 75 percent with a mean for the class of 21.9 percent. Thirty students had an average of fifty percent or less. Twenty-two students had an average of thirty percent or less.

Percentage of Revisions at Both the Formal or Word Levels

For assignment number one the average percentage of revisions at both the formal and word levels was 60.1 percent (see Table 10). For assignment nunmber two it was 57 percent and for assignment number three it was 61.8 percent.

The average percentage of revisions at both the formal and word levels for all three assignments was 59.1 percent (see Tables 10 and 11).

Percentage of Revisions at Both the Sentence and Text Levels

The percentage of revisions at both the sentence and text levels ranged from zero to 53 percent for

Table 9

Average Percentage of Word Level Revisions Over the Three Pieces of Writing Showing Number of Students at Each Level

Average Percentage	Students
0-10	12
11-20	2
21-30	8
31-40	3
41-50	5
51-60	0
61-70	1
71-80	0
81-90	0
91-100	0

Table 10

Percentage of Formal and Word Level Revisions on Each Assignment

Student	No. 1	No. 2	No. 3
Adam	77.8	46.2	71.4
Ben	93.6	0.0	66.7
Bob	86.7	92.3	50.0
Brenda	88.0	0.0	66.7
Brian	100.0	0.0	100.0
Bridget	50.0	71.4	28.6
Colin	100.0	0.0	0.0
Crystal	72.7	71.4	100.0
Darrell	23.1	0.0	75.0
Douglas	100.0	100.0	100.0
Edward	9.1	100.0	0.0
Evan	41.4	66.7	44.4
Gail	33.3	0.0	66.7
Gloria	0.0	0.0	0.0
Heather	62.5	0.0	100.0
Helen	73.7	64.7	50.0
Hilda	28.6	50.0	0.0
Houston	77.8	0.0	0.0
Howard	100.0	25.0	0.0
John	20.0	100.0	100.0
Mary	35.0	50.0	75.0
Melissa	70.8	50.0	27.3
Paige	57.1	71.4	62.5
Paula	38.9	100.0	0.0
Rebecca	91.4	89.5	100.0
Sandy	87.9	66.7	100.0
Scott	0.0	0.0	0.0
Sean	0.0	100.0	0.0
Tammy	90.9	0.0	100.0
Tracy	25.0	50.0	25.0
Wanda	66.7	60.0	36.4

Table 11

Average Percentage of Formal and Word Level Revisions Over the Three Pieces of Writing Showing Number of Students at Each Level

Average Percentage	Students
0-10	2
11-20	0
21-30	1
31-40	3
41-50	4
51-60	7
61-70	5
71-80	2
81-90	2
91-100	5

assignment number one resulting in a mean of 13.7 percent (see Table 12). For assignment number two the percentage ranged from zero to 80 percent resulting in a mean of 14.2 percent. Assignment number three produced a range of from zero to 50 percent with a mean of 13.1 percent.

Once again a summary measure was calculated. The average percentage of revisions at both the sentence and text levels for all three assignments was 13.7 percent. Indeed, fifteen students had an average percentage of 10 percent or less (see Table 13).

Other Variables

For a summary of the other variables used, see Table 14.

Age. The children's ages ranged from 10 years 0 months to 11 years 8 months. The average age on January 1, 1986 was 10 years 9 months.

Measure of ability. The measure of ability percentile scores used in this study ranged from 10 to 99 giving a mean score of 61.9.

Typing speed. The three-minute typing speed test administered in April resulted in scores of from 4.0 to 14.3 words per minute with a mean of 9.6 words per minute.

Facility of use. In the test to measure the students' facility of use of the Bank Street Writer word

Table 12

Percentage of Sentence and Text Level Revisions on Each Assignment

Student	No. 1	No. 2	No. 3
Adam	3.7	30.8	0.0
Ben	0.0	80.0	0.0
Bob	0.0	0.0	50.0
Brenda	8.0	0.0	38.0
Brian	0.0	0.0	0.0
Bridget	16.7	28.6	28.6
Colin	0.0	0.0	0.0
Crystal	9.1	28.6	0.0
Darrell	53.9	0.0	0.0
Douglas	0.0	0.0	0.0
Edward	27.3	0.0	0.0
Ewan	37.9	20.0	44.4
Gail	0.0	66.7	16.7
Gloria	0.0	0.0	0.0
Heather	25.0	0.0	0.0
Helen	5.3	11.8	12.5
Hilda	35.7	0.0	50.0
Houston	0.0	0.0	0.0
Howard	0.0	25.0	0.0
John	20.0	0.0	0.0
Mary	30.0	0.0	6.3
Melissa	4.2	0.0	18.2
Paige	33.3	14.3	0.0
Paula	33.3	0.0	0.0
Rebecca	2.9	0.0	0.0
Sandy	7.6	0.0	0.0
Scott	0.0	0.0	0.0
Sean	0.0	0.0	0.0
Tammy	0.0	0.0	0.0
Tracy	45.8	50.0	50.0
Wanda	10.4	0.0	18.2

Table 13

Average Percentage of Sentence and Text Level Revisions Over the Three Pieces of Writing Showing Number of Students at Each Level

Average Percentage	Students
0-10	15
11-20	9
21-30	5
31-40	1
41-50	1
51-60	0
61-70	0
71-80	0
81-90	0
91-100	0

Table 14

Age, Measure of Ability (CTBS), Typing Speed (WPM), and Time (in seconds) to Complete Test of Facility with the Use of the Bank Street Writer Program

Student	Age	CTBS	WPM	BSW Test
Adam	10.02	80	13.0	360
Ben	10.08	94	13.3	280
Bob	10.02	74	11.3	380
Brenda	10.10	50	9.3	430
Brian	11.08	25	9.0	560
Bridget	10.02	67	8.3	63
Colin	10.11	10	5.0	583
Crystal	10.00	25	10.0	593
Darrell	10.11	99	7.0	394
Douglas	10.04	67	13.0	300
Edward	10.00	18	4.0	828
Evan	10.00	93	14.3	230
Gail	10.08	93	10.0	320
Gloria	10.05	50	10.0	592
Heather	10.04	67	9.7	260
Helen	10.03	82	11.0	274
Hilda	10.05	46	13.0	255
Houston	10.10	10	5.7	575
Howard	10.09	88	9.3	300
John	10.09	64	10.7	420
Mary	10.04	46	6.7	480
Melissa	10.05	74	10.0	357
Paige	10.01	67	11.3	280
Paula	10.04	67	7.6	401
Rebecca	10.11	39	9.0	510
Sandy	10.05	57	7.3	480
Scott	10.09	70	7.3	563
Sean	10.11	98	11.3	240
Tammy	10.08	64	9.0	470
Tracy	10.11	70	9.0	480
Wanda	10.06	67	12.6	270

processing program, the times ranged from 230 seconds to 828 seconds with a mean of 414.

Relationships

Table 15 shows the correlation between each of the variables noted in this study and the numbers and levels of revisions in each of the three pieces of writing.

Table 15

Matrix of Corrrelation Coefficients

	Age	WPM	BSW	CTBS
No. Formal Rev. Assign. 1	-.13	.05	-.02	-.20
No. Formal Rev. Assign. 2	-.20	.24	-.12	.04
No. Formal Rev. Assign. 3	-.09	-.06	-.04	-.03
% Formal Rev. Assign. 1	.05	-.03	-.04	-.16
% Formal Rev. Assign. 2	-.23	.12	-.10	.02
% Formal Rev. Assign. 3	-.15	.04	-.07	-.11
% Word Level Rev. Assign. 1	.34	.28	-.14	-.09
% Word Level Rev. Assign. 2	-.13	.13	-.04	-.12
% Word Level Rev. Assign. 3	.47	.26	-.14	.21
% Formal/Word Level Rev. Assign. 1	.23	.12	-.11	-.19
% Formal/Word Level Rev. Assign. 2	-.30	.20	-.11	.06
% Formal/Word Level Rev. Assign. 3	.21	.15	-.11	.05
% Phrase/Sent./Text Rev. Assign. 1	-.23	-.03	.01	.16
% Phrase/Sent./Text Rev. Assign. 2	-.13	.07	-.13	.14
% Phrase/Sent./Text Rev. Assign. 3	-.19	.38	-.36	.32
% Sent. and Text Rev. Assign. 1	-.18	-.07	-.10	.13
% Sent. and Text Rev. Assign. 2	-.10	.31	-.26	.39
% Sent. and Text Rev. Assign. 3	-.14	.34	-.30	.18
Rev. Per 100 Words Assign. 1	-.24	-.01	.10	-.14
Rev. Per 100 Words Assign. 2	-.23	.41	-.26	-.21
Rev. Per 100 Words Assign. 3	-.15	.09	-.16	.12
Age	1.00	-.09	.20	.01
Typing Speed (WPM)	-.09	1.00	-.75	.55
Facility at Using BSW	.20	-.75	1.00	-.75
Measure of Ability (CTBS)	.01	.55	-.75	1.00

Note.

Rev. = Revisions
Assign. = Assignment
Sent. = Sentence
BSW = Bank Street Writer
CTBS = Canadian Test of Basic Skills
WPM = Words Per Minute

CHAPTER 6

ATTITUDE SURVEY

Questionnaire Results

After the children had finished their third writing assignment, an attitude survey in the form of a questionnaire was administered. The children's answers revealed some interesting data regarding their attitudes about writing with computers (see Table 16, p. 111). These results confirm those reported earlier in this report. The answers to each question are reported below. (An asterisk beside the scale indicates Evan's answer.)

1. How well did you like writing using a computer?

Scale	Students	Percent
1 (a lot)	21	72%
2*	6	21%
3	1	3%
4	0	0%
5 (not at all)	1	3%

2. How difficult was it for you to learn to use the Bank Street Writer program?

Scale	Students	Percent
1 (very easy)	9	31%
2	14	48%
3*	6	21%
4	0	0%
5 (very hard)	0	0%

3. Is it easier to write with a pencil or on the computer?

Scale	Students	Percent
1 (pencil)	4	14%
2	1	3%
3	3	10%
4	2	7%
5 (computer)*	19	66%

4. Is it easier to make changes in what you have written when you are using a pencil and paper or when you are using a computer?

Scale	Students	Percent
1 (pencil)	1	3%
2	1	3%
3	1	3%
4	0	0%
5 (computer)*	26	91%

5. How important do you think it is to be able to make changes in your stories easily?

Scale	Students	Percent
1 (very important)	18	62%
2	6	21%
3*	5	17%
4	0	0%
5 (not important)	0	0%

6. How quickly were you able to type when you started using the computer?

Scale	Students	Percent
1 (very quickly)	0	0%
2	8	28%
3	8	28%
4*	12	41%
5 (very slowly)	1	3%

7. How quickly are you able to type now?

Scale	Students	Percent
1 (very quickly)	4	14%
2	16	55%
3*	9	31%
4	0	0%
5 (very slowly)	0	0%

8. Would you like to use the computer to help you write when you get in grade six?

Yes*	28	97%
No	1	3%

9. Do you have a computer at home?

Yes*	18	62%
No	11	38%

10. For what reasons would you prefer to use the word processor over handwriting?

Some typical answers to this open ended question were:

You can replace things easy and fix things a lot easier. Also you won't have to sharpen your pencil. (Evan's answer)

It's much neater. It's better for doing assignments. You can put things in without erasing.

Handwriting hurts my hand.

I prefer to use the word processor becauses it's alot easier and more fun.

I would prefer to use the word processor because if you make a mistake and erase a word nobody will see where you made the mistake.

The main reason is because I'm not a very good handwriter. You don't have to waste time erasing and blowing the stuff off the paper you just press one button.

What you write can't be wrinkled when you work on it.

You don't run out of space.

You can hand your paper in clean.

11. For what reasons would you prefer handwriting to the word processor?

No reasons. I hate handwriting so I would much prefer the word processor.

I like handwriting to the word processor because handwriting is faster for me.

I would prefer handwriting to the word processor because you don't have to wait for it to load.

You can use your pencil to practice writing. (Evan's answer)

12. If you were a teacher, how would you use Bank Street Writer with your students?

I would do certain assignments on the computer. (Evan's answer)

Well I'd start them off with short stories then they'd work their way up. And by the time they were up to big stories they'd be good at it.

I would do it the way I'm doing it now.

13. What did you find most difficult about using the Bank Street Writer?

I found learning how to use the cursor.

I found the most difficult thing about the Bank Street Writer was finding the right keys.

I didn't find anything difficult.

Well at first it was loading the program but now it's very easy to me.

Learning how to use it was the hardest and finding the keys.

14. What did you like best about using the computer for writing?

You could do things easier like erase, move, replace and moveback. (Evan's answer)

It is fun.

I like when you have a mistake probably half way up the page and you don't have to rub all your work out.

I like how easy it was to use the most.

The best thing was that you could pick out everybody's writing.

Learning to write.

The answers to question one indicated that the majority of the children liked to write using the computer. Ninety-three percent of the class circled either one or two on the scale.

Answers to question two revealed that the children found the Bank Street Writer program relatively easy to learn. One hundred percent of the children circled either answers one, two or three on the scale.

Sixty-six percent answered in question three that it was easier to write with a computer than with a pencil and chose answer number five. Fourteen percent felt it was easier to write with a pencil and circled answer number one. It was indicated to the children that they should circle answer two if they thought it was "only a little easier" to write with a pencil and circle answer four if they thought it was "only a little easier" to write with a computer.

Ninety-one percent of the class felt it was easier to make changes in what they had written when using a computer than when using pencil and paper. They circled answer five on the scale of question number four.

On question number five, sixty-two percent of the class circled answer number one indicating they felt it

was very important to be able to easily make changes in their writing. One hundred percent of the class answered either one, two or three on the five point scale.

The answers to questions six and seven indicate the children felt their typing was slow when they first started using the computer but that the speed improved as they became familiar with using the word processor.

Ninety-seven percent of the children felt that they would like to continue using a word processor in grade six.

Table 16

Summary of Questionnaire Data

	Answer 1	Answer 2	Answer 3	Answer 4	Answer 5
Question 1	21 72%	6 21%	1 3%	0 0%	1 3%
Question 2	9 31%	14 48%	6 21%	0 0%	0 0%
Question 3	4 14%	1 3%	3 10%	2 7%	19 66%
Question 4	1 3%	1 3%	1 3%	0 0%	26 91%
Question 5	18 62%	6 21%	5 17%	0 0%	0 0%
Question 6	0 0%	8 28%	8 28%	12 41%	1 3%
Question 7	4 14%	16 55%	9 31%	0 0%	0 0%

	Yes	No
Question 8	28 97%	1 3%
Question 9	18 62%	11 38%

CHAPTER 7

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Conclusions

Based on the results obtained from analyzing the revisions in the three pieces of writing in this study, one cannot say that there are significant correlations between either the number or level of revisions made and either the students' ages, typing speed, facility at using the word processor or ability.

However, many of the children made interesting higher level revisions to their work, revisions that this researcher's teaching experience and the experience of others (as noted in earlier sections of this report) have shown are not readily made by children using pencil and paper (see Chapter 4, Gathering the Data: Level 3). Additions, deletions and substitutions at the phrase and sentence levels were not uncommon in this study. Deliberate shortcuts using the "replace" function of the word processor were becoming more frequent toward the end of the period of study. A child of ten years using "XX" for a commonly used name and then replacing it with that name at the end of the writing session shows an attempt at using the word processor in a manner thought of as uncommon by the researcher before the study began. Revisions at the textual level, showing a major change

in direction of the piece of writing, however, were not common.

Close observation of the students in levels one and two of this study and analysis of the written products of the children in level three indicated that the general writing pattern was to write on the first day simply to get their initial ideas "down on paper." Revisions at the formal and word levels were common on day one as spelling mistakes were immediately corrected and synonyms chosen sometimes immediately after writing a word. Subsequent days seemed to produce a different pattern in writing behavior. After work was retrieved, students would reread their previous day's work (perhaps to see if it was all there) and this was a time when intended meaning seemed to become more important than on day one. Sentence level additions, deletions and phrase substitutions were more common after day one as students tried to "flesh out" their story of clarify points which seemed vague or not coming across as intended. It was in writing sessions after day one that the value of the editing features of a word processor became most evident. The children would generally move on to add new material to the end of their story after working on revisions to their previous day's work.

Constraints of the Study

Finding time for a class of thirty students to

write using word processors each day of the week for several weeks was somewhat of a difficulty. A limit of thirty minutes to a writing period was also a negative aspect of the study. Indeed, once time was allowed for retrieving work and saving work, even less than thirty minutes remained for writing. The after-school group suffered lost writing time more than any other because of teachers' meetings, stormy weather, special student activities and the like. Acting as participant researcher (i.e. teacher and researcher collecting data) imposed constraints on the amount and quality of data collected. Because the library at the site of this study is a busy student work area, there were often interruptions to the "atmosphere conducive to writing."

Keyboarding skills (i.e. touch typing) offer a definite advantage to writers. The students in this study were exposed to a minimum of touch typing instruction before embarking on this project. Although many could type at ten words per minute, many others were slowed considerably by their lack of typing skill.

For there to be any real comparison between these students and those written about by Graves (1983), these students would have to have had much more exposure to the process-conference approach to writing. To make process writing natural to the students, it must be a daily, extended commitment on the part of the teachers

of those students.

Another constraint of this study was the relatively small number of students involved. Several classes of students treated in the same way by several researchers may have been a more effective approach.

Recommendations for Further Study

This researcher would like to see more such studies carried out over a longer period, perhaps two years, with a larger number of students.

Since research indicates that students are more apt and better able to revise personal narrative writing than writing on topics chosen by the teacher, similar studies using student-chosen topics should be carried out.

Many of the students of greater ability did not appear to make many revisions at all. A study to determine the type of internal revision of younger students who use word processors may prove interesting.

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