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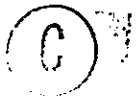
THE DIFFERENTIAL EFFECTS OF USING THE COMPUTER IN A PROCESS WRITING PROGRAM ON THE WRITING QUALITY AND QUANTITY OF THIRD AND FOURTH GRADE PUPILS

By

Audrey Joan Pearce-Burrows 

A thesis submitted to the Faculty of Graduate Studies and Research in partial fulfillment of the requirements for the degree of Doctor of Philosophy.

In

Special Education

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The undersigned certify that they have read, and recommended to the Faculty of Graduate Studies and Research, for accepting, a thesis entitled: "The Differential Effects of Using The Computer in A Process Writing Program on The Writing Quality And Quantity of Third And Fourth Grade Pupils" submitted by Audrey Joan Pearce-Burrows in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Special Education.

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Dr. Joyce Edwards

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Dr. Carol Crealock

Date: Sept 26, 1991

The organic potentialities do not develop at all in the absence of environmental influences. This is true of physical potentialitis, it is even more true of mental ones. The development of the mental potentialities presents virtually infinite possibilities under the actions of various environments...

M.F. Ashley Montagu

DEDICATION

In our roles as special educators it is imperative that we continue to search for methods to assist our students in becoming more effective learners. This research is dedicated to the many students who struggle daily with the demands of their written work.

ABSTRACT

A comparison of process instruction with and without computers was conducted. A thorough review of the current related literature indicated that to date much of the research in the area of computers and writing has not obtained a statistically significant qualitative difference between groups using a holistic scoring system.

A repeated measures design was used to test the research question exploring whether writing skills, as measured by the Test of Written Language (TOWL), the Diagnostic Evaluation of Writing Skills (DEWS), and Holistic rangefinders, would improve more for the computerized process group. The second research question addressed the issue of superiority of the computer for some students. Will the benefits of the computer be greater for weak writers as compared to above average writers. A third research question addressed differences in writing attitudes and practices between computer groups and paper and pencil groups. Data gathered through observation as well as responses to both questionnaire and interview questions were utilized.

Results of this research paired with the informal observations and data gathered during the study suggest that word processing offers potential for the development of writing skills. This potential may be especially relevant for below average writers, however several logistical and methodological problems must be overcome before these benefits can be realized. Therefore, the results of this study are cautiously discussed in relation to intervention effectiveness in light of several plausible competing hypotheses. A tentative link between improved writing using the computer and more efficient thinking skills was also indicated. Implications for practice and future research are discussed.

Research as a search for knowledge has as its roots a "wondering" or musing about interesting unanswered questions, as in all serious inquiry, the research reported here has begun with curiosity and moved toward insight. As one cannot expect that a single study can embrace adequately the complex issues about which we wonder, it is hoped that this project will offer some fresh insight into the important questions addressed.

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CHAPTER I

INTRODUCTION

The Problem

The process approach to teach writing involves pre- and post-writing activities such as percolating, drafting, revising, editing and publications (Alberta Education, 1986). Word processing programs on the computer offer advantages over paper and pencil for this process approach since they make it easier to review, store, retrieve and print text (Morocco & Neuman, 1986).

The process approach to writing was combined with computers in the classroom by Kerchner and Kistinger (1984) to assist students with written expression. Their method involved an eight-stage process which included: pre-writing conference; composing at the keyboard; printing a draft; editing conference; editing at the keyboard; printing a final copy; illustrating the composition; and providing an audience. Results of the study indicated that an improvement in written language skills using word processing could transfer to paper and pencil tasks such as those on the Test of Written Language (TOWL) (Hammill & Larsen, 1983).

Other studies in this area have demonstrated quantitative (number of words, amount of time spent) but not qualitative (holistic overall story quality) differences in comparing methods utilizing computers and traditional methods for teaching writing (Crealock, Sitko, Hutchinson, Sitko & Marlatt, 1985; Vacc, 1987; Woodruff, Bereiter & Scardamalia, 1981).

Kopp's (1985) research however, has demonstrated both quantitative and qualitative improvements in writing through use of the word processor. He reports that not only did students make more revisions to their stories with a computer than with a pen and paper, but they also composed better stories with a word processor. In addition, students made more lower level or mechanical revision such as spelling, punctuation, underlining, paragraphing and capitalization.

After reviewing numerous studies involving varying uses of the computer to improve writing skills, several key issues have emerged which should be addressed.

Firstly, as opposed to one-to-one tutoring which several special education researchers have utilized to study changes in writing (Pearce-Burrows, 1988; Vacc, 1987),

training methods for entire classrooms to improve achievement appears to be the challenge given the current trend toward mainstreaming (Derry & Murphy, 1986).

However along with a philosophy which supports mainstreaming and a non-categorical approach is an emphasis in seeing students as individuals with specific strengths and weaknesses rather than relying on definitions which are unclear (Bachor & Crealock, 1986). Therefore if in fact academic skills such as writing are being assessed, educators should distinguish between average and below average writers, as a students' level of skill development affects the access to, and outcomes of, intervention (Ysseldyke & Algozzine, 1982).

A further concern arising from the previous literature is small sample size. Vacc's (1987) study involved a total of four grade eight students. Crealock's et al., (1985) first experiment involved only five SLD students in the sample. Kerchner and Kistinger (1984) utilized 18 students in the experimental group and 19 students in the control group. Kopp's conclusions are based solely on the observation of twelve grade five students. Similarly Woodruff et al., (1981) base their recommendations on the

work of only twelve grade six students in their first study. It is inappropriate to generalize to all students based on a few. The external validity of much of the research to date is questionable due to this factor.

An additional short-coming of much of the previous research completed to date is the short-time frame ranging from four days to three months. (Crealock et al., 1985; Kopp, 1985; Wetzel, 1985; Woodruff et al., 1981-82). The importance of this factor becomes apparent with Wetzel's (1985) finding that students involved in research projects consisting of less than twenty weeks duration lack fluency in keyboarding skills.

Of perhaps foremost concern with past research is the methodology involved in establishing procedures for treatment and control groups. Except for the work of Dalton & Hannafin (1987) research in the area of writing and computers conducted to date has not compared the process approach to writing with and without computers. Many researchers have chosen to study the results of a traditional language arts program with treatment groups combining both computers and the process approach to writing. (Kerchner & Kistinger, 1984; Spence 1986; Wetzel, 1985). For example,

although Kerchner and Kistinger (1984) obtained significant quantitative differences between computer and non-computer groups, the methodology is suspect. Although much detail is offered to explain the procedures for the process and computer group, little information is given for the control group other than some used a "language experience" approach and others were involved in a reading and spelling program. With this methodology it becomes difficult to decide whether to attribute changes in the experimental group over time to the computer or to process writing.

The present study offers improvement over earlier work in that above average, average, and below average writers were identified, and their progress in improving their writing skills using one instructional approach--process writing, under two different methodologies--computer and handwriting, was examined. The rationale here is that many low achievers are often discouraged from editing and reviewing their work as the revision process is perceived as difficult, tedious and burdensome. The likelihood of revision by low ability learners may increase as a result of the ease of revision provided through word processing (Dalton & Hannafin, 1987).

Additionally, in many of the previous studies in the area of writing and computers, subjects have been removed from their natural writing environments (Crealock et al., 1985; Crealock & Sitko, 1990; 1987; Vacc, 1987 and Woodruff et al., 1981-82). This current research project was designed to offer valuable insight into whether conclusions reached under laboratory conditions pertain to students in their normal classroom environments.

Statement of the Problem

This research sought to determine the effects of using the computer in a process writing program on the quality of writing produced by third and fourth grade pupils. First, two months duration was allowed for acquiring keyboarding familiarity. Second, the study was implemented in the students' natural writing environment. Third, instruction was carried out with a minimal degree of researcher involvement: all process writing sessions were directed by the students' regular classroom teacher; all tests and stories were scored by a research assistant blind to the purpose(s) of the study. Fourth, besides teacher directed monthly process stories, spontaneous first draft writing samples collected by the researcher were also analyzed by the research assistant to study changes in students internalizing the writing process. Fifthly, as students are aware of both lower and higher level revisions, but are initially more concerned with the former, (Crealock et al., 1985; Kopp, 1985; Vacc, 1987; Woodruff et al., 1981), this research addressed both meaning and mechanical errors.

In relation to evaluation procedures, the study was designed to examine differences between paper and pencil and

computer groups, not only in relation to progress in writing, but also the children's actual writing environment--the classroom. Consequently the research studied differences using (a) a standardized writing test, (b) an error checklist, (c) a holistic writing assessment, (d) interview questions, (e) writing questionnaires, and (f) observations.

The specific research questions that the study sought to answer in relation to computer effects were:

(1) Will writing skills as measured by the Test of Written Language, the Diagnostic Evaluation of Writing Skills, and four-point holistic rangefinders improve more for the computerized process group than for the regular process group?

(2) Will the benefits of the computer be greater for weak writers as compared to above average writers?

(3) What differences will be found between process writing groups with and without computers in writing attitudes and practices?

Scope of the Study

This six month study was conducted as part of the regular writing program for sixty-two, grade three and four students, in four classes in Edmonton and surrounding area. Two classrooms utilized paper and pencil to compose stories and two used computers as a writing tool. As the participants would be continuing with their writing programs after termination of this project, the study was conducted within the general framework provided by the Alberta Education Grade Three English Language Arts, and Elementary Language Learning Program of Studies, (ECS-Grade 6).

Purpose of the Study

The purpose of this study was to determine the effects of using computers in a process writing program upon student writing quality and quantity, and to assess the impact of word processing upon students natural writing environment.

Definition of Terms

The following terms are used in this study:

Writing: The active construction of meaning through the involvement of the author and the unfolding text (Wetzel, 1985).

Writing Process: The act of writing as an interrelated series of operations leading to the solution of a problem. These operations include pre-writing activities; composing; drafting; editing; and post-writing activities.

Computers for Process Writing Program:

A process approach to writing that involves teacher directions and the computer as a tool.

Word Processing: A soft ware program enabling a computer to be used to create documents, stories, or other written texts. Once entered into the computer's memory the text may be edited, stored, retrieve or printed.

Word Processor: A system for the production of typewritten documents with automated typing and text-editing equipment.

Computer Assisted Instruction (CAI):

CAI refers to instruction of students that is largely controlled by computer programs that determine presentation, sequencing and pairing of instructional content,

> remediation, drill, practice, testing, monitoring and record-keeping functions. (Sitko in Bachor & Crealock, 1986, p. 408).

Qualitative Aspects of Writing:

> Composition quality refers to holistic overall story impression. In this study technical aspects such as transposition quality were also considered through use of the Diagnostic Evaluation of Writing Skills (DEWS) which addresses both lower levels (punctuation, spelling and grammar) and higher meaning level aspects of text.

Holistic Writing Assessment:

> A procedure for rating student writing samples based on an overall impression of student writing quality which includes both the conventions of print as well as

semantics. In this study each sample was assigned a score of one to four.

Quantitative Aspects of Writing:

Refers to fluency measures such as number of words and sentences per story as well as number of revisions and amount of time spent writing. In the current study changes over time in number of words per story and amount of time spent writing were studied.

CHAPTER II

REVIEW OF THE LITERATURE

This chapter presents the theoretical framework for using the computer as a tool to enhance process writing. Chapter II begins by exploring the relationship between language and learning. Expectations about writing are then highlighted, followed by a discussion of changing writing philosophy. The writing process model is then outlined. Next, a research section examines the effects of the computer as a writing tool on students' writing. The research review is followed by a section that focuses on the evaluation of written composition. The chapter, concludes with a brief overview of several issues in instructional intervention effectiveness.

Language and Learning

The importance of language in the development of students' writing dictates that educators must have a clear understanding of the relationship between language and learning in order to effectively introduce students to the principles of the writing process (Alberta Education, 1989). Leonardi and McDonald (1986) and O'Brien (1984) have analyzed the instructional problems of pupils using microcomputers who are being taught to write by means of the process approach to writing. They offer classroom strategies that move successfully from the theoretical to the practical. Their basic assumptions about the teaching-learning task have been summarized by Alberta Education (1989) and are adopted here as underlying assumptions about language, learning and computer technology. The theory has been adapted appropriately for the purposes of this study.

1. Learning involves linking new knowledge and prior knowledge: language is the tool for making these connections.

2. Language has a dual function: the communication of ideas as well as the discovery of ideas. Writing is not simply the transfer of thought from one person to another, but is a process through which a writer discovers meaning by constructing text to which a reader will also give meaning.

3. Language is developed and most effectively learned in extended, meaningful contexts. Skills are best taught as means to an end rather than an end in themselves.

4. Respect for intention empowers the learner in language use.

5. Self-exploration and exploration of personal experiences are fundamental to the development of language ability.

6. Language is the primary tool in all subject areas. It helps the learner:

   - discover and collect ideas
   - clarify, consolidate and extend thinking
   - think about thinking and learning strategies
   - communicate subject knowledge
   - hypothesize and test ideas against those of others, and
   - respond to ideas expressed by others.

7. Computer technology can be used as a tool to promote language development and learning.

8. Computer technology has the potential to free students from difficulties with lower order skills (handwriting, formatting, spelling, recopying, filing, etc.) so that their attention and effort can be directed to higher order skills and strategies (composing, organizing, reviewing, elaborating, etc.). (p. 1-11 and 1-12).

As Vygotsky's theoretical approach indicates that young children use language-based routes to knowledge, the relevance of these principles of teaching is apparent.

Recent research supports Vygotsky's interpretation of language and cognitive development (Beck, 1989), making his

arguments key in discussing the context in which the integration of process writing with computers should take place.

Vygotsky's research showed that another child's presence increases verbalization and encourages speech activity. Besides this social speech, he also noted the importance of egocentric speech. Vygotsky contended that the speaking aloud to oneself becomes a child's inner language or internal thought. Britton (1982) explains that Vygotsky did not speak in terms of socialized speech emerging out of egocentric speech. Instead he saw social speech developing in two distinct directions in order to serve two different purposes. Specifically, social speech for social exchange increases in range and complexity and becomes more communicative and better able to take account of a listener's point of view. As speech for oneself, it becomes individualized and abbreviated.

Similar to Vygotsky's distinction between two distinct, purposes of language, John-Steiner and Tatter (1983) have differentiated between writers using social speech to communicate directly with others and inner speech which is used to discover relationships between thoughts which could

be lost without the permanence of written language. Inner-speech writing is seen not only as a means of exploring but also as a method for assisting the writer with planning and moving ahead.

Hence, just as Vygotsky argued for language to be seen as a means of critical analysis, the use of writing to teach problem solving skills has become equally important. Young writers must learn to become attentive and ask questions, to be critical and probe meanings, and they also must become reflective about their own experiences (Baldursson, 1988). It is no longer sufficient or even necessary for students to be skilled at reciting their teacher's point of view. Instead what should count as important is their ability to solve new problems, to make sense of what they have learned and to elaborate upon their own ideas (Applebee, 1986).

Development of Students' Writing

As written speech requires that communication be achieved only through words or symbols, the evolution from first draft to final copy reflects our mental processes (John-Steiner & Tatter, 1983). Writing can be thought of as a way of making thinking visible or as a meaning-shaping activity (D'Arcy, 1989), and in this sense very young children develop their first experiences with writing quite naturally. They move from talking about scribbling and asking questions after being read to, to recognizing printed words, and labeling and discussing elaborate drawings. Parents and educators who create situations to enhance these experiences are encouraging this interactive relationship between visualizing and verbalizing (D'Arcy, 1989).

Emergent young writers are gradually exposed to various expectations about writing which can focus on product or on process. However, product and process teaching are complementary and not mutually exclusive teaching strategies (Gerard & Junkala, 1980). Even though writing can be focused on the writing process, the product is not to be ignored. Students need to know what good products are like.

If they do not know what good products are like, they cannot use the writing process to good effect. In a sense the work determines the means. The purpose for the writing and the product are closely linked. Students need to know for example, what good informational prose is like in order to write it themselves. Products are also important because students need to "internalize" the reader's expectations. Products are important because the product is all that the reader has. The process that the author went through is largely unavailable (Alberta Education, 1988).

Figure 1 illustrates a model of writing which validates four interpretations of what writing is. D'Arcy (1989) argues that children should be exposed to each of these perspectives. When writing is regarded as a code, the emphasis in on learning how the code works. D'Arcy (1989) feels the computer can be most useful here in building more confident code breakers. Many children feel a strong disinclination about making their thoughts and feelings visible, so being able to erase mistakes at the tap of a key may alleviate some of these fears. This ability to refine text may encourage young writers to see written language as a medium for them to experiment with. Children can also be

encouraged to achieve better products by giving them more time and more help (D'Arcy, 1989). However, unless writing is regarded as an active process of discovering, re-collecting, re-creating and re-constructing, students will never fill the first three expectations to their full potential (D'Arcy, 1989).

Insert Figure 1 about here

FIGURE 1

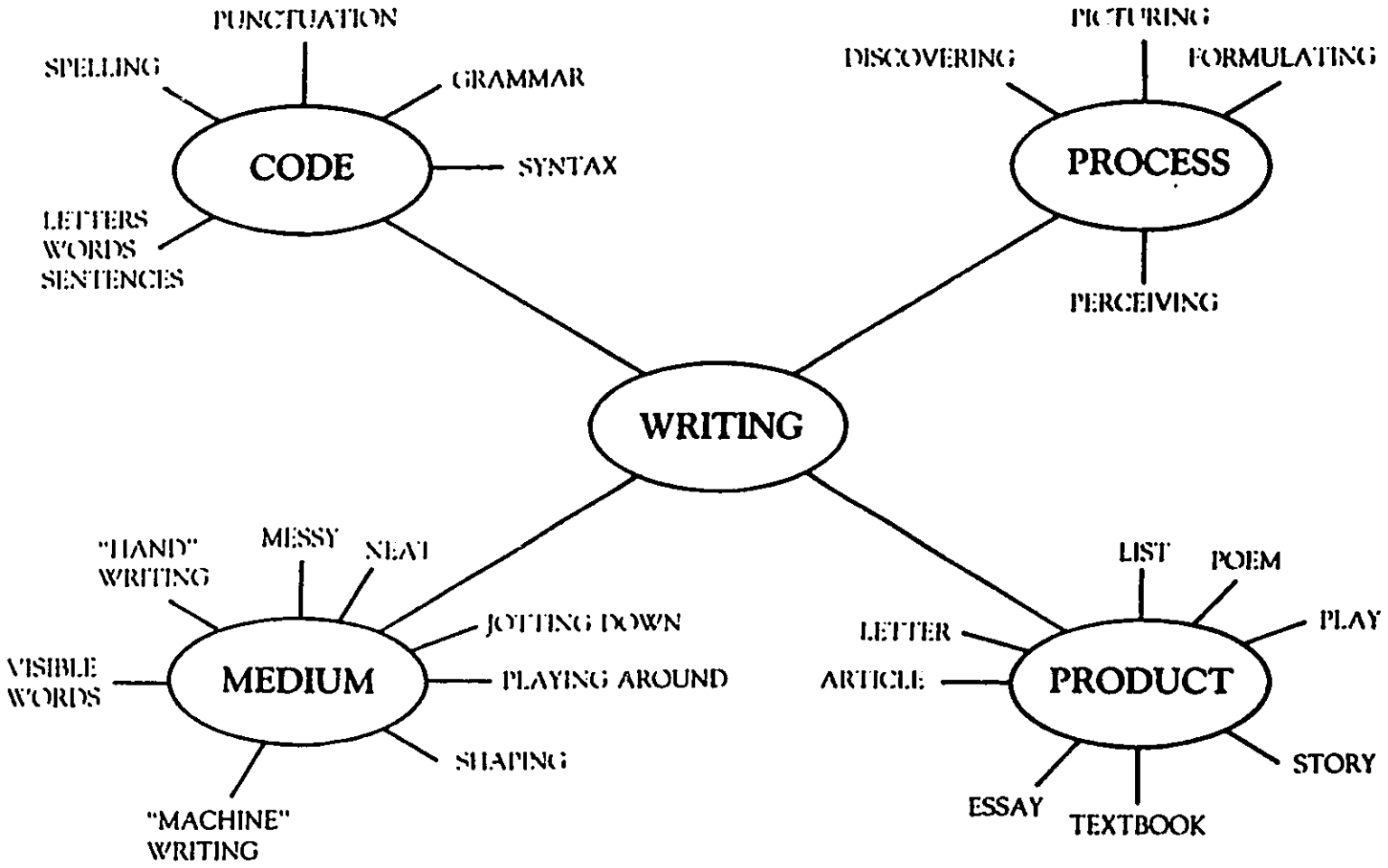


Figure 1 Expectations about Writing

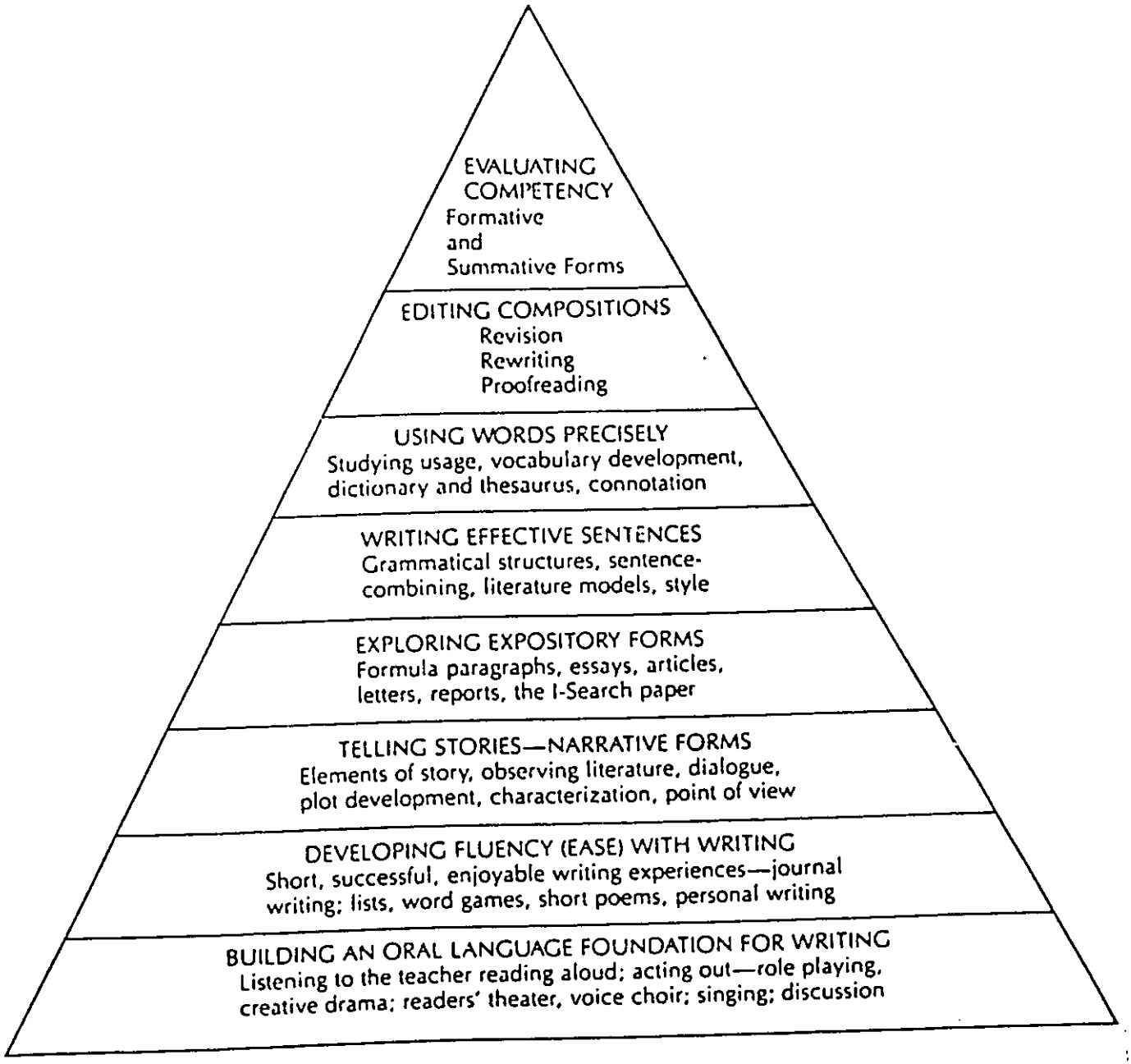
Writing Instruction

Until recently the process expectation about writing has been least evident in the classroom (D'Arcy, 1989). A conventional language arts program, in the past, involved using workbooks and exercise sheets in order to follow a specific sequence of skill development. Conversely, "whole language" proponents adhere to a "top-down" approach to learning, as illustrated in Figure 2 so that specifics such as conventions of print are focused on only after an effective foundation for written language has been built. The importance of Tiedt, Bruemmer, Lane, Stelwagon, Watanabe and Williams (1983) model is its holistic approach to teaching writing. The emphasis is on the process of writing; only when students feel comfortable with writing can the content of their work be analyzed.

Insert Figure 2 about here

Some educators equate the "whole language" method of language instruction with skills not being taught and errors not being corrected in a context of minimal guidance from

FIGURE 2



The Tiedt holistic model for teaching writing: A sequential framework for focusing group instruction during a one-year period.

teachers. Ideas are fundamentally important in writing and hence strict enforcement of neat printing and good spelling for a first draft would be more stifling than encouraging. However, as a major goal of language arts instruction is clear communication, mechanical errors must be addressed at later stages of the writing process to develop fluent readers and writers. The whole language approach is consistent with intelligent planning and problem solving techniques. First, a general concept of the goal to be achieved is established, then a broad set of guidelines is identified, modified and refined. Specific tasks are only tackled once these initial steps have been carried out (Windrim, 1990).

The underlying contention of the process approach to teaching writing is that the traditional "skills to writing" approach is unnatural in terms of what is known about children's language development, and may be detrimental to the development of real writing abilities (Proctor, 1986). The basic assumption of the process approach to writing is that as learners concentrate on meaning and on the composition as a whole, mechanical skills develop within the context of the writing (Dalton & Hannafin, 1987). Therefore the mechanics of written language are not ignored,

but dealt with as they emerge, as opposed to being presented as totally, separate isolated skill exercises. Emig (1981) identifies the key differences between the perspective of the "current-traditional" and "new or re-invented" in this way:

Current-Traditional	New or Re-invented
- emphasis on written product	- emphasis on writing process
- belief that writing is taught, not learned	- belief that writing is learned, not taught
- learning proceeds from part to whole	- writers work both from whole and from part to whole
- writing is a linear process... planning, then writing, then revising	- writing is recursive...written plan, write and then revise, but also revise, plan and then write
- writing is a silent solitary activity	- writing is enhanced working with others who give vital response

The process approach for teaching writing is being used more and more frequently by educators in their classrooms. It moves beyond the usual two-step procedure of think/write where the only teaching consists of a verbal command, "Now here's the topic - write!" (Soter, 1987). The emphasis of

the latter approach has traditionally been on the product, whereas the current "process approach" focuses on specific teaching activities to assist students with organizing their thoughts and ideas, before, during and after writing. Instructional approaches typically associated with process approaches include brainstorming, journal writing, focus on the students' ideas and experiences, small-group activities, teacher/student conferences, the provision of audiences other than the teacher, emphasis on multiple drafts, postponement of attention to editing skills until the final draft and elimination or deferment of grading (Applebee, 1986).

This changing conception of writing offered through the use of the process approach to teaching writing can constitute an emphasis on students' learning instead of teachers' teaching. Children can learn to write without direct instruction if they are given adequate opportunities to write and discuss their writing with teachers and peers (Proctor, 1986). The importance of the social aspect of writing has been recognized by such scholars as Vygotsky: "Writing itself, a symbolic and social tool, grows out of children's experiences with other tools - gesture, speech, dramatic play, drawing - and with other people" (Vygotsky in Dyson, 1987, p. 649).

White and Hubbard (1988) envision teachers becoming mentors to their students as opposed to the primary source of knowledge. This role change is even more evident with the use of computers where the teacher no longer remains at the front of the classroom and the writer has more control over the text than with ordinary writing instruments (Baldursson, 1988). The drafting stage of the writing process would appear to be best served with the assistance or word processing to help students to re-arrange their ideas. The final phase of revising can be handled by the students themselves through conferencing with peers and alone with the guidance of some type of checklist.

Unfortunately writing instruction in some classes has been replaced by instruction in the mechanics of word processing. Teachers still need to support students through the writing process. Classroom teachers can guide students by modelling the revision process and monitoring student revisions (Balajthy, McKevney & Lacitgnola, 1986-87). An example of how teachers can model the writing process for their students is offered by Pellegrini and Ingles (1986-87) (see Appendix I). Although the teacher may choose to act as a model throughout all the stages of the writing process

(Graves in Temple & Gillet, 1984), perhaps the most important role of the teacher is that of motivator at the pre-writing stage. For as Carruthers reminds us, a good teacher has been defined as one who makes himself progressively unnecessary (in Atwell, 1987). This statement holds true in terms of students' learning how to think critically and become actively involved in solving problems.

The Writing Process

Educators are quick to establish the point that computers alone cannot assist students through all the stages in the writing process. Some researchers believe that the most significant factor of all in the success of a classroom writing program is the attitude of the teacher (Gillespie, 1987). This current study accepts the underlying principle adhered to by Alberta Education (1989), that teachers should possess a thorough understanding of the process approach to writing prior to using computers in the classroom. Therefore process writing will be discussed in much detail to ensure that the philosophy towards writing instruction held by the teachers involved in this research is made clear.

Writing Process Models

Although there is general agreement that process writing can be divided into three stages (pre-writing, and establishing context; composing and writing the first draft; and post-writing involving editing and revising), in reality the writing process is not as clearly defined as implied by these stages. Writing is not a linear process, it is essentially recursive by nature, and the path through the

process is different for every writer. However, discussing various writing process models provides a useful structure for planning, discussing, and examining writing for instructional purposes (Alberta Education, 1989).

Three-Step Version.

Soter (1987) discusses: pre-writing activities such as brainstorming, note-making, list-making, and planning; writing-activities including drafting, revising and writing; and post-drafting-editing activities. However, she also informs the reader that these processes are not sequentially fixed and do not occur similarly for all writers.

A similar three-stage approach entitled "The Writing Cycle" is offered by Temple and Gillet (1984). Stage one is pre-writing or rehearsing during which time students are encouraged to keep a list of topics, interview others, write alternative leads, and draw and free write in order to uncover what the writer can write about. Stage two involves drafting, where the focus is on writers re-arranging, adding and/or deleting ideas to get their message across to others. The third and final stage of revising involves students sharing their work with others before editing and completing

a final copy of their work.

A somewhat original version for a three-step model of the writing process which includes collecting, planning and developing has been outlined by Murray (1985). Six ways of collecting information are explained: awareness, observation, recall-brainstorming, mapping, exploration drafts, empathy, interviewing and library research. This first phase involves the gathering of ideas and experiences, whereas the planning stage requires the writer to make decisions about his /her story regarding the focus, voice, design, genre, and structure. The final step of developing is the actual writing phase where drafting, revising and editing all take place. The value of Murray's (1985) approach may simply be that the terminology used, collecting, planning and developing, is more familiar and therefore less threatening to students (and teachers) than words such as drafting, revising and editing.

Five-Step Version.

An expanded version of the above process approaches is suggested by Gillespie (1987). His five stage writing process involves pre-writing, drafting, revising, editing and

proofreading, and publication which includes teacher evaluation and school publication for fellow classmates. Although Gillespie's (1987) procedure does not necessarily offer any additional strategies over those previously suggested, he does manage to break the process of writing down into five steps which could serve to make the process more manageable for both teachers and students. He also offers us some insight into exactly what is required by the teacher at each step of the process. For example, during the publication phase, Gillespie (1987) encourages providing an audience for students' writing besides the evaluation by the teacher by sharing stories out loud in small groups, by displaying work in hallways or by constructing books for individual students or class work (see Appendix II). He also emphasizes the important role the teacher should play in motivating students at the pre-writing phase. A pre-writing activity suggested by Gillespie (1987) and outlined in detail by D'Arcy (1989) is clustering or mapping. The idea is to give students some visual clues to assist them in getting started with their writing. Instead of writing <u>down</u> the page you write <u>around</u> the page as illustrated in Figure 3. As the key word is circled with further ideas, clustering can be thought of as circular

brainstorming (D'Arcy, 1989)

Insert figure 3 about here

Eight-Step Version.

Breaking down the process approach even further, writing skills can be presented to students as an eight stage process involving pre-writing conference, composing, printing a draft, editing conference, revision and proofreading, printing a final copy, illustrating the composition and providing an audience (Kerchener and Kistinger, 1984). The benefits of this model of the writing process may be that each step is specifically labeled which may be preferable to condensing the entire process into three stages, especially for aspects such as conferencing which are key in process writing.

FIGURE 3

Clustering, Mapping of Circular Brainstorming

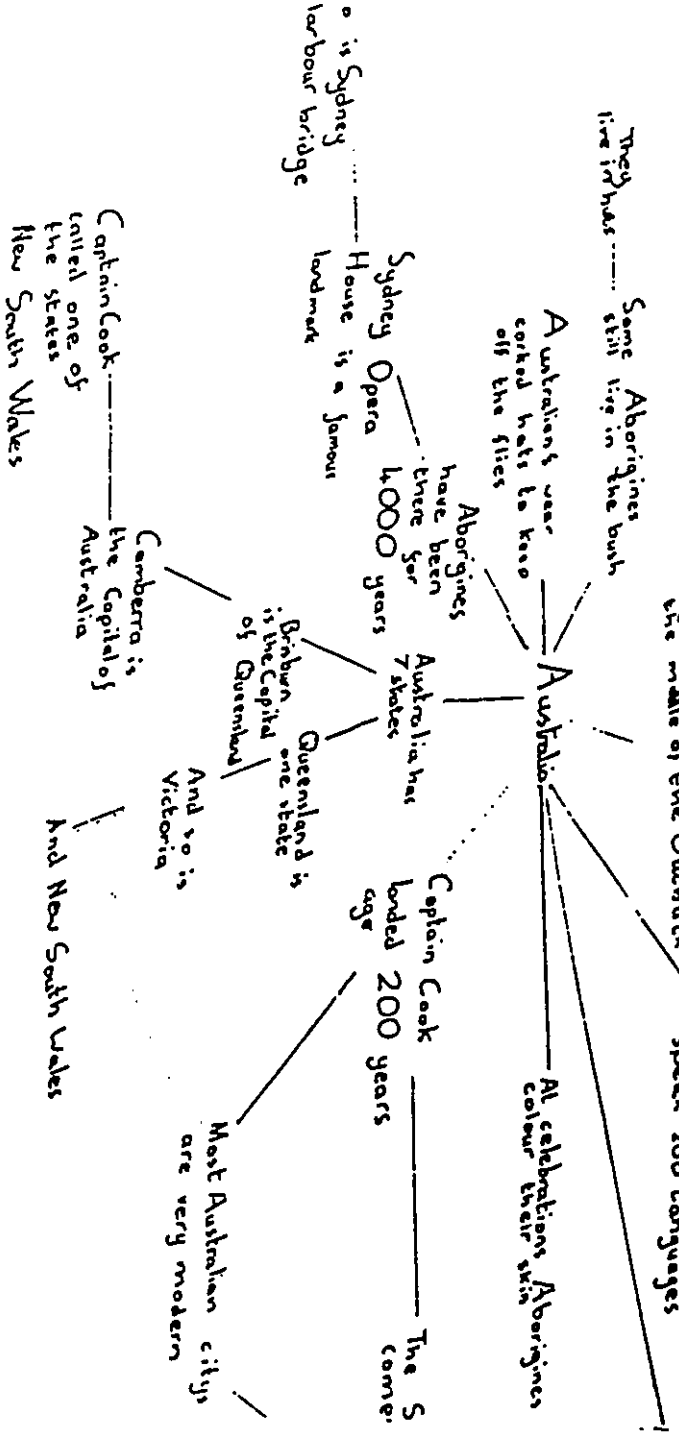


Figure 3 "What I Know About Australia" by Jessica

Conferencing Aspects

The writing process can be thought of as a "hierarchieally organized, goal-directed, problem-solving process." When writing a story a student must solve the "sub-problems" of where to get ideas, how to organize those ideas, how to construct well-written sentences, how to write legibly, and last, but not least, how to apply punctuation, grammar and spelling rules (Freedman, 1987, p. 21). Hernandez (1987) reports that Graves (1984) also saw the writing process as a series of steps leading to the solution of a problem, within which editing for mechanics such as grammatical errors must occur, although not until the final stages.

Britton offers some insight into how children can solve problems by talking and solving problems jointly (Barnes, Britton & Rosen, 1978). He was really outlining one of the strategies currently used in writing process classrooms--peer conferencing.

Teacher/student conferencing is also an important component of the process approach to teach writing. During a pre-writing conference, for example, the teacher can meet

with students to discuss what topic will be chosen. The benefits of students choosing their own topics are outlined by Graves (1979). The topic can be based on the student's own experiences or upon a mutually agreed upon subject. Atwell's (1987) abbreviated recording system offers the teacher a realistic strategy for implementing a conferencing procedure in the classroom (see Appendix III).

Children conferencing with themselves allows for another opportunity for problem solving during the writing process: "You just read the piece over to yourself and it's like there is another person there and you think thoughts of what is wrong with it" (Calkins, 1983, p. 138). A self-checking list to guide students in a final evaluation of their work may be helpful (See Appendix IV). In addition strategies as outlined in Hammill, Bartel and Bunch (1984, p. 139) can be mentioned on a poster (Haley-James, 1981) (See Appendix V). These strategies and poster checklist focus on lower-level revisions as students appear to be initially concerned with only this level. High level revisions or qualitative changes appear to require a much longer time period. (Crealock & Sitko, 1990; Wetzel, 1985; Woodruff et al., 1981-82). In order to provide further

individual assistance with composing and editing students can be given reams of scratch paper which can be cut into half sheets. This size of paper is less threatening than a full-size sheet, and is appropriate for adding ideas (Haley-James, 1981). A further strategy to eliminate the fear of a blank page is the use of the microcomputer. Neuman (1983) argues that it is easy to fill the screen due to its small size.

The Writing Process with Computers

Numerous educators have emphasized the many benefits of a microcomputers in assisting students with the writing process (Crealock et al., 1985; Hernandez, 1987; Hooper, 1987; Kerchener and Kistinger, 1984; Murray, 1985; Newman, 1983; Temple & Gillet, 1984; Vacc, 1987; Woodruff, Bereiter & Scardamalia, 1981-82). Most agree that word processing eases the drafting, editing and revising stages of the writing process for students.

> I do not know of any writer who used a word processor who is not impressed with the writing tool. It will not make a poor writer a good writer, but it does make the act of writing, revision, and editing much easier.
>
> (Murray, 1985, p. 70)

Morocco and Neuman (1986) found that besides having mechanical and spelling problems, below average writers lack strategies for processes such as planning, composing and editing which have been identified by numerous writing researchers (Calkins, 1983; Graves, 1979; Murray, 1985) as being basic thought processes that recur in writing. The word processor may offer such students access to these writing processes, as children have been found to remain

highly involved in writing (Woodruff et al., 1981-82) and produce rich first drafts (Morocco & Neuman, 1986) when teachers have their pupils use computers for composing.

Specifically, Morocco and Neuman (1986) found that the word processor can be more effective for brainstorming than a pencil as students are willing to make more than one attempt to begin a piece of writing. Their observations suggest that weak writers were more likely to view their work on the computer as a first draft and hence be less afraid to take risks during the beginning stages of writing. The researchers cite that an additional benefit for weak writers using word processors was the ease with which the large type allowed students with messy handwriting to read their own ideas. As well Morocco and Neuman (1986) found that the upright monitors and large print facilitated an openness of the child's work which increased the opportunities for collaboration between teacher and student.

Therefore access to word processors may assist students in acquiring writing strategies necessary to becoming productive members of the mainstream classroom (Morocco & Neuman, 1986). Other research also indicates that computers have been found to make the students' writing easier, better

and more enjoyable (Crealock et al., 1985; Woodruff et al., 1981-82). Jones Loheyde (1984) cites a further advantage of utilizing word processing for composing as both student and teachers benefit from the production of a legible copy. She feels this is particularly true for young writers:

> Elementary-aged children for example struggle for neatness and perfect copy. They will write or print usually laboriously, until they make a spelling or transposing error; then they wad up their paper and begin again. Here the positive efforts of terminal use are readily apparent: the youngster, uninhibited by his or her lack of manual dexterity which causes messy handwriting, can easily correct surface errors, can therefore complete that which he or she intends to write, and can easily produce a legible copy of the work for the teacher (p. 81-82).

Writing With Computers

A literature search was conducted to examine the effects of the computer on students' writing in grades one through nine as indicated in Table 1. Studies were found that included a measure pre-test/post-test measures of writing quality and quantity. After reviewing the relevant literature, it is difficult to make specific conclusions concerning combining writing instruction with the computer to improve students' writing skills due to the wide variations

in specific treatments. However it appears that although some research has demonstrated significant differences between groups regarding quantitative changes in writing, few studies, using a holistic scoring system to reflect qualitative improvement, have revealed a significant main effect for computers.

Insert Table 1 about here

TABLE 1

Summary of Previous Research

Study	Grade	No. of Students	Time	Method	Focus	Results
Woodruf	a. 6	12	4 days	CAI vs. Handwritting Lower Level	Quantity & Quality	No main effect for No. of words. Quality or time
	b. 8	36	4 days	On-line intervention Higher Level		
Kopp	5	12	less 3 months	Word processing	Quantity & Quality	More revisions, better quality-computer. All made more lower level revisions.
Spence	4-9	2 classes each	8 months	Word processing vs. paper & pencil traditional	Quantity	Poor handwriters benefitted most.
Wetzel	3,4,5	93-exp. 95 control	8 weeks	Computer process vs. traditional	Quality	No difference between two groups. Faster typists better than slow.
Daiute	a. 7	34	6 months	Computer process vs. traditional	Quantity	Wrote more with pen and paper.
Kerchener & Kistinger	4,5,6	LD 18 vs. 19 normal	Oct.- May 8 months	Computers and process vs. traditional	TOWL	Significant differences in favour of computer.

TABLE 1 Cont'd

Summary of Previous Research

Study	Grade	No. of Students	Time	Method	Focus	Results
Crealock et al.	a. SLD 15 yrs gr. 10	5 SLD & 16 gr. 10 Exp. vs.	12 weeks	Creative writing vs. Regular class	Quantity & Quality	Both experimental and computer groups improved from pre-test
	b. 9 vocational	4 classes	12 weeks	Computer and grid Grid - 1 class control-1 class		
Vacc	gr. 8	4 E.M.H.	6 sessions 24 letters 12 word processing 12 paper & pencil	Word processor vs. Handwriting	Quantity & Quality	More revisions, more time, longer text with computer. No difference in quality.
Dalton & Hannafin	9	64	1 year	Computer and process vs. process	Quality	No main effect for computer.
Crealock & Sitko	4,5,6,	27	Sept.-May 9 months	1. Keyboarding and composition on computer 2. Composition on computer 3. Handwriting 4. Regular	Quantity & Quality	Entire group improved no. of words and sentences, but not maturity or technical TOWL - N/S.

Although these studies which have looked at changes in students' writing with and without computers have varied widely both in method and results, they tend to fall into two categories: those that studied the effects of combining computers and writing for non-handicapped students (Daiute, 1985; Kopp, 1985; Spence, 1986; Wetzel, 1985; Woodruff, Bereiter & Scarmadalia, 1981-82), and those that investigated the effects of utilizing the computer on the writing of students with special needs (Crealock et al., 1985; Crealock & Sitko, 1990; Dalton & Hannafin, 1985; Kerchner & Kistinger, 1984; Vacc, 1987).

Woodruff, Bereiter, and Scardamalia (1981-82) report varying results from two studies conducted to assess the feasibility of an interactive computer program with regular classroom students. In study 1, twelve grade six students wrote two essays, one with paper and pencil, and one with computer assisted instruction which allowed students to request help with sentence openers, planning strategies and spelling assistance The essays were scored using a holistic scoring system ranging from 1 to 5, with a score of five meaning high in quality. No significant difference for amount of time spent, number of words produced or quality of

papers produced were found. The researchers also found that students used low level skills such as "What will I say next?" rather than global planning strategies such as "Have I met the purposes of the assignment?" or "Have I convinced my audience?" Study 2 involved 36 grade eight students writing three essays. The research design was similar to the previous study with a more active intervention program implemented in the composing process such that the computers provided higher-level assistance than in Study 1. After every sentence the program asked a question such as "Have you made your reason clear to the reader?" Again results showed no significant effect for number of words produced. Students using this questioning strategy, scored significantly lower on writing quality ratings than those students writing on the topic without the on-screen prompts. The researchers concluded that the questioning strategy was too intrusive.

Kopp's (1985) research with regular classroom students has demonstrated both quantitative and qualitative improvements in writing through use of the word processor. Using a case-study approach he assessed student compositions, student and teacher questionnaire responses, and student interview responses. He reports that not only did students

make more revisions to their stories with a computer than with a pen and paper, but they also composed better stories with a word processor based on a four point holistic scale analysis. However, students made more lower level or mechanical revisions such as spelling, punctuation, underlining, paragraphing and capitalization than higher level revisions regarding meaning, regardless of medium utilized to compose stories.

Spence (1986), also chose a descriptive approach to analyze differences between students writing with and without the word processor. In grades four through nine, two classes from each grade level were randomly assigned to a treatment group. Results indicated that although all students using word processors profited from the experience, those with poor handwriting gained the most. The word processor prompted reluctant writers to produce more writing and effect more revision. It was noted, though, that these differences were not apparent until the end of the eight month study. Spence (1986) also noted improved student writing attitudes for all treatment classes using word processors. He concluded that although quality of writing does not suffer, it doesn't improve significantly until operational skills, keyboarding

skills and access issues are effectively dealt with. Both teachers and students must be aware of the computer as a familiar tool.

Wetzel (1985) found no significant differences in writing quality between groups of students from regular classrooms after eight weeks of random assignment to treatment groups with and without computers. He indicated his results are consistent with previous research on writing and computers involving less than twenty weeks.

In contrast to other research findings (Vacc, 1987), Daiute's (1985) studies of thirty-four seventh graders and eight fourth through sixth graders indicated that in a fifteen minute period children wrote more words with a pen and paper than they did on the computer. Since even after six months of using the computer at least once a week, students did not write as much in time-continuous situations on the computer, she concluded that children may write less when they are composing on the computer until they become as comfortable typing as they are handwriting. Inadequate keyboarding skill has been discussed as the key factor in explaining the lack of significant findings in much of the previous research in the area of writing and computers

(Spence, 1986; Vacc, 1987; Wetzel, 1985).

The process approach to writing was combined with computers in the classroom by Kerchner and Kistinger (1984) to assist learning disabled students. Their method involved an eight-stage process which included pre-writing conference, composing at the keyboard, printing a draft, editing conference, editing at the keyboard, printing final copy, illustrating the composition, and providing an audience. Results of the study (Kerchner & Kistinger, 1984) indicated that an improvement in written language skills using the Bank Street Writer Program could transfer to paper-and-pencil tasks such as those on the Test of Written Language (TOWL) (Hammill & Larsen, 1983). Other studies in this area have demonstrated quantitative, but not qualitative, differences in comparing writing with computers and traditional methods for teaching writing (Crealock, 1985; Vacc, 1987; Woodruff, Bereiter & Scardamalia, 1981-82).

Crealock, Sitko, Hutchinson, Sitko and Marlatt (1985) conducted two experiments with different groups of handicapped students. One experiment involved specific learning disabled (SLD) adolescents using a creative writing strategy with a paper and pencil, cut and paste editing

strategy versus a control group which carried on with the regular curriculum. The second study involved two classes of mildly handicapped students using creative prompts with the Bank Street Writer Computer Program (1982), a third class using only the creative writing grid, and a fourth class serving as the control with regular instruction. In each experiment students wrote a story at pre-testing, wrote additional stories with specific training and assistance provided by research assistants, and at post-testing wrote a story on a topic of their choice for twenty minutes. The stories were scored on three measures; composition quality--holistic, number of complex sentences, and number of words per sentence; composition quantity--number of words; and transposition quality--percent of spelling errors. Results showed that gains which were made in the holistic scores and number of words during the treatment phase were significant, but at a lower level at post-testing. The control group also made gains in experiment two. Overall results showed that both experimental and control subjects improved from pre-test and post-test in both experiments, irrespective of editing strategy.

Vacc (1987) used a single subject design to compare the

word processor and traditional methods for letter writing. Results indicated that all subjects spent more time writing letters, wrote longer letters, and engaged in more revision when using the Bank Street Writer Program. No differences were found in quality of letters between the two methods.

Dalton and Hannafin (1987) found that although word processing appeared to make writing and revision less tedious for all the students involved in the study, the word processor was most effective for low-achieving students, based on their year-long study of sixty-four grade seven remedial language arts students.

Crealock and Sitko (1990) used a pre/post design to train twenty-seven learning disabled students in narrative writing. Two groups used computer technology while the remaining two groups were trained using paper and pencil. Results indicated that although the number of words and sentences per story increased over time, the changes were statistically significant for the entire group.

Problems in Previous Research

After reviewing numerous studies involving varying uses of the computer to improve writing skills several key areas which require clarification have emerged.

A primary concern arising from the previous literature is small sample size. Vacc's (1987) study involves a total of four grade eight students. Crealock's et al. (1985) first experiment involved only five SLD students in the sample. Kerchner and Kistinger (1984) utilized 18 students in the experimental group and 19 students in the control group.

Kopp's conclusions are based solely on the observation of twelve, grade five students. Similarly Woodruff et al., (1981-82) base their recommendations on the work of only twelve, grade six students in their first study. It is not possible to generalize to all students based on just a few. The external validity of much of the research to date is questionable due to this factor.

An additional short-coming of much of the previous research completed to date is the short-time frame, ranging from four days to three months. (Crealock et al., 1985;

Kopp, 1985; Wetzel, 1985; Woodruff et al., 1981-82). The importance of this factor becomes apparent with Wetzel's (1985) finding that students involved in research projects consisting of less than twenty weeks duration lack fluency in keyboarding skills.

Of perhaps the foremost concern is the methodology utilized in past research for establishing procedures for treatment and control groups. Except for the work of Dalton et al., (1987), research in the area of writing and computers conducted to date has not compared the process approach to writing with and without computers. Many researchers have chosen to study the results of a traditional language arts program with treatment groups combining both word processing and the process approach to writing. (Kerchener & Kistinger, 1984; Spence, 1986; Wetzel, 1985). Therefore, although Kerchner and Kistinger (1984) did obtain significant quantitative differences between computer and non-computer groups, the methodology is suspect. Although much detail is offered to explain the procedures for the process and computer group little information is given for the control group other than some used a "language experience" approach and others were involved in a reading and spelling program.

With this methodology it becomes difficult to decide whether to attribute changes in writing in the experimental group to the computor or to process writing.

Evaluation of Writing

Previous research comparing computer and paper and pencil in writing training with students has recognized the need to identify specific academic weaknesses in the area of writing. Crealock, Sitko, Hutchinson, Sitko and Marlatt (1985), conducted one experiment involving specific learning disabled students who had serious problems in written language. More recently Crealock and Sitko's (1990) study included students with learning disabilities with a discrepancy between ability and written language scores based on the TOWL. Dalton and Hannafin (1987) were also successful in differentiating between high and low writing abilities in a remedial language arts program based on the total language subscale score on the Comprehensive test of Basic Skills (CTBS).

These studies, dealing with computers and writing, represent major improvements over most of the research in this area due to their respective efforts to draw low-writing ability children into their testing samples. Addressing the writing problems of below average writers is important as they may lack the cognitive strategies more experienced

writers use (Morocco & Neuman, 1986). Therefore as opposed to simply grouping students as LD or non-LD (Kerchner & Kistinger, 1984), the need to identify students with a proven language deficit becomes apparent.

An instrument which may be used to distinguish average and below average writers is the Test of Written Language (TOWL) (Hammill & Larsen, 1978). (Appendix VI).

The TOWL is made up of six subtests, the results of which yield information about the following areas:

1. Word usage -the use of standard verb tenses, plurals, pronouns, and other grammatical forms.

2. Style - the use of generally accepted conventions regarding punctuation and capitalization.

3. Spelling - the ability to phonetically spell regular and irregular words.

4. Thematic maturity - the ability to construct a meaningful story on a given theme.

5. Vocabulary - the level of words used in a spontaneously written story on a given theme...

6. Handwriting - the legibility of the written story. Hammill et al., 1984, p. 135)

The Test of Written Language is a norm-referenced test capable of assessing both composition and technical skills in writing (Bachor & Crealock, 1986). As shown in Table 2, the TOWL is one of several tests of written expression, commercially available, which can be used as survey tasks (Zigmond, Vallecorsa & Silverman, 1983). Although the content of the TOWL does not offer the depth of assessment necessary to plan instructional programs, it is well suited for research and screening (Salvia & Ysseldyke, 1988).

Insert Table 2 about here

TABLE 2

List of Commonly Available Measures for Written Expression Survey

Test Name	*Publisher*	*Writing Requirement*	*Structure*
Picture Story Language Test	Grune & Stratton	Generate story	Single picture
Test of Written Language	Pro-Ed	Generate story	Sequence of pictures
Brigance Diagnostic Inventory of Essential Skills: Writing Subtest	Curriculum Associates	Generate sentences	Stimulus words

A further assessment device allows for identification of weak writers. Kopp (1985) used a four-scale holistic assessment from the Student Assessment Branch of the Edmonton Public School Board. As shown in Table 3 the essays can be given an overall rating based on the general readability of the story. Wetzel (1985) used similar categories of rangefinders to evaluate the writing quality of third, fourth and fifth grade pupils using the computer in a process writing program.

Insert Table 3 About Here

TABLE 3

Holistic Scoring Criteria
from Edmonton Public Schools

FOUR The paper reads smoothly, is carefully thought through and organized. The author's intentions are evident and awareness of the reader is present. There is evidence of precise vocabulary and the few mechanical errors that exist do not interfere with the author's intended meaning.

THREE The paper reads smoothly but may contain a few unnecessary or awkward sections. The writer shows some awareness of the reader. There is some evidence of precise vocabulary but it is sometimes inappropriate or too formal. There is some evidence of thought and organization but some sections may show thinking or organizational problems. There may be mechanical errors but they do not interfere significantly with the intended meaning. Mechanical errors may give evidence of a specific kind of problem.

TWO The paper reads unevenly. There is evidence that the writer is gaining some control of some elements of the writing process, but there are several areas lacking control. Vocabulary is correct but it does not convey the author's intended meaning specifically. Content lacks clarity of thought and organization, although there is some evidence that the author knows what he means to say. The contol necessary to communicate precise thoughts is lacking. Mechanical errors interfere with the message to some degree.

ONE The paper is difficult to read, but some understanding of the author's meaning is present. The writer does not have an awareness of the reader. There is a general lack of thought and organization. Mechanical errors and sentence problems interfere with what is trying to be said.

An additional technique for assessing writing has been developed by Weiner (1980). The Diagnostic Evaluation of Writing Skills (DEWS) allows evaluation in terms of six categories of errors: graphic, orthographic, phonologic, syntactic, semantic, and self-monitoring, as shown in Table 4.

Insert Table 4 about here

Weiner and Weiner (1984) have demonstrated the usefulness of the DEWS for identifying students with weak writing skills as well as specific areas in need of remediation.

The suitability of both the holistic rangefinders and Weiner's (1980) DEWS scoring criteria for purposes of evaluating writing at the grade three level are confirmed by Alberta Education's scoring criteria for grade three language arts, as both higher and lower level aspects of text are addressed as outlined in Table 5.

Insert Table 5 about here

TABLE 4

The Diagnostic Evaluation of Writing Skills

Graphic (visual features)	Examples of errors
1. Excessive pencil pressure marks	
2. Letter formation ambiguities; erasures	
3. Capital and lowercase letter mixture	
4. Size or spacing irregularities	
5. Off-line writing	
6. Margin slant or crowding	

Orthographic (spelling)	Examples of errors
7. Sequencing of letters (reverse order) or three consonant clusters	
8. Doubling final consonant	
9. ed ending with sound of d or t	
10. Prefix or suffix generalizations	
11. ie becomes ei after c and with sound of a	
12. y becomes i, except before ing	
13. c or g, followed by e, i, or y	
14. ch=k and sh; sh=si, ti, ci, ce, su	
15. ph and gh = f	
16. Silent letters in special spellings	
17. Schwa sounds; related words	
18. Word division by syllable	

Phonologic (sound components)	Examples of errors
19. Nonphonetic spelling (bizarre)	
20. Strictly phonetic spelling	
21. Letter or syllable omissions	
22. Words run together	

Syntactic (grammatical)	Examples of errors
23. Subject and predicate agreement	
24. Tense, plural, possessive endings	
25. Word order; omissions	
26. Incomplete sentences (fragments)	
27. Run-on sentences	
28. Punctuation; indentation of paragraphs	
29. Variety in sentence structure	
30. Coordination (and/but)	
31. Complex sentences: subordination	
32. Amount of information per sentence	

Semantic (meaning)	Examples of errors
33. Flexible vocabulary, connotative-denotative	
34. Coherence; focus and tense shifts	
35. Logical sequencing	
36. Transitions	
37. Distinction between major and minor points	
38. Inferential thinking; cause-effect	
39. Idiomatic and figurative language	

Self-Monitoring skills	Examples of errors
40. Self-correction: spelling and punctuation	
41. Improvement through revision	

TABLE 5

Alberta Education - Scoring for Gr. 3 Language Arts

REPORTING CATEGORY (Scoring Guide)	DESCRIPTION OF WRITING ASSIGNMENT	RANGE OF MARKS
CONTENT (Selecting events and details to achieve a purpose) Events and/or actions should be plausible within the content established by the writer. The student should be able to select appropriate details to describe characters, their actions, and events. DEVELOPMENT (Organizing events and details into a coherent whole) The student should be able to organize events and details in a coherent sequence. SENTENCE STRUCTURE (Structuring sentences appropriately) The student should be able to use a variety of sentence structures appropriately. VOCABULARY (Selecting and using words and expressions correctly and effectively The student should be able to use words and expressions correctly and effectively. CONVENTIONS (Using the conventions of written language correctly) The student should be able to communicate clearly by adhering to correct spelling, punctuation, and capitalization.	The writing assignment follows a story starter that is to be read by the student. The assignment sets a specific writing task but allows the student to use imagination and background experience to develop a story.	In each reporting category, the student receives a score within the following range: 5 - EXCELLENT 4 - PROFICIENT 3 - SATISFACTORY 2 - LIMITED 1 - POOR INS - INSUFFICIENT

Error Analysis

Error analysis appears to be an appropriate approach in assessing improvement in writing given that students have been found to spend more time making lower level revisions such as spelling, punctuation, paragraphing and capitalization, (Crealock et al., 1985; Vacc, 1987; Kopp, 1985; Woodruff Bereiter & Scardamalia, 1981-82). Improvement in these lower level written language skills using the computer can transfer to paper-and-pencil tasks such as those on the TOWL, (Kerchner & Kistinger, 1984).

For students to achieve improvements in both lower mechanical and higher meaning level functions, the teacher must consider all aspects of the writing process. For example, if the child becomes more self-conscious and aware of the conventions and need for readable handwriting, it likely indicates an awareness of an audience beyond the teacher and peers, so the teacher should spend more time with the child at the editing stage, (Hannon & Hamilton, 1984).

In the previous research section distinctions have been made between quantitative and qualitative changes in writing. Although more does not equal better, as Haley-James (1981) states,

> Drafting and redrafting type of revising can profitably take place only when there is enough raw material on paper that interests the writer to allow the writer to focus on content and meaning that fit a felt or emerging purpose for writing. (p. 564)

Rewriting the text involves taking the writer's intended effect into account. Wahfeldt (1985) makes a distinction between a lower level of revising to fit convention and revising to fit intentions at a higher level.

Woodruff, Bereiter and Scardamalia (1981-82) make similar distinctions between lower levels of text production such as identifying misspelled words, overly complex sentences, long paragraphs, awkward phrases, and higher level aspects of the text dealing with meaning and theme.

These two categories relate to the transposition versus composition issues as presented by Crealock et al., (1985). She concluded that since SLD students were aware of both, but more concerned with the former, any strategy that assists in getting their ideas in an acceptable form is valuable.

Woodruff et al. (1981-82) made similar recommendations. The researchers concluded that anything which encourages students to become more involved in the development of

composition is worthwhile. The investigators see the computer as a valuable asset in this regard as students appear more willing to compose when using word processing.

Issues In Instructional Intervention

As opposed to one-to-one tutoring which several researchers have utilized (Pearce-Burrows, 1988; Vacc, 1987), training methods for entire classrooms to improve achievement appears to be the challenge, given the current trend toward mainstreaming (Derry & Murphy, 1986). However, within the classroom there are factors such as physical characteristics, nature of treatment, teacher characteristics, setting-variables, and the behaviour one tries to change which influence intervention effectiveness (Ysseldyke & Algozzine, 1982).

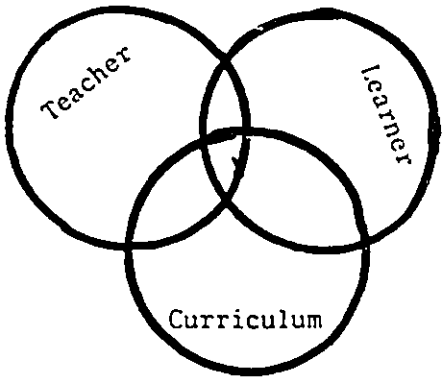
As illustrated in Figure 4 the learning process is influenced by a number of factors that can be grouped under the headings of curriculum, teacher and learner (Renzulli & Smith, 1978). Intervention effectiveness is based on the interaction among these variables.

Insert figure 4 about here

Proctor (1986) studied the effect of teachers' theoretical orientations on the writing produced by grade one students. He compared teachers using the traditional skills approach to teach writing with teachers developing the writing process in their classroom. The findings of the study showed that students in classrooms headed by traditional skills teachers were learning a different definition of writing.

FIGURE 4

Abilities
Interests
Teaching
Style (s)



Disabilites
Abilities
Interests
Learning Style (s)

Content Objectives
Process Objectives
Methodological Objectives

The Learning Process

(Adapted from Renzulli and Smith, 1979, P. 3)

Source: Burrows, 1987, p. 12

He concluded that the students' concepts of writing was a result of what teachers had demonstrated to them. Teachers were not just transmitting their view of writing to their students but their view of the purpose of education as well. Students in the traditional classroom began to construe that writing is not thinking. If students are to develop as writers, much of the time spent on traditional grammar instruction would be better used having students involved in the writing process (Alberta Education, 1989) as illustrated in Table 6.

Insert Table 6 about here

As the traditional skills approach to writing presents students with a dramatically different learning format from the process approach, this current study was strongly opposed to involving teachers still in the habit of exposing their students to a welter of skill practice. For ethical reasons, only teachers of writing committed to the nurturing of beginning writers through process writing were involved in the current research. The intent of this research was also to reduce the influence of teacher and curriculum factors by

TABLE 6

The Writing Process

The Stages of Writing

Teacher's View	*Stage*	*Young Writer's View*
I teach the students in my classroom to brainstorm, to discuss, to develop word banks, to list, to visualize, and to observe.	Prewriting	I know how to observe, to play with words, to list, to discuss, and to generate ideas.
My students have learned to focus their attention. They know they can explore their feelings and thoughts on paper.	Drafting	I know some way to explore my own thinking with words on paper. I can focus my attention.
My students have learned to obtain satisfaction from giving and receiving editing help. They know a number of ways to change the drafts they have written.	Editing	I can change what I have written. I can assist a fellow writer. I can *learn* to write.
My students are learning the mechanics of the English language in a way that makes sense to them. I teach the skills they need to publish their work.	Proof-reading	I know how the English language looks in print. I can check for details.
My students think of themselves as authors. They enjoy reading their own books, and feel confident reading their written work to others. They see meaning in expressing their ideas and feelings.	Publishing	There is a reason for doing this writing. Other people value my ideas and feelings. I can get reactions to my work at any stage. I am an *author.*
My students rehearse so that they can learn to present their written work to others. They enjoy obtaining reactions to their ideas.	Presenting	There is an audience who enjoys listening to me read my work aloud.

limiting the instructional methodology used in the teaching of writing. A solution in dealing with learner issues in intervention is offered through aptitude-treatment interaction (ATI) research.

Attribute-Treatment Interaction Research

The intent of ATI research is to decide if the effects of different instructional methods are influenced by learner characteristics. ATI research assumes that the two variables (task and student) may interact significantly and be of educational importance. Initially ATI research focused on aptitudes, hence the label aptitude-treatment interaction. However, as other characteristics such as personality, learning style or level of academic achievement may also interact with method, the designator has more recently been attribute-treatment interaction (Borg & Gall, 1983).

Given that different students have different learning styles and aptitudes, Pascarella (1977) recognized that a single instructional program may not be suitable for all students. His study on the interaction of motivation, mathematics preparation and instructional method provides an example of ATI research. He compared two methods of calculus instruction including a personalized system of instruction (PSI) and a conventional approach. The single effect for instructional method across each level of mathematics preparation was significant at the low levels, but not at the middle and high levels.

Pascarella's ATI research was conducted in a classroom setting, however according to Smith, "The majority of these studies have been conducted on a short-term basis in the laboratory. In most cases researchers don't know whether the laboratory instruction transfers to classroom skills and behaviours..." (1983, p. 387). The intent of this current research project is to study the interaction of learner, task and setting within the students' regular classroom.

CHAPTER III

RATIONALE

From the literature it would appear that the process approach to teaching writing is preferable to the more traditional method which emphasized product (Applebee, 1986; Gillespie, 1987; Hernandez, 1987; Soter, 1987). Numerous educators have emphasized the many benefits of a word processor in assisting students with the writing process, (Hernandez, 1986; Hooper, 1987; Murray, 1985; Newman, 1983; Temple & Gillet, 1984). Researchers who have compared other hand writing programs ranging from traditional to creative writing approaches and writing with computers have reported various gains in students' writing skills, (Crealock et al., 1985; Kopp, 1985; Spence, 1986; Vacc, 1987; Wetzel, 1985; Woodruff et al., 1981-82). Additional research which compared traditional language arts programs with the combination of a process approach to teach writing and word processing has reported significant main effects favoring the experimental group, (Kerchner & Kistinger 1984). Other studies which have compared the process approach to teaching writing, with the writing process using word processing have found either a difference in treatment

effects favouring the computer group, (Pearce-Burrows, 1988) or a significant achievement-by-writing interaction which indicated that relatively low achievers benefited more from composition taught via word processing than conventional instructional methods (Dalton & Hannafin, 1987).

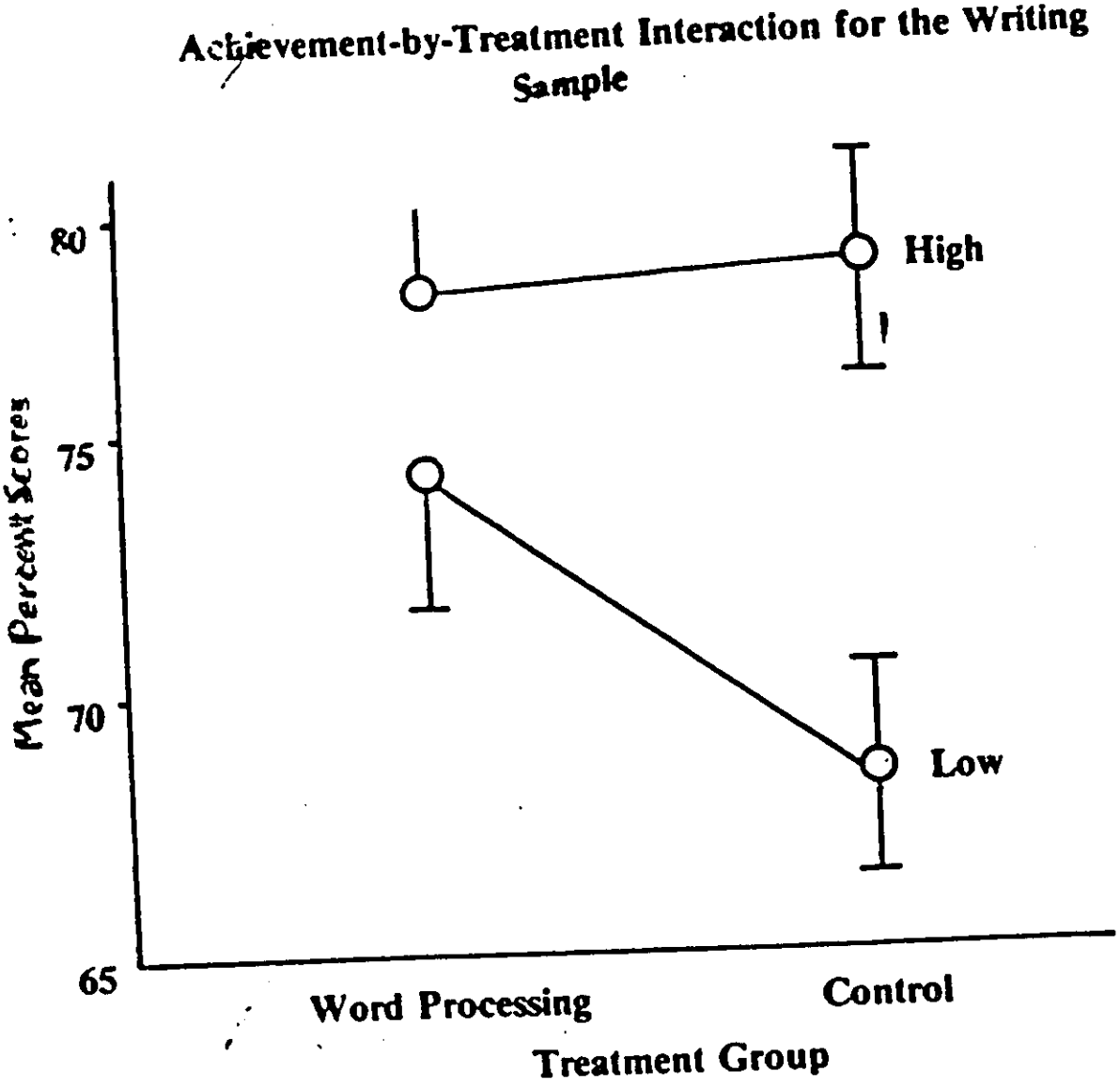
The rationale in the latter study is that many low achievers are often discouraged from editing and reviewing their work as they perceive the revision process as difficult, tedious and burdensome. The likelihood of revision by low ability learners may increase as a result of the ease of review provided through word processing, (Dalton & Hannafin, 1987). Prior to the beginning of their research, students were designated as relatively high or low in prior writing ability based on total language subscale scores from the Comprehensive Test of Basic Skills (CTBS). An analysis of writing samples taken upon completion of this, (Dalton & Hannafin, 1987) study suggested that word processing alone was of little consequence for able learners, but proportionately most effective for low achieving students as illustrated in Figure 5.

Insert Figure 5 about here

Dalton and Hannafin's (1987) findings support attribute-treatment interaction research. ATI research attempts to match instructional method with students who are best able to learn from them, (Borg & Gall, 1983). This type of research design is consistent with the current

FIGURE 5

Achievement-by-Treatment Interaction for the Writing Sample



educational philosophy which supports mainstreaming and a non-categorical approach along with an emphasis in seeing students as individuals with specific strengths and weaknesses rather than relying on definitions which are unclear (Bachor & Crealock, 1986). This shift away from labelling may be best served in the area of learning disabilities, which is by far the fastest growing, most controversial and often the most confusing area within special education (Roth Smith, 1983).

A typical definition of learning disability includes the following criteria:

1. Average or greater intelligence as measured by standard intellegence tests.
2. A discrepancy between potential ability (IQ) and actual achievement in language and/or mathematical areas.
3. An exclusion clause stating that the learning problems are not primarily due to visual, motor or hearing problems, mental retardation, emotional, disturbance or cultural disadvantage." (Crealock, 1982, p. 6).

Currently the Canadian Association of Children and Adults with Learning Disabilities has estimated the number of learning disabled persons at 10-15% of the population (C.A.C.L.D., p. 2).

However, in dealing with students of various ages and grade levels, kindergarten through to adult, educators are still not meeting the needs of a certain portion of the remaining 85-90% of pupils in the classrooms. One reason may be that the aforementioned description of a learning disabled student is fairly restrictive.

A somewhat broader definition is provided by the C.A.C.L.D. and accepted by the British Columbia A.C.L.D.

> Learning disabilities is a generic term that refers to a heterogeneous group of disorders due to identifiable or inferred central nervous system dysfunctions. Such disorders may be manifested by delays in early development and/or difficulties in any of the following areas: attention, memory, reasoning, co-ordination, communication, reading, writing, spelling, calculation, social competence and emotional maturation.
>
> Learning disabilities are intrinsic to the individual, and may affect learning and behaviour in any individual, including
>
> those with potentially average, average or above average intelligence.
>
> Learning disabilities are not due primarily to visual, hearing or fine motor handicaps; to mental retardation emotional disturbance, or environmental disadvantage; although they may occur concurrently with any of these.
>
> Learning disabilities may arise from genetic variation, biochemical factors, events in the pre-to-peri-natal period, impairment. (Love, 1985, p. 3).

The inclusion of "potentially average" is most important

when considering the limitations of a single testing session.

Currently the Special Education Administrative Unit of Alberta Education is reviewing the validity of the definitions/descriptions of exceptional students. There appears to be a major philosophical move away from "labelling" or classification. (J. McLellan, personal communications, December, 1990). This shift is certainly preferable to Category Funding where educators in their haste to receive funding, may have been identifying pupils as learning disabled, when in fact they could actually possess academic difficulties which may not be a result of any neurological impairment. Supporters of the non-categorical approach believe that most students' needs are better served at least in part in the regular classroom (Bachor & Crealock, 1986). Clearly "maindumping" (Irvine, 1988) would be counterproductive in addressing the needs of special students, however mainstreaming does represent definite benefits over the former "pull-out" resource room model which often increased the demands made of special needs students resulting in added confusion and frustration. (For further discussion of this issue see Pearce-Burrows, 1986).

Research Questions

The lack of common focus in previous research studies in computers and writing has made it difficult to make comparisons among them. The need to clarify whether the writing program or the computer were responsible for changes in students' writing (Wetzel, 1985) was addressed in this present study by using one instructional approach--process writing, under two different methodologies--computer and handwriting, over a six month period of time. Although the optimal length of time for such studies needs to be investigated, studies of less than four months have not obtained significant writing quality improvement (Wetzel, 1985). The rationale and specific research questions are stated in relation to each of the components of the program. While the research questions are stated in relation to expected intervention outcomes it is also recognized that no definitive answers can be provided in view of the limitations of the research design.

Computer Effects

The first research question in the present study sought to address a discrepancy between the priorities of educators

and the priorities of students involved in process writing. Although the holistic approach concentrates on the process of writing, placing emphasis on meaning and on composition as a whole (Dalton & Hannafin, 1987), students appear to be at least initially preoccupied with the form rather than the substance of their writing (Rose, 1983). Support for this contention is evident in that studies dealing with computer intervention in writing programs have failed to obtain statistically significant qualitative differences between groups using a holistic scoring system.

Therefore to determine if the quality of writing improves as a result of using the computer, the present study utilized the following instruments which assess both lower and higher level aspects of text. The Test of Written Language, which consists of both a spontaneous writing sample as well as contrived responses, is a standardized writing test which will provide support or non-support for previous research findings (Crealock & Sitko, 1990; Kerchner & Kistinger, 1984). The second means of analysis was provided by actual student writing samples. There were two strategies employed for collecting student stories. The first approach involved monthly process stories, revised, edited and

completed with the regular classroom teacher. An additional strategy involved the researcher collecting several first draft or "best" stories from all students. If, through process writing, there is growth in students' completed written compositions, then perhaps gains are also evident in students' initial drafts. Are students internalizing the writing process such that even at the first draft stage they are already revising and editing in their heads as Graves (1979) suggested? This second strategy will also enhance the internal validity of the study as these "best" stories were written by all students with the researcher giving each classroom the same instructions and time limits. All writing samples were then evaluated by trained "blind readers" according to structure and organization, correct usage of the parts of speech, punctuation, capitalization and spelling, using Kopp's (1985) rangefinders to provide a holistic scoring system, as recommended by Kerchner and Kistinger (1984), and the Diagnostic Evaluation of Errors which measures changes in meaning as well as mechanical errors.

The first specific research question that the study sought to answer in relation to the effects of using the computer as a tool on students' process writing was:

Will writing skills as measured by the TOWL, the DEWS, and Holistic rangefinders improve more for the computerized process group than for the regular process group?

Differential Computer Effects

Given the current shift toward declassification of students with special needs, the present study supports the attribute-treatment-interaction framework as an appropriate research design for studying changes in students' writing over time. Therefore in the present study as opposed to labelling students as LD or non-LD, above average, average and below average writers were identified, as a students' level of skill development affects the access to, and outcome of intervention (Ysseldyke & Algozzine, 1982),and their progress in improving their writing skills was examined.

Support for this method of grouping students is found in Thorpe, Chiang and Lubke's (1987) research which attempted to discriminate LD students from non-LD students by holding the instructional method constant for the two groups. LD and non-LD students were randomly paired and randomly assigned to one of two computer classes. Both instructors and assistants directly involved in the study were not made aware of the

specific backgrounds of any of the students. No significant differences between groups were found in on-task rate while learning Logo or in their learning of Logo-related content and applications at the end of the four week study. Additional support for grouping students based on specific skill deficit rather than relying on generic labels is evident in the subjects involved in Dalton and Hannafin's (1987) research. All subjects involved in their study were drawn from remedial programs based on below average scores on the Comprehensive Test of Basic Skills (CBS) and teacher recommendations. The researchers note that although the students possessed below average language skills, many of the subjects possessed average to above average skills in related content areas, such as mathematics and science. Crealock's research (1985; 1990) has also involved students identified as having specific academic weaknesses in the area of writing.

Consequently, the present study sought to determine whether the effects of word processing would be differential based on ability groupings rather than unclear definitions.

In relation to this second aspect of the research, the following question was asked:

Would students identified as weak writers benefit more from the combination of process writing and computers, and would the performance for above average writers be comparatively similar under both methods?

Qualitative Data Analysis

Although the potential of computerized word processing to assist learners in writing, especially in the writing and revising processes seems formidable, many questions remain (Dalton & Hannafin, 1987). The purpose of this third research question was to examine what elementary students had to say about writing with and without computers. The third specific research question asked:

What differences exist between computers and paper and pencil groups in relation to writing attitudes--what do students think about writing; and in relation to writing practices--how do students "go about their writing?"

In order to determine if there were differences in how students wrote stories and what students had to say about writing, depending on whether their writing tool was a computer or paper and pencil, data were generated from both questionnaire and interview responses as well as observation.

It should be noted that due to restrictions imposed by class settings, the data analyses were conducted based on LD and non-LD groupings for the purposes of this third research question.

CHAPTER IV

METHODOLOGY

Chapter Four presents the methodology adopted for the study. The collection of both monthly process stories which were revised, edited and completed with the regular classroom teachers, as well as "best" stories which were first draft stories collected by the researcher, will be explained. Questionnaire and interview questions are also presented. The specific forms and levels of statistical analysis performed in the data, as well as the design of the study are also described in the chapter. As specific instruments such as the TOWL, the DEWS, and Holistic rangefinders were previously described in detail in Chapter Two--Evaluation of Writing, their purpose will only be summarized here.

Participants

The sixty-two grade three and four students involved in this study were from four classrooms in the Edmonton area. Three of the classrooms were in two schools which were located within the Edmonton Public School Board System and the remaining classroom was from a school under the St. Albert Protestant School Board Jurisdiction.

The teachers were all volunteers who indicated an interest in the study. Two classrooms were regular grade three classrooms. One was equipped with thirty-two computers so that each student had access to his/her own computer. The other classroom consisted of twenty pupils to whom computers were not available.

The remaining two classrooms involved students with learning disabilities. One room was a segregated one-to-two year program for nine students, combining years three and four. At the end of this program students were to be placed in the regular classroom. This room had no access to computers. (However it was noted at the beginning of this study that a solitary computer sat at the back of this classroom. When asked about it's use the teacher replied, "I have no time to teach computers.") The final group of five students with learning disabilities were members of the only existing grade four classroom in the school, with an enrollment of thirty. (Students with learning disabilities in grade four as opposed to year three, were utilized here due to LD definitions requiring significant skill deficit, and two year nature of segregated program). The pupils with learning disabilities participated in a pull-out resource

room program consisting of three, fifty minute periods per six day cycle. During these support sessions the students were able to utilize a computer lab set up in the school. Students were learning disabled such that they met the criteria of normal to above average (or potentially average) intelligence (IQ) with some discrepancy between ability and performance. The average IQ of the students in the segregated classroom's program was 116.89. The resource room students' average IQ was 95.05. Characteristics of the sample are summarized and presented in Table 7.

TABLE 7

Number, Distribution and Characteristics of Entire Sample

Writing Ability Grouping	Experimental Group			Control Group		
	Computer	Avg.	Mean Written Language Quotient	Paper and Pencil	Avg.	Mean Written Language Quotient
Below Average	Resource Room Room 1 Regular Class 8	8.54	75	Segregated 5 Regular Class 5	8.5	80
Average	Resource Room 4 Regular Class 23	8.61	96.963	Segregated 4 Regular Class 12	8.7	98

*Note TOWL - WLQ X=100, SD=15

Classification	Range
Superior	131 - 145
Above Average	116 - 130
Average	85 - 115
Below Average	70 - 84
Poor	55 - 69

Insert Table 7 about here

All students in all four classrooms were identified by the researcher as either below average or average writers according to their classification based on the Written Language Quotient (WLQ) from the Test of Written Language (TOWL). An above average group was not possible due to the low frequency of only two students in the overall sample. The two students were from the regular classroom using paper and pencil and were collapsed into the average group.

The age of students is an important consideration as written language is considered a developmental process and different skills are demanded at varying age levels. In the classroom, it is essential to initially establish a familiarity with writing so that students feel comfortable developing their written compositions. According to Bachor and Crealock..."when evaluating written product: the typical expectations for younger children emphasize acquisition, whereas for older students different types of writing are expected depending on what is to be written (1986, p. 230). The average age of the below average computer group was 8.54; the mean age of the average computer group was 8.61. The

below average paper and pencil group had an average age of 8.5; the average paper and pencil groups' mean age was 8.7.

Insert Table 8 about here

Grade three and four would appear to be two appropriate grade levels to monitor changes in students' writing since the skill of altering text is an important aspect of the editing process; and although students may begin revising much earlier, or not develop the skills until later, it seems teachers begin to formally teach students how to critically analyze their work at this level. In the most recent elementary language learning program of studies produced by Alberta Education (January, 1990) as shown in Table 8, it is expected that students in grade two through four will demonstrate abilities to "revise by adding to or elaborating on the ideas or information contained in their initial writing draft(s)" (p. c-14).

TABLE 8

Alberta Education Elementary Language Arts Curriculum

CONSTRUCTING General and Specific Learner Expectation

ECS	Grade 1	Grade 2	Grade 3	Grade 4	

STUDENTS WILL DEMONSTRATE ABILITIES TO:

monitor their understanding in order to assure that meaning is not lost ....

revise by adding to or elaborating on the ideas or information contained in their initial writing draft(s)

rev
sul
inf
wr

use semantic, syntactic and graphophonic knowledge to confirm, reject or revise initial pre

recognize when reading or listening does not make sense

identify the problem source(s) in reading an (difficulties with content, sentence structure

adopt appropriate corrective strategies (ask for help, reread, summarize), if meaning is being lost ....

STUDENTS WILL DEMONSTRATE ABILITIES TO:

respond to experiences through evaluation and reflection ....

evaluate their personal effectiveness as presenters

assess their personal effectiveness as presei response with the intent of the presentation

Materials and Equipment

Both formal and informal assessments were carried out in the measurement of writing skills. Formal assessment was accomplished through the use of the Test of Written Language (1983). The TOWL, which consists of six subtests, generates standard scores which total to an overall score referred to as the Written Language Quotient (WLQ). This score has a mean of 100 and a standard deviation of 15.

Salvia and Ysseldyke (1988) report internal consistency coefficients to range between .80 to .96. Test authors report a stability reliability of .62 to .90, which is within accepted limits (Salvia & Ysseldyke, 1985, cited in Crealock & Sitko, 1990). According to Bachor and Crealock (1986) the total score for the TOWL has a "reasonable test re-test reliability" (p. 234). Salvia and Ysseldyke found the validity data of the TOWL to be mixed, as the data for content, concurrent and construct validity ranges from satisfactory to some that are less than adequate. However, it should be noted that the sub-test "Thought Units" considered inadequate has since been removed from the test. In addition, although the "handwriting" sub-test had less than adequate coefficients it is not included in the WLQ. A

distinct advantage of the TOWL is seen in its use of both contrived and spontaneous formats. Salvia and Ysseldyke (1981) conclude that "the TOWL has many positive aspects." Reviewers in The Ninth Mental Measurements Yearbook agree that the TOWL is useful for purposes of identification. Polloway (1985) states the test offers "the most structurally sound and instructionally relevant instrument currently available in the area of written language" (p. 1602). Williams (1985) summarizes that the TOWL "has a very sound theoretical basis and although it involves complex procedures, the test is clearly presented....and represents a major new direction in the evaluation of written language" (p. 1604).

The Diagnostic Evaluation Writing Skills (DEWS) (Weiner, 1980) error checklist was also utilized to score writing generated in the narrative mode. Due to the variability in length of stories written by students errors were calculated per 100 words. This type of evaluation system is an appropriate instrument to assist in looking at changes in writing over time as previous research has confirmed that students are initially more concerned with lower level types of revisions than with higher aspects of text (Crealock et

al., 1985; and Woodruff et al., 1981-82). As significant quantitative but not qualitative differences have been recorded, this phenomena is reflected in many of the studies conducted to date. (Crealock et al., 1985; Vacc, 1987; Woodruff et al., 1981-82). In addition, Weiner and Weiner (1984) have demonstrated the validity of the DEWS through a discriminant analysis which was 93.55% correct in identifying students with weak writing skills.

Holistic rangefinders offers a four-point holistic scoring criteria. Utilizing both DEWS and the Kopp's rating systems allows for data collection in both the traditional skills areas as well as overall story impression. It is important to note here that in this study the evaluation of specific skills was done within the context of written stories which is consistent with the process approach to writing as opposed to the traditional language arts program which evaluated each skill separately in isolated exercises. Both the DEWS criteria and Holistic rangefinders represented informal assessment procedures which were applied to monthly process stories completed by the students with their regular classroom teacher. The same two scoring systems were also used to assess several first draft stories collected by the researcher.

In order to further assess differences between computer and paper and pencil groups, all students completed a writing questionnaire as presented in Table 9. The fourteen questions are based on Giordano's (1984) research in the area of writing attitude surveys.

Insert Table 9 about here

TABLE 9

WRITING QUESTIONS

1. WRITING MAKES ME FEEL_____

2. WHEN I HAVE TO WRITE, I_____

3. THE PERSON IN OUR CLASS WHO WRITES STORIES BETTER THAN ANYONE ELSE IS_____

4. HE/SHE IS THE BEST WRITER BECAUSE_____

_____

5. MY TEACHER IS HAPPY WHEN_____

6. I BECOME NERVOUS WHEN_____

7. WHAT I LIKE MOST ABOUT WRITING IS_____

8. I LIKE TO WRITE ABOUT_____

9. I DON'T LIKE WRITING ABOUT_____

10. I WRITE BEST WHEN_____

11. I CAN'T WRITE WHEN_____

12. WHAT I LIKE LEAST ABOUT WRITING IS_____

13. IF I HAVE A PROBLEM WHILE I AM WRITING I_____

14. IF SOMEONE ELSE HAD A PROBLEM I WOULD_____

In addition to completing the questionnaires, individual interviews with students were also conducted in April, 1989. All of the students with learning disabilities and five percent of the regular classroom students were interviewed at random. The actual questions asked as presented in Table 10 below with the inclusion of one additional item: "What steps did you use to write your story?" This was the key question utilized for the "Pilot" study conducted in 1988. The remaining questions were found in the document "The Writing Process Using the Word Processor" published by Alberta Education (March, 1989).

Insert Table 10 about here

The software program chosen to assist students in developing their writing and keyboarding skills was AppleWorks (Apple Computer Inc.) AppleWorks is designated by Alberta Education (1989) as a basic learning resource for

students in grades one through twelve, as it is the most appropriate integrated software program for meeting the majority of goals and objectives for familiarizing students with the three most popular applications for personal computers--a word processor, a data base and a spread sheet. AppleWorks is a very functional, easy to learn, well-documented program ideally suited for novice users (Alberta Education, 1989).

TABLE 10

Interview Questions

My writing

Name _____

Date _____

Things I know about writing that help me when I write:

Things I still need to learn to be a better writer:

Things that cause me problems when I write:

Things that make writing easier for me:

These are the kinds of things I write about:

This is why:

Procedures

In this current study, two month (September and October) were allowed for acquiring keyboarding familiarity as indicated in Table 11. This time period would appear to be sufficient as research (Wetzel, 1985) indicates that thirty-five minutes over twenty days is required for students to become proficient at the keyboard. According to Alberta Education, 1989, the purpose of elementary keyboarding instruction should be to provide opportunities for students to become familiar with the keyboard layout and correct fingering.

Insert Table 11 about here

The TOWL pre-test and post-test was administered by the individual classroom teachers in November, 1988 and April, 1989 as indicated in Table 12.

Insert Table 12 about here

TABLE 11

Procedures for Four Classrooms

	Classroom	Time Period: Sept. Oct.	Nov. 1988	Dec.	Jan. 1989	Feb.	Mar.	Apr.
Computer	Resource Room	KEY BOARD	PRE TEST	PROCESS	MONTHLY	BEST FIRST	PROCESS	POST TEST
	Regular	REGULAR CURRICULUM	MONTHLY PROCESSING STORY		PROCESSING STORY	OBSERVATION DRAFT STORY		OBSERVATION DRAFT STORY
Pencil and Paper	Segregated	DING	TOWL	WRITING	PROCESS	STOR	WRITING	TOWL
	Regular							

TABLE 12

Timeline and Specific Dates for Collecting Data for Study

September - Initial Contact

October - Permission Letters

Data	Computer		Paper and Pencil	
	Resource Room	Regular	Segregated	Regular
TOWL - Pre-Testing	Oct. 27/88	Nov. 2/88	Nov. 2/88	Nov. 2/88
Post-Testing	May 1/98	May 1/89	Apr. 19/89	Apr. 19/89
Monthly Stories November	Nov. 20/88	Oct. 24/88	Nov. 7/88	Nov. 8/88
January	Jan. 23/89	Jan. 10/89	Feb. 1/89	Jan. 27/89
Best Stories & Observations & Questionnaires & Interviews February	Feb. 6/89	Feb. 8/89	Feb. 7/89	Feb. 7/89
April	Apr. 26/89	Apr. 27/89	Apr. 24/89	Apr. 24/89
Number of Students Interviewed (All LD, 13% Regular)	5	6	9	4

A second strategy involved the collecting of monthly stories completed by all students in their normal classroom environment, with their regular teacher. As only months where all classes completed stories following the process approach could be utilized, several groups of stories were omitted from this analysis due to discrepancies in how some of the writing samples were obtained. (One month a group of stories had only been peer edited; another month due to time constraints with the computer lab, insufficient sessions had been available for students to complete a story.) Consequently, in regards to monthly stories which had been revised and edited, although the researcher visited each classroom every month, sufficient data was only available for all students for November and January.

An additional strategy involved the researcher collecting several first draft stories from all students. Crealock et al. (1985) employed this particular technique to elicit a spontaneous writing sample from each student. The strategy of collecting "best stories" can be used in the present research to determine whether students were actually able to internalize the writing process. However, due to time constraints, pre-testing could not ethically take place prior to November 19, 1988, following successful completion of the candidacy exam. As well, the Christmas period was avoided at the recommendation of Crealock et al., (1985), as students were found to be somewhat distracted. Consequently, there was again a short period of time between testings--February and April.

In order to obtain further information regarding differences between computer and paper and pencil groups, direct observation was used utilized during the writing of "best" stories in order to gather information concerning quantitative changes indicated by both length of stories as well as amount of time spent writing.

All tests and pieces of writing were scored by a Research Assistant who was blind to the research questions.

Informed written consent was obtained from the parents of all participants. (See Appendix VII). Subjects were not identified, but were referred to as subject #1, #2, etc.

Student first draft stories, completed in the medium used for writing during the study (paper and pencil or computer), were obtained for all students. The researcher asked students to write their "best" stories and hand them in when they were finished. Students had one, forty minute period to complete these stories. Topics for the stories were based on student experiences. At pre-testing all students wrote about "The Blizzard" as there had recently been a severe snowstorm. In April the topic for all students' "best" stories was "spring".

All four classrooms spent one hundred and twenty minutes per week for process writing. The paper and pencil groups and regular computer classroom, spent two periods of sixty minutes per week, and the Resource Room computer students has access to a computer lab for three, fifty minute periods per six day cycle. However due to timetabling constraints, this did not mean access to equal amounts of time, as the paper and pencil groups, who were team taught by both the segregated and regular classroom teacher, had an

extra thirty minute period for writing Friday afternoons. This additional time could be termed as "make-up" or equalization period, as team teaching represents the same logistical problems as gaining access to a computer lab, in regards to the time consuming necessity of having students move from one location to another. However students using the computer lab, had the same limitations yet their" equalization period" occurred once every six day cycle as opposed to once in a five day week.

Kerchener and Kistinger's (1984) eight-stage model which combines the strength of the process approach with the benefits of word processing, was applied to produce monthly stories in the classroom. All four teachers involved in this present research project were able to use their customary process approach to written expression, as this model was extended beyond the computer classroom and adapted appropriately for use with the paper and pencil students as the following summary of writing process procedures indicate.

1. Process Only Group

a. Pre-Writing Conference

Teacher met with student to discuss what he/she would like to write a story about. Graves (1979) outlines the benefits of students choosing their own topics as they can plan ahead and think about their writing, in effect revising before they even begin to write. The topic can be based on the student's own experience or upon a mutually agreed upon subject.

b. Composing

Emphasized getting ideas written down.

c. Printing a Draft

Students produced a first draft of their story.

d. Editing Conference

Teacher and student or student and student meet to discuss the story.

e. Revision and Proofreading

Student made final check that story said what he/she wanted it to say.

f. Printing Final Copy

"Good copy" completed.

g. Illustrating the Composition

This was included as part of the writing process in this study as elementary age children may, initially feel most comfortable with this aspect of the process, (Kerchner & Kistinger, 1984).

h. Providing an Audience

Initially, students read to their peers. Work was also taken home to show parents. Work also posted and presented formally in a resource room newspaper or in individually bound books.

2. Computer and Process Writing

a. Pre-Writing Conference

Same as for process-only group.

b. Composing at the Keyboard

Focus on getting their ideas down.

c. Printing a Draft

Produce a copy of first draft.

d. Editing Conference

Same as for process-only group.

e. Editing at the Keyboard

Students manipulate text by erasing, replacing and moving.

f. Printing Final Copy

Produce story as they wish it to appear.

g. Illustrating the Composition

Suggested by both Brown (1987) and Kerchner and Kistinger, (1984) and enjoyed by students in this study.

h. Providing an Audience

Same as for process-only group.

Design of the Study

A factorial design was implemented, specifically a 2x2x2 Anova with last factor repeated. The three independent variables were instructional procedure, writing skill, and time.

According to Isaac and Michael (1978) "an important characteristic of factorial designs is that several hypotheses can be tested simultaneously, releasing researchers from rigidity of classical designs" (p. 52). This is certainly appropriate given that at least two research questions are being tested here.

The three dependent variables are the TOWL, the DEWS and Holistic rangefinders.

A repeated measures design would appear to be an appropriate design to explore the question whether the use of a computerized process approach to teach writing, increases students' writing skills more than using paper and pencil.

In experiments designed to study the performance changes of learning as a function of treatment effects, repeated measures on the same subject are a necessary part of the design (Winer, 1971).

Data Analysis

In order to explore data regarding the first research question, two-way Anovas with repeated measures with one factor were carried out. The overall Alpha level for the study was 0.05.

A two-way Anova was carried out looking at computer and paper and pencil groups on the first dependent measure. Support for the first research question would be obtained if scores on the TOWL increased the most for the computerized process group. Two-way Anovas were also carried out on the two groups according to their scores on both monthly stories and best stories using the DEWS. If the number of errors made by the computerized process group decreased the most, additional support for the first research question would be obtained. Two-way Anovas were also carried out on the two groups according to their scores on both monthly stories and best stories using Holistic rangefinders. Support for the first research question would be obtained if the overall scores for stories increased the most for the computerized process group.

Support for the second research question would be obtained if the below average computer group improved significantly more than the below average paper and pencil group on any of the above measures using three-way analyses of variances. However, as the Test of Written Language was used to divide the sample into ability groupings, the TOWL was eliminated as a dependent measure for the three-way Anovas. As the grouping factor's interaction with the other factors was key in answering the second research question, covariate analysis was considered, but not employed.

In order to address the third research question, regarding differences in writing attitudes and practices between the groups, the data from questionnaires, interviews and observations was analyzed qualitatively and quantitatively. Any consistently recurring themes or patterns are presented and discussed.

Internal Validity

The key problem in applying experimental methods to problems in education is establishing suitable control over extraneous variables so that any change in the post-test can be accounted for by the administration of the experimental treatment. However as human subjects are not as adaptable as physical matter, it is doubtful whether the rigorous control of the science laboratory will ever be achieved in the behavioural sciences (Borg & Gall, 1983).

Researchers in the field of education confront numerous potential threats to the internal validity of their experiments. Campbell and Stanley (1963) have identified eight types of extraneous variables including history, maturation, testing, instrumentation, statistical regression, differential selection, experimental mortality and selection maturation interaction.

The internal validity of this project was established since the researcher was not involved directly in teaching the participants. The teachers themselves administered the testing battery, and also conducted the daily instruction. This procedure reduced the historical suspects as well as

instrument-decay suspects (Agnew & Pyke, 1987).

Also, it is unlikely that students became "test-wise" due to the length of time between pre- and post-testing.

A further strategy which was employed to reduce the threats to internal validity was that all stories were marked by a research assistant, trained in the scoring techniques, and blind to the research questions. This process reduced the effect of experimenter bias.

Differential mortality did not pose much of a threat to validity as only one student dropped out during the research study. However some data was lost through student absences. Only data collected from students who were present for pre and post-testing was analyzed. Therefore students moving in during the course of the experiment could not be included in the sample. As well data from one student from the LD paper and pencil group could not be used as a dramatic change in performance was evident at different testing times depending on whether he was taking his medication, ritalin, or not.

Additionally, despite the demonstrated equivalence of the treatment groups on age scores, intelligence scores, and written language scores, as random assignment procedures were

not used, the design of this study should be considered as a quasi-experiment (Pascarella, 1977).

Experimental treatment diffusion can also threaten the internal validity of an experiment. Experimental treatment diffusion is especially likely if the experimental and control subjects are in close proximity to each other (Borg & Gall, 1983). In order to avoid this problem, conditions in the present study were arranged so that contact between the two instructional groups were minimized. Specifically four different teachers, in three different schools, involving two different school boards were utilized.

External Validity

"Educational researchers are faced with the `dilemma' that as more rigorous controls are applied to the experiment, less carry over can be expected between the experiment and related field situations." (Borg & Gall, 1983, p. 638).

Campbell and Stanley (1963) identified four general factors that affect the generalization of findings as follows: the reactive effect of testing; the interaction of the experimental treatment with particular student characteristics; measuring instruments, and the time of the study; the possible artificiality of the experimental treatment and the students' knowledge that they are involved in an experiment; and multiple treatment interference.

The generalizability of present findings was increased as the sample population involved sixty-two grade three and four students from four different classes, in three different schools within two different school jurisdictions. Additionally the sample population was not restricted to only below average writers. Due to these factors, the research findings may be generalizable to at least all grade three students in the Edmonton area.

The ecological validity has been increased as an attribute-treatment interaction framework was utilized to assess whether the instructional method was interacting with student characteristics. In addition students participated in the treatment as part of their regular instruction, in their regular classroom with their regular teacher.

Measurement restrictions were limited as both formal and informal assessment devices were utilized several times.

Formal assessment involved pre and post-testing with the TOWL. Informal assessment consisted of monthly stories and "best" stories scored according to the DEWS and Holistic rangefinders. These procedures were carried out in order to measure the changes over time.

Treatment restrictions were limited by using the popular Appleworks Program on the computer, and by utilizing the process approach to teach writing which is currently receiving wide attention.

Snow (1974) has criticized conventional experimental designs for their artificiality and subsequent production of unnatural behaviours in the learner. He advocates representative designs which reflect the natural learning

environment in which students are active learners. His recommendations include the following: conduct the study in an actual school setting; use a sample of teachers, rather than just one teacher to evaluate a new instructional method; observe what students are actually doing during the experiment; incorporate a control treatment which allows pupils to use their customary approaches to learning.

In many of the previous studies in the area of writing and computers, subjects have been removed from their natural writing environments. (Crealock et al., 1985; Vacc, 1987 and Woodruff et al., 1981). This current research project was designed to offer valuable insight into whether conclusions reached under laboratory conditions pertain to students in their normal classroom environments.

CHAPTER V

RESULTS

Computer Effects

The first research question asked whether writing skills as measured by the Test of Written Language, the Diagnostic Evaluation of Writing Skills, and Holistic Scoring Criteria will improve more for the computerized process group than for the regular process group. (See Appendix VIII for Raw Data).

Test of Written Language

Analysis of variance revealed a main effect for time as post-test errors (M=103.274) were far below pre-test scores, (M=91.306), F (1, 1) =74.824, p=0.001 as shown in Tables 13 and 14. The interaction effect was not significant F (1, 60) =3.370, p=.071, however the data indicates a trend in the hypothesized direction.

The overall interaction effects between the two groups over pre and post-testing are clearly demonstrated in Figure 6. Subtests from the TOWL yield scaled scores, the total of which converts to a standardized Written Language Quotient

(WLQ). The WLQ is standardized with a mean of 100 and a SD of 15.

TABLE 13

Scores on the Test of Written Language Before and After Treatment for Computer and Process Only Groups

	Pre-Test TOWL		Post-Test TOWL	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV.
COMPUTERS	91.583	12.013	105.611	15.513
PROCESS	90.923	12.201	100.038	8.884

TABLE 14

2-Factor Repeated Measures Anova For The TOWL

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
*A	293.208	1.	293.208	1.105	0.297
S-Within	15927.000	60.	265.450		
B	4042.986	1.	4042.986	74.824	0.001
A B	182.105	1.	182.105	3.370	0.071
B S-Within	3242.000	60.	54.033		

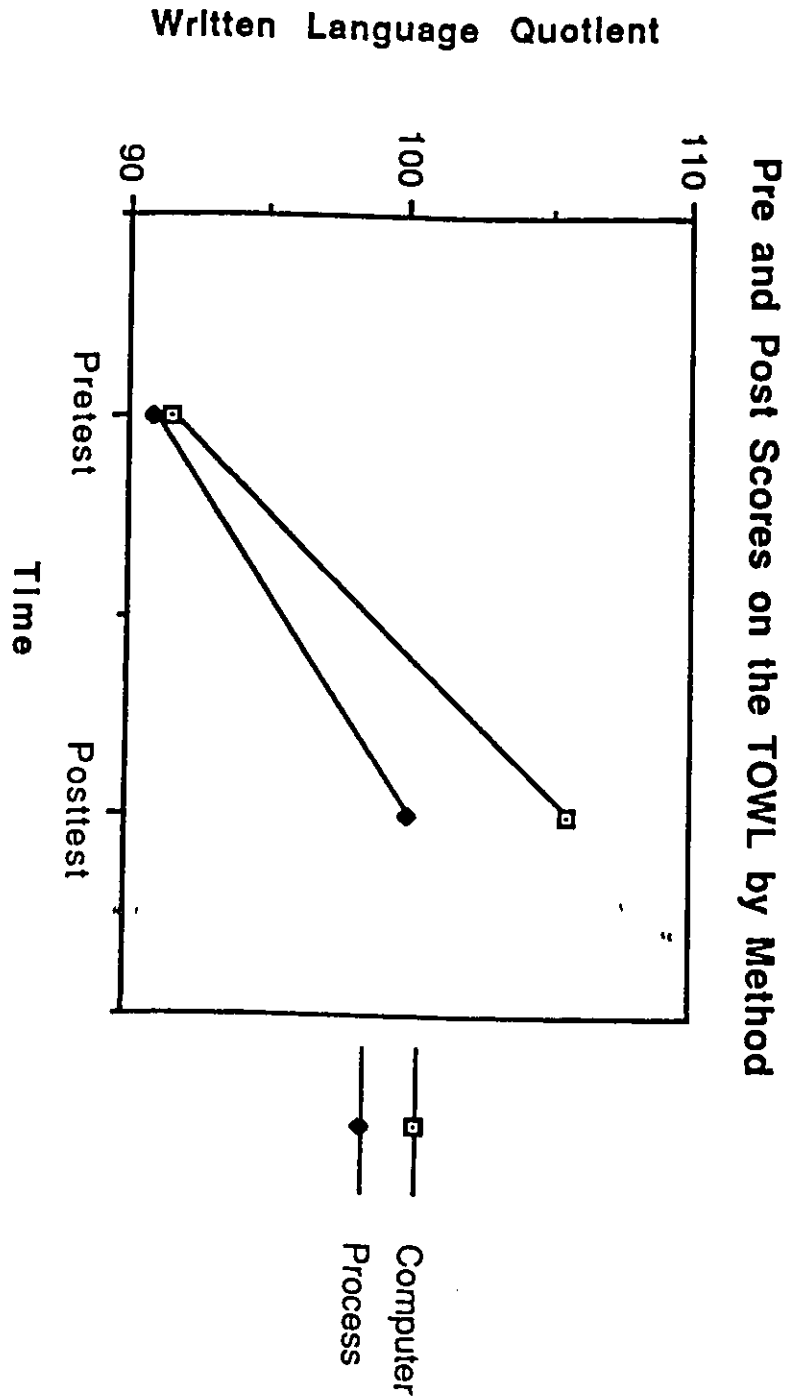
*Between subject factors are:

A - Method (computer/process)

Within subject factors are:

B - Time (Pre/post)

FIGURE 6


Written Language Quotient
Pre and Post Scores on the TOWL by Method
110
100
90
Pretest
Posttest
Time
Computer
Process

Diagnostic Evaluation of Writing Skills

Monthly Process Stories

The use of an error analysis checklist such as the DEWS provided another means of exploring the first research question. As shown in Table 15, although both groups reduced their errors over time, the process group made more errors overall than the computer group.

A two-way analysis of variance revealed a significant main effect for method as the computer method, (M=19.608), resulted in fewer DEWS errors than the process approach (M=32.612), F (1, 59)=17.705, p=0.001. Changes over time were also significant as post-test errors (M=10.790) were far below pre-test errors (M=39.085), F (1, 1)=132.564, p=0.001. Although there was a some variance between the two groups the interactions are not significant, as shown in Table 16.

The interaction effects between method and time are illustrated in Figure 7.

TABLE 15

Reduction of Errors Passed on in DEWS Criteria Applied to Monthly Stories For Computer and Process Only Groups

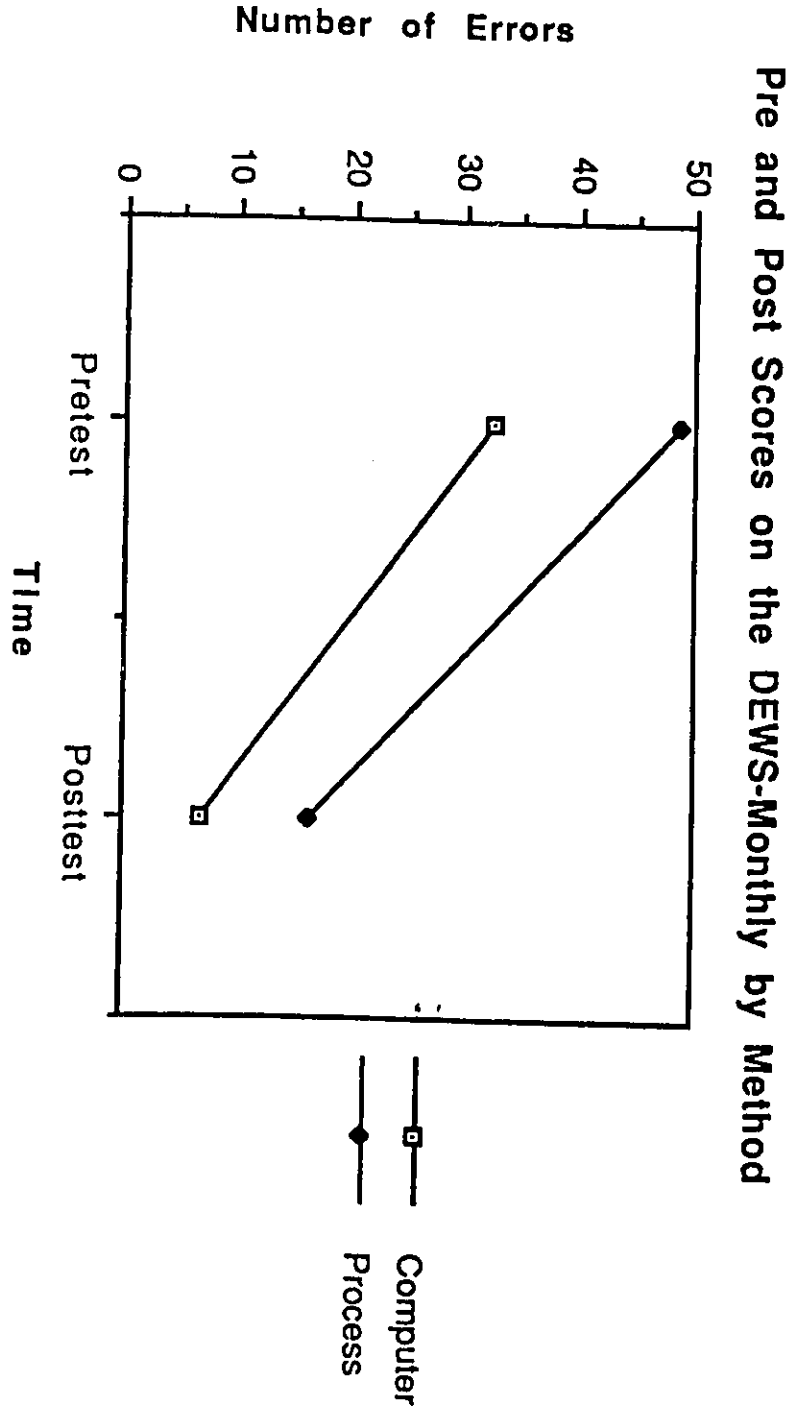
	Pre-Test DEWS Mon.		Post-Test DEWS Mon.	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV
COMPUTERS	32.327	16.810	6.889	5.291
PROCESS	48.817	24.304	16.408	10.349

TABLE 16

2-Factor Repeated Measures Anova For DEWS Monthly

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
A	4990.168	1.	4990.168	17.705	0.001
S-Within	16629.188	59.	281.851		
B	24686.324	1.	24686.324	132.564	0.001
A B	358.449	1.	358.449	1.925	0.171
B S Within	3242.000	60.	54.033		

FIGURE 7


Pre and Post Scores on the DEWS-Monthly by Method
Number of Errors
0
10
20
30
40
50
Pretest
Posttest
Time
Computer
Process

Spontaneous Writing Samples

The usefulness of the Diagnostic Evaluation of Writing Skills in measuring growth in writing becomes further apparent when looking at the improvement in student's "best" stories. Crealock et al. (1985) employed this particular technique to elicit a spontaneous writing sample from each student. Several first draft stories written by the students were collected by the researcher.As shown in Table 17 there was an overall reduction in errors over time. The two-factor repeated measures Anova indicated for the DEWS "best" revealed a main effect for time, as post-test errors (M=19.266) were significantly less than pre-test errors (M=22.316), F (1, 55)=9.300, p=0.004, as seen in Table 18.

Changes in students' initial writing drafts over time are illustrated in Figure 8.

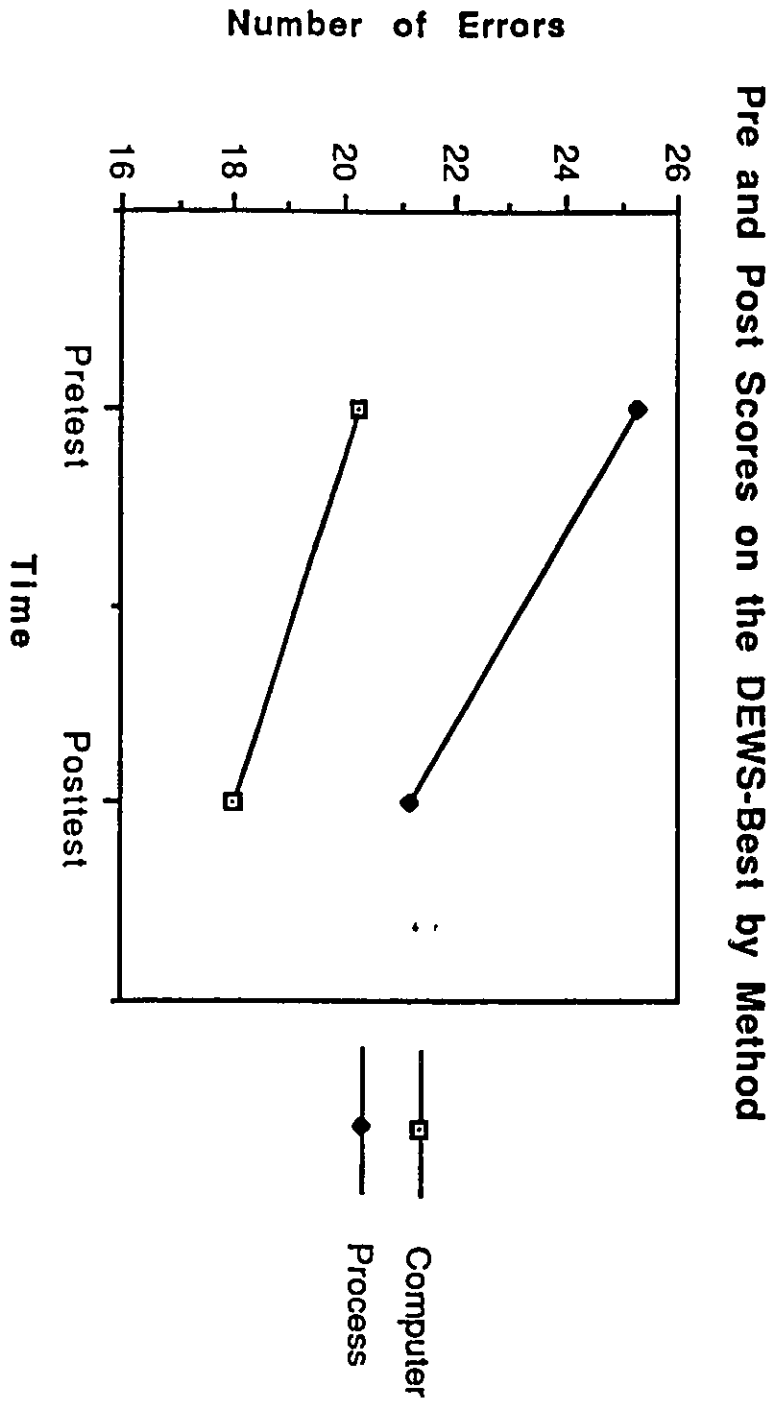
TABLE 17

	Reduction of Errors Based on DEWS Criteria Applied to Best Stories For Computer and Process Only Groups			
	Pre-Test DEWS Best		Post-Test DEWS Best	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV
COMPUTERS	20.294	10.131	17.175	11.447
PROCESS	25.304	12.062	21.174	13.006

TABLE 18

2-Factor Repeated Measures Anova For DEWS Best					
SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
A	462.269	1.	462.269	1.964	0.167
S-Within	12945.820	55.	235.379		
B	285.339	1.	285.339	9.300	0.004
A B	22.508	1.	22.508	0.734	0.395
B S-Within	1687.465	55.	30.681		

FIGURE 8


Pre and Post Scores on the DEWS-Best by Method
Number of Errors
16
18
20
22
24
26
Pretest
Posttest
Time
Computer
Process

Holistic Scoring Criteria

The use of a four-point holistic scoring system provided further insight into providing answers for the first research question. As opposed to looking for decreases in specific types of errors, this criteria utilizes "rangefinders" to measure increases in overall story quality.

Monthly Process Stories

The holistic scoring criteria to measure improvement in student's stories, generated monthly, revealed that both groups increased their overall story quality over time as shown in Table 19.

The two factors repeated measures Anova for the Holistic monthly revealed a main effect for time, as overall story quality at post-testing (M=2.661) had improved greatly over pre-test scores (M=1.903), $F(1, 60)=56.690$, $p=0.001$, as seen in Table 20.

The interaction effects between pre and post-testing with student's monthly stories using the Holistic scoring system is illustrated in Figure 9.

TABLE 19

Increase in Overall Story Quality Using Holistic Four-Point Holistic Scoring Criteria For Computer and Process Only Groups

	Pre-Test Holistic Mon.		Post-Test Holistic Mon.	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV
COMPUTERS	2.000	0.828	2.611	0.803
PROCESS	1.769	0.587	2.731	0.667

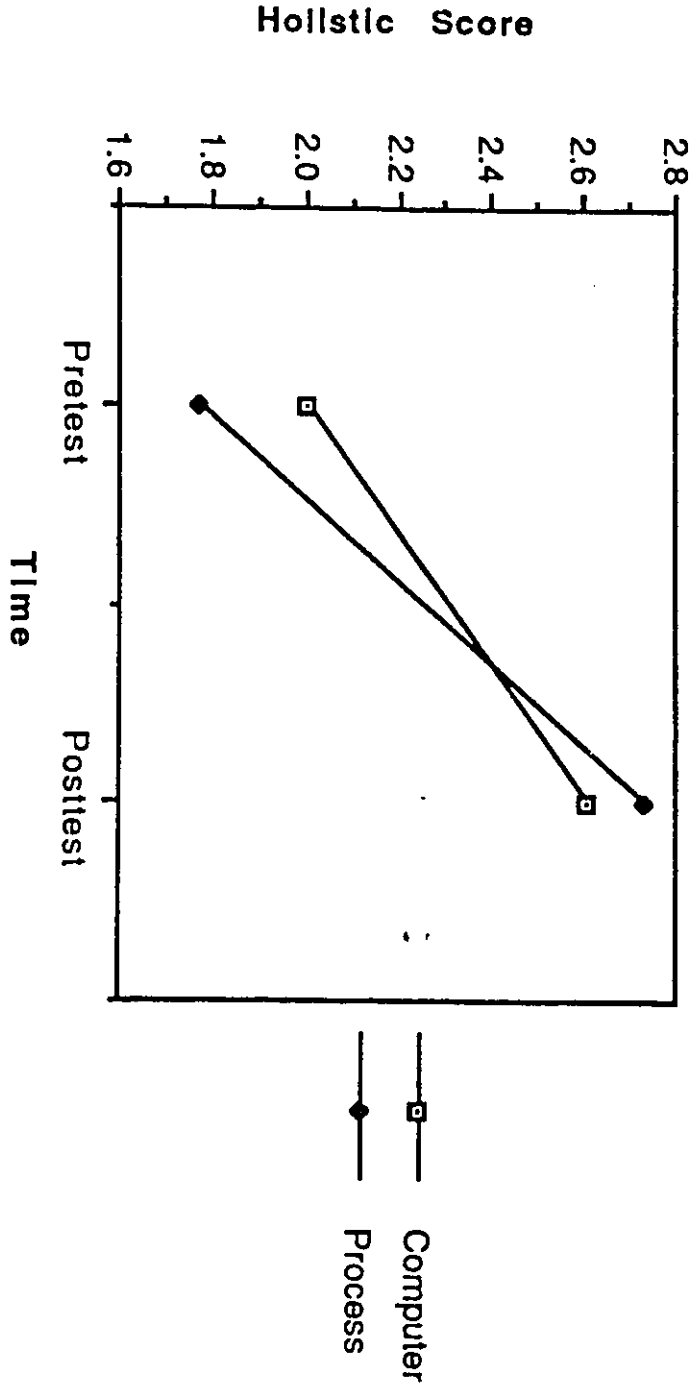
TABLE 20

2-Factor Repeated Measures Anova For Holistic Monthly

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
A	0.093	1.	0.093		
S-Within	46.528	60.	0.775	0.120	0.730
B	18.669	1.	18.669	56.690	0.001
A B	0.927	1.	0.927	2.815	0.099
B S-Within	19.759	60.	0.329		

FIGURE 9

PRE AND POST SCORES ON THE HOLISTIC MONTHLY BY METHOD



Spontaneous Writing Samples

As shown in Table 21, overall gains in writing improvement were minimal based on a holistic scoring system for measuring growth in student's "best" stories. The Anova table for a 2-factor repeated measures analysis of variance on Holistic "best" storied indicates no significance as shown in Table 22.

TABLE 21

	Increase in Overall Story Quality Using Four-Point Holistic Scoring Criteria			
	Pre-Test Holistic Best		Post-Test Holistic Best	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV
COMPUTERS	2.031	0.695	2.063	0.914
PROCESS	1.792	0.509	2.000	0.590

TABLE 22

2-Factor Repeated Measures Anova For Holistic Best					
SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
A	0.626	1.	0.626	0.798	0.376
S-Within	42.339	54.	0.784		
B	0.394	1.	0.394	1.705	0.197
A B	0.215	1.	0.215	0.932	0.339
B S-Within	12.464	54.	0.231		

Differential Effects of Computer

The second research question asked whether students identified as weak writers would benefit more from the combination of process instruction and computer, whereas the performance for above average writers would be comparatively similar under both methods.

Test Of Written Language

As the Test of Written Language became an independent variable here for purposes of identification of weak writers, TOWL scores cannot simultaneously be utilized as a dependent measure. Therefore test scores are not analyzed using three-way analysis of variances. Results for monthly process stories and students' spontaneous writing samples are presented using the DEWS and Holistic scoring criteria. (For further discussion of this issue see section entitled "Data Analysis".)

Diagnostic Evaluation Of Writing Skills

Use of the Diagnostic Evaluation of Writing Skills provided the initial analysis of the differential effects of the computer.

Monthly Process Stories

The DEWS criteria were applied to monthly stories completed by the students with their regular classroom teacher. The means for pre and post-testing using the DEWS were then calculated for each group. As shown in Table 23, the below average groups decreased their errors more than the average groups.

TABLE 23

	Reduction of Errors Based on DEWS Criteria Applied To Monthly Stories To Determine Differential Effects Of Computer			
	Pre-Test DEWS Mon.		Post-Test DEWS Mon.	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV
COMPUTER A	26.056	12.276	6.000	5.674
COMPUTER BA	51.141	14.682	9.556	2.673
PROCESS A	40.844	21.045	13.808	8.074
PROCESS BA	62.991	24.258	21.029	12.705

The interaction effects between pre and post-testing with the DEWS monthly are illustrated in Figure 10. The interaction is not statistically significant, but it is important as the below average computer group improved beyond the average paper and pencil group.

Three way analyses of variance revealed three main effects and a significant interaction as seen in Table 24.

First a main effect for method revealed that the computer method, (M=19.608) resulted in fewer DEWS errors than the process approach, (M=32.612), $F(1, 57)=16.417$, $p < .01$. The average group also made fewer overall errors, (M=20.232), than the below average group, (M=36.179), F (1, 57), =26.199, $p < .01$. Thirdly post-test errors, (M=10.790) were far below pre-test errors, (M=39.085), $F(1, 57)=172.155$ $p < .01$.

A significant ability group by testing interaction, $F(1, 57)=13.406$, $p < .01$, was also found, and is shown graphically in Figure 11. These results indicate that the below average group improved to the level of the average group from pre to post- testing.

FIGURE 10

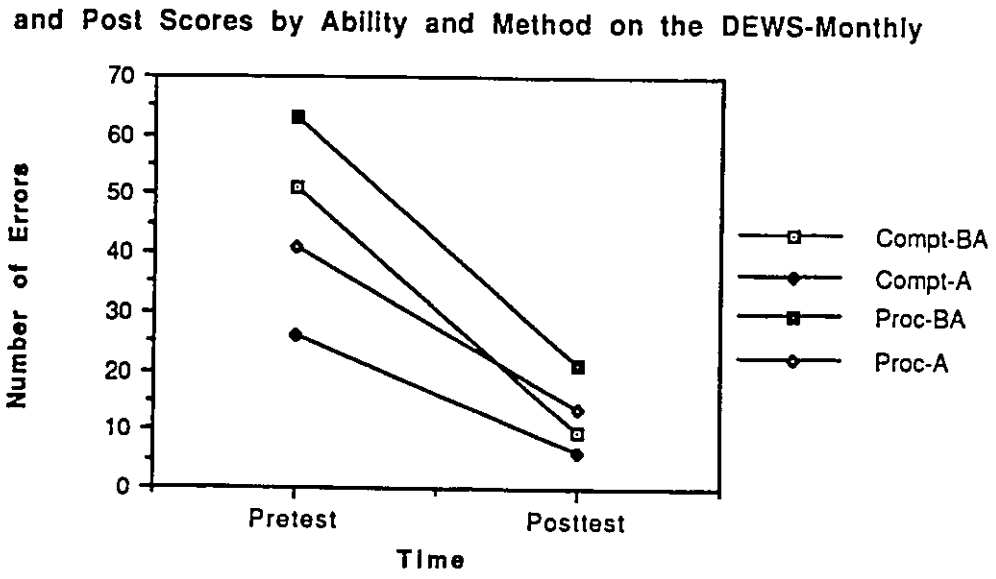

Pre and Post Scores by Ability and Method on the DEWS-Monthly
Number of Errors
70
60
50
40
30
20
10
0
Pretest
Posttest
Time
Compt-BA
Compt-A
Proc-BA
Proc-A

Table 24

3-Factor Repeated Measures Anova
For DEWS Monthly

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
*A	3276.712	1.	3276.712	16.417	0.001
B	5229.160	1.	5229.160	26.199	0.001
A B	0.826	1.	0.826	0.004	0.949
S-Within	1376.668	57.	199.591		
C	26520.945	1.	26520.945	172.155	0.001
A C	84.108	1.	84.108	0.546	0.463
B C	2065.306	1.	2065.306	13.406	0.001
A B C	67.694	1.	67.694	0.439	0.510
C S-Within	8781.000	57.	154.053		

*Between subject factors are:

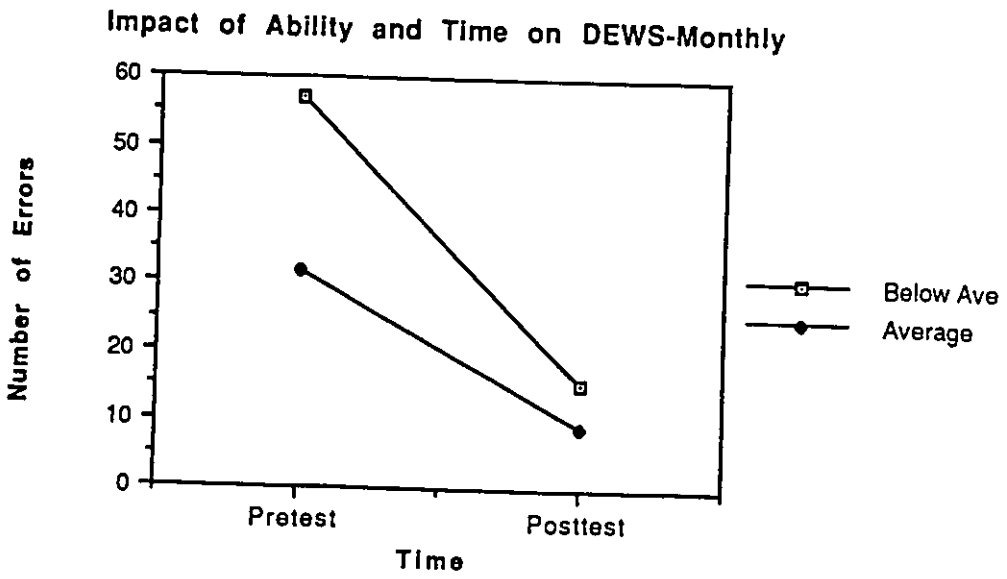
A - Method (computer/process)

B - Ability (below average/average)

Within subject factors are:

C - Time (pre/post)

FIGURE 11


Impact of Ability and Time on DEWS-Monthly
Number of Errors
60
50
40
30
20
10
0
Pretest
Posttest
Time
Below Ave
Average

Spontaneous Writing Samples

The mean difference between pre and post-testing using the Diagnostic Evaluation of Writing Skills (DEWS) applied to several "best" stories collected by the researcher were also calculated for each group. However, as show in Table 25, the data lend little support to the second research question, as both of the below average groups showed only a slight reduction in errors over time.

The interaction effects between pre and post-testing are illustrated in Figure 12. Although progress was indicated through a reduction of errors for both average groups, the improvement was similar for both groups. Little progress was achieved by either of the below average groups.

The three factors repeated measures Anova for the DEWS "best" revealed two main effects and a significant interaction as shown in Table 26. A main effect for ability indicated that the average group made fewer overall errors, (M=17.056), than the below average group (M=28.882), $F(1, 1)=16.690$, $p < .01$. Secondly, post-test errors, (M=19.266) were far below pre-test errors (M=22.316), $F(1, 53)=5.401$, $p < .05$.

A significant ability-groups by testing interaction, $F(1, 53)=4.040$, $p=.05$ was also found, and is shown graphically in Figure 13. These results are in the opposite direction than was expected, and they indicate that overall the average group decreased their errors more than the below average over time.

TABLE 25

	Reduction of Errors Based on DEWS Criteria Applied To Best Stories To Determine Differential Effects Of Computer			
	Pre-Test DEWS Best		Post-Test DEWS Best	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV
COMPUTER A	17.200	8.554	14.176	8.081
COMPUTER BA	28.889	9.532	28.528	13.199
PROCESS A	22.786	11.410	16.214	9.031
PROCESS BA	29.222	12.657	28.889	14.920

TABLE 26

3-Factor Repeated Measures Anova
For DEWS Best

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
A	103.729	1.	103.729	0.567	0.455
B	3055.122	1.	3055.122	16.690	0.001
A B	71.932	1.	71.932	0.393	0.533
S-Within	9701.633	53.	183.050		
C	158.708	1.	158.708	5.401	0.024
A C	18.498	1.	18.498	0.629	0.431
B C	118.715	1.	118.715	4.040	0.050
A B C	19.200	1.	19.200	0.653	0.423
C S-Within	1557.418	53.	29.385		

FIGURE 12

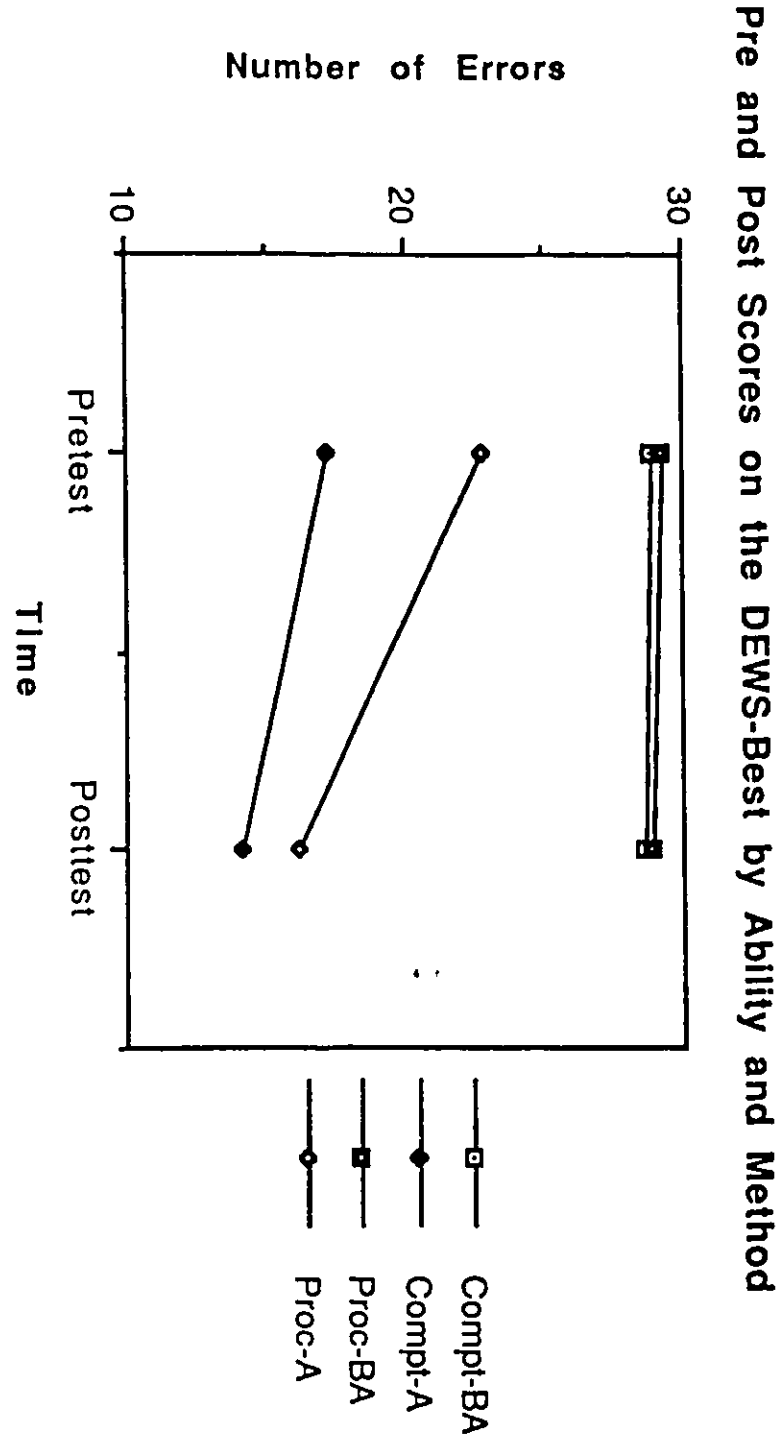
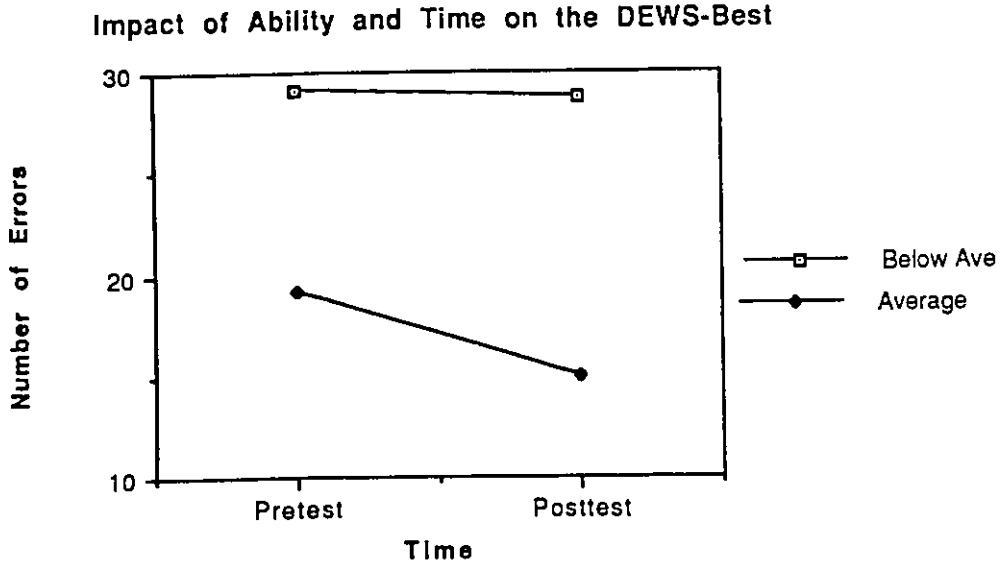

Pre and Post Scores on the DEWS-Best by Ability and Method
Number of Errors
10
20
30
Pretest
Posttest
Time
Compt-BA
Compt-A
Proc-BA
Proc-A

FIGURE 13


Impact of Ability and Time on the DEWS-Best
Number of Errors
30
20
10
Pretest
Posttest
Time
Below Ave
Average

Holistic Scoring Criteria

Use of four point holistic scoring system provided the second analysis of the differential effects of the computer.

Monthly Process Stories

The means for pre and post-testing were calculated for each group. As shown in Table 27 the below average computer group improved their story quality as much as the average process only group over time.

The three factor repeated measures Anova for the Kopp's monthly revealed two main effects as seen in Table 28. First, a main effect for ability revealed that overall the average group had higher holistic scores (M=2.465) than the below average (M=1.868), $F(1, 58)=14.596$, $p < .01$. Secondly, post-test scores (M=2.661) far exceeded pre-test scores (M=1.903), $F(1, 58)=55.801$, $p < .01$.

TABLE 27

	Increase In Overall Story Quality Applying Four-Point Holistic Scoring Criteria To Monthly Stories To Determine Differential Effects Of Computer			
	Pre-Test Holistic Mon.		Post-Test Holistic Mon.	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV
COMPUTER A	2.259	0.764	2.778	0.801
COMPUTER BA	1.222	0.441	2.111	0.601
PROCESS A	1.938	0.574	2.813	0.750
PROCESS BA	1.500	0.527	2.600	0.516

TABLE 28

3-Factor Repeated Measures Anova
For Holistic Monthly

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
A	0.370	1.	0.370	0.606	0.439
B	8.917	1.	8.917	14.596	0.001
A B	1.787	1.	1.787	2.925	0.093
S-Within	35.432	58.	0.611		
C	18.414	1.	18.414	55.801	0.001
A C	0.519	1.	0.519	1.571	0.215
B C	0.571	1.	0.517	1.729	0.194
A B C	0.034	1.	0.034	0.103	0.749
C S-Within	19.140	58.	0.330		

Spontaneous Writing Samples

The means for pre and post-tests were also calculated for each group using Holistic rangefinders in order to assess students "best" stories using a holistic scoring criteria. As seen in Table 29 the quality of stories increased equally across the ability groupings.

The three factor repeated measures Anova for the "best" showed some significance as seen in Table 30. A main effect for ability revealed that overall the average group increased the quality of their stories ($M=2.197$) more than the below average group ($M=1.528$), $F(1, 52)=18.284$, $p < .01$. A significant ability-groups by method interaction, $F(1, 52)=8.957$, $p < .05$, was also found, as the treatment affects were not the same overall for these groups. The below average process only group increased their general impression scores, whereas the below average computer group actually decreased their scores. This interaction is not in the expected direction.

TABLE 29

	Increase In Overall Story Quality Applying Four-Point Holistic Scoring Criteria Student's "Best" Stories To Determine Differential Effects Of Computer			
	Pre-Test Holistic Best		Post-Test Holistic Best	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV
COMPUTER A	2.304	0.559	2.391	0.839
COMPUTER BA	1.333	0.500	1.222	0.441
PROCESS A	1.800	0.561	2.133	0.640
PROCESS BA	1.778	0.441	1.778	0.441

TABLE 30

3-Factor Repeated Measures Anova
For Holistic Best

SOURCE	SUM OF SQUARES	DEGREES OF FREEDOM	MEAN SQUARES	F RATIO	PROBABILITY
A	0.085	1.	0.085	0.163	0.688
B	9.537	1.	9.537	18.284	0.001
A B	4.627	1.	4.627	8.957	0.004
S-Within	27.124	52.	0.522		
C	0.144	1.	0.144	0.622	0.434
A C	0.192	1.	0.192	0.831	0.366
B C	0.425	1.	0.425	1.837	0.181
A B C	0.028	1.	0.028	0.119	0.731
C S-Within	12.024	52.	0.331		

Qualitative Data Analysis

The third research question assessed differences in writing attitudes and practices between computer groups and paper and pencil groups using both questionnaire and interview questions as well as observations. It should be noted here that although for the second research question, students were grouped according to writing ability, for purposes of observation this was not possible due to limitations imposed by the classroom settings. Although it would have been possible to observe paper and pencil students according to ability groupings as all of these students were team taught together in one school; the regular computer classroom was in one school, and resource room computer lab was in another school jurisdiction.

Questionnaire Data - Recurring Themes

Qualitative analysis of the data generated from the questionnaires revealed several recurring themes.

Writing As A Thinking Process

One major finding as indicated in Table 31 is that 87.50% of all students across the four groups completed Item

Number 11, "I can't write when...", with phrases involving "noise" or "talking" or words to this effect. This finding indicates that students find it most difficult to write when there are other distractions around them, which is not surprising since writing is a thinking process. This appears to be especially true for the students with learning disabilities, as 100% of the students with learning difficulties, using both word processing and paper and pencil, indicated that they found it difficult to write with noise or some type of disturbance in the classroom. In addition the most common response to Item Number 10, "I write best when...", made a reference to "quiet" which lends additional support to the need for a quiet and reflective space in which children can write and think. More supportive data is offered in Table 32 to illustrate the role of thinking skills during the writing process, and the need for undisturbed writing time for children.

TABLE 31

Writing Questionnaire Responses Indicating Recurring Themes Across All Student Groups

Recurring Theme	Item Number	Incomplete Statement	Student Response	Percentage	Item No.'s Providing Additional Support
Writing As A Thinking Process	11.	I can't write when...	Phrases involving "noise" or "talking"	87.50%	#2, #4, #6, #7, #10, #12, #13
Writing Increasing Self-Esteem	1.	Writing makes me feel...	Phrases involving "good" or "happy"	93%	
Conferencing Aspect Of Writing Process	14.	If someone else had a problem I would...	"help"	89%	

TABLE 32

Student Questionnaire Responses Reflecting
Writing As A Thinking Process

Student Number	Item Number	Incomplete Statements	Student Response	Method	Class
One	#10	I write best when...	"I think right."	Paper and Pencil	Regular
Two	#2	When I have to write I...	"thick." (think)	Paper and Pencil	Students with Learning Disabilities
Three	#2	When I have to write I...	"think"		
	#4	He/she is the best writer because...	"he thinks"		
	#10	I write best when...	"I am ready (think)"		
	#13	If I have a problem I...	"think"		
Four	#13	If I have a problem I...	"Think about about what's in the story		
Five	#11	I can't write when...	"I am not consabrting on in (concentrating on it)	Computer	Students with Learning Disabilities
	#2	When I have to write I...	"preper" (prepare)		
Six	#10	I write best when...	"I cannot dislerbed." (disturbed)		
Seven	#2	When I have to write I...	"think of something to write about		

TABLE 32 Cont'd

Student Questionnaire Responses Reflecting
Writing As A Thinking Process

Student Number	Item Number	Incomplete Statements	Student Response	Method	Class
Eight	#2	When I have to write I...	"I think of think of an idea."	Computer	Regular
	#4	He/she is the best writer because...	"She thinks of good ideas		
	#6	I become nervous when...	"I can't think of what happens next."		
	#7	What I like best about writing is... problem I...	"being able to write down your thoughts."		
Nine	#13	If I have a problem while I am writing ...	"Think."		
Ten	#7	What I like most about writing is...	"You could make it up in your mind."		
	#13	If I have a problem while I am writing I...	"think."		
Eleven	#13	If I have a problem while I am writing I...	"I can't think."		
Twelve	#10	I write best when...	"I have an idea."		
Thirteen	#12	What I like least about writing is...	"I get mixed up."		

TABLE 32 Cont'd

Student Questionnaire Responses Reflecting
Writing As A Thinking Process

Student Number	Item Number	Incomplete Statements	Student Response	Method	Class
	#13	If I have a problem while I am writing I...	"Can't think well."		
Fourteen	#12	What I like least about writing is...	"I can't think of ideas."	Computer	Regular
Fifteen	#12	What I like least about writing is...	"I don't have good ideas."		

Writing Increasing Self-Esteem

The second significant trend as shown in Table 31 involves statement No. 1 dealing with the "Writing makes me feel..". An overwhelming majority of students (93%) indicated that writing makes them feel good or happy. Some of the more original responses included the following: "exilent" (excellent); "that I'm a good writer"; "happy you can let go of your flelings" (feelings); "Imaganative" (imaginative); "like I am a righter" (writer); "excited"; "super"; "wonderful"; "like it's happening right then"; "relaked" (relaxed); "comeftibull" (comfortable).

Conferencing Aspect Of Writing Process

The third major pattern to emerge from the questionnaire responses dealt with Item No. 14, "If someone else had a problem I would...". As shown in Table 31, eighty-nine percent of all the students responded that they would "help". This appears to reflect the conferencing aspect of the writing process. Students may be indicating that they have internalized the collaborative aspects of the process approach to writing.

Questionnaire Data-Differences Between Methods

Data generated from the questionnaires also revealed some differences between the two instructional groups in type of responses given.

Student Preference For Computer

Computer students emphasized various positive aspects of utilizing word processing.

Computer Student No. 1: Item No. 7 - What I like most about writing is "it is on the computer."

Item No. 12 - What I like least about writing .. "I sometimes have to use pencil."

Computer Student No. 2: Item No. 7 - What I like most about writing is "you don't have to use the pencil all day."

Computer Student No. 3: Item No. 7 - What I like most about writing is "it's faster."

Item No. 12 - What I like least about writing is "with pencil."

Computer
Student No. 4: Item No. 7 - What I like most about writing is "I can do it faster on the computer."

Item No. 13 - If I have a problem while I am writing I "delete."

Computer
Student No. 5: Item No. 7 - What I like most about writing is "putting in the options."

Computer
Student No. 6: Item No. 10 - I write best when I "use the computer."

Computer
Student No. 7: Item No. 12 - What I like least about writing is "If it's by hand not computer."

The above responses indicate that at least some students find the transfer from one medium to another difficult, which may help to explain the lack of significant differences between pre and post-testing in paper and pencil tests such as the TOWL.

Cooperative Nature Of Computer

Students who had access to computers indicated that they discovered yet another advantage of completing their writing with word processing, as the following response appears to reflect the benefits of the cooperative nature of the computer.

Computer
Student No. 8: Item No. 4 - He/she is the best writer because

"Robert and me I think when we help each other. We get a good story."

However responses from process-only students indicated that the cooperative atmosphere may be more intrusive with paper and pencil.

Paper and Pencil
Student No. 1: Item No. 11 - I can't write when "someone helps me."

Paper and Pencil
Student No. 2: Item No. 11 - I can't write when "everybody is watching me."

Paper and Pencil Student No. 3: Item No. 6. - I become nervous when when the teacher looks down at me when I'm writing."

Mechanical Problems Of Pencils

Responses from the following students who did their writing using paper and pencil indicate that even equipment as simple as a pencil can cause mechanical problems for young writers. This is an important aspect as perhaps part of the reason some teachers are reluctant to use word processing in their classroom is that the computer is viewed as a potential mechanical problem.

Paper and Pencil Student No. 4: Item No. 11 - I can't write when "my pencil's too small."

Paper and Pencil Student No. 5: Item No. 12 - What I like least about writing is

"When my pencil breaks."

Interview Responses

Several patterns also emerged from the interview data upon qualitative analysis.

Keyboarding Skills

Upon completion of the analyses of the data generated from the interviews it became apparent that the majority of students with learning disabilities who were writing on the computer were clearly still focusing on keyboarding skills. Only one out of five students interviewed appeared to have moved her/his thinking beyond the mechanics of using the computer to the actual writing process itself. A comparison of these two levels of thinking is offered in Table 33 with Student A still emphasizing keyboarding, and student B moving on to focus on the actual writing of the story.

Internalization Of The Writing Process

However with the regular classroom students who had access to word processing a reversal of the previous trend was apparent as a majority of the students interviewed focused on the writing process, with only one out of six pupils who still appeared "hung up" on the keyboard. The various responses to Question No. 7 are offered in Table 34.

A significant benefit to students writing on the computer became apparent in a comparison of their responses in Table 27, to the paper and pencil groups. It appears that

the computer students who focused on the writing process have internalized the process at a much higher level than their counterparts who did not use word processing. Perhaps the difference can be illustrated using Beyer's (1987) Model of Functional Thinking.

As shown in Figure 14, the inner ring involves recall which is the only level displayed by the paper and pencil groups, in their answers to the interview questions, and the lowest level of cognitive function. In comparison the computer groups at the very least achieved the second level of cognition which is processing and reasoning. In addition to the higher level of cognitive thinking reached by the computer students, it would appear they were also able to move beyond mere memory making to explain how they were actually carrying out the process approach. Once individuals are aware of how they are thinking, the operation becomes a metacognitive function.

TABLE 33

Comparison of Interview Responses Reflecting Differences In Keyboarding Fluency Among Computer Students With Learning Disabilities

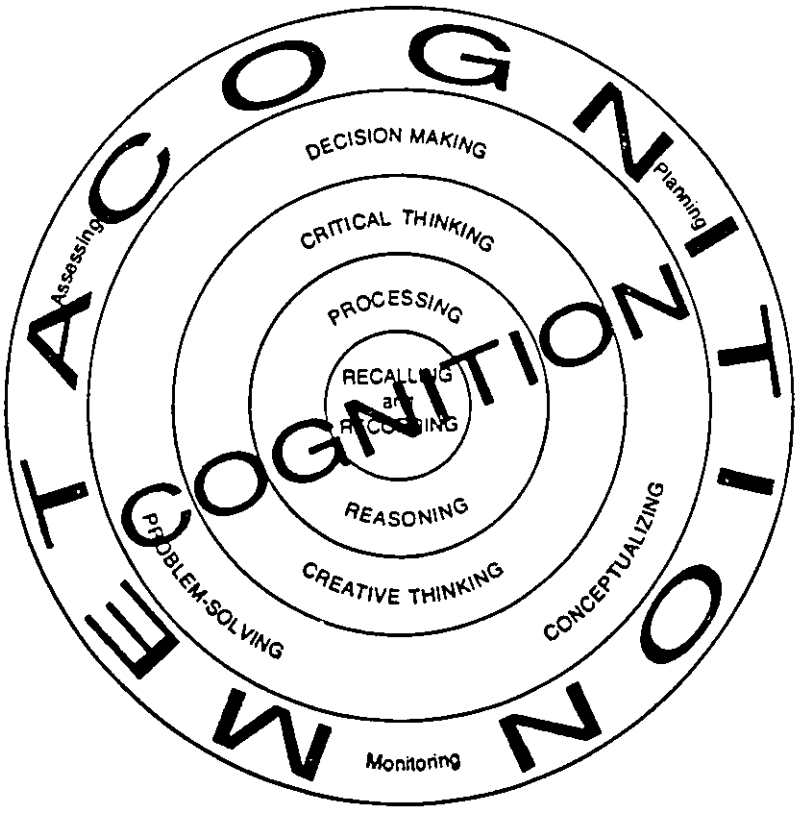
		Student A	Student B
Question No. 1	Things I know about writing that help me when I write.	"eye on screen, not looking at keyboard."	"What I'm writing about."
Question No. 2	Things I still need to learn to be a better writer.	"Not to look at keyboard."	"How to concentrate better."
Question No. 3	Things that cause me problems when I write.	"When I press wrong key."	"When someone's bothering me."
Question No. 4	Things that make writing easier for me.	"When I look at keyboard."	"Something that I like that I write about
Question No. 5 & 6 (Did not appear to differ across groups and are therefore not considered using these analyses.)			
Question No. 7	What steps did you use to write your story.	"First look at screen; second don't touch computer disc; third - don't look at keyboard."	"Think about what to write about; write it; read it over."

TABLE 34

Internalization Of The Writing Process As Indicated In Interview Responses From Computer Students In The Regular Classroom

Question No. 7	What steps did you use to write your story?
Student No. 1	"Think of an idea; write it; another idea; fit it in; read story over a couple of times; find a title, write a title; make sure all paragraphs are in right places, punctuations, did I make mistakes; see if any spelling mistakes, errors didn't type correctly; save and print."
Student No. 2	"Remember about a story, another story, another, then I get them all together and see if it'd bee good; write them down; start writing; put apostrophes when people are talking."
Student No. 3	"I think about it; I write my ideas down; double check; ask how to spell things; print, read it over."
Student No. 4	"My mind; make up a story; write it on computer; print it; read some stories."
Student No. 5	"Concentrate; plan ahead; set a plot; who did it; how; how to end it; that's it."
Student No. 6	"Use options centered; editing after."

FIGURE 14



A Model of Functional Thinking

Beyer (1987)

Memorization Of Steps Of Writing Process

Two of the nine students with learning disabilities in the process-only group who were interviewed were not able to think of any steps that they used to write their stories. Of the remaining seven, two focused on spelling and the other five were only able to recite the steps as they were printed on a poster in the classroom. Their responses are presented in Table 35.

The regular classroom students who used paper and pencil gave similar response as also shown in Table 35. Therefore eight out of the thirteen students using pencil and paper who were interviewed had memorized the steps in the writing process, but the question remains whether or not they truly understood them.

TABLE 35

Memorization Of The Steps Of The Writing Process As Indicated In Interview Responses From Process Only Students

Question No. 7 What steps did you use to write your story?	
Students With Learning Disabilities:	
Student No. 1	"Don't know."
Student No. 2	"Nothing."
Student No. 3	"Read word back; if you can't think of word for spelling ask teacher."
Student No. 4	"Stuck on a word; sound out; ask teacher; look up dictionary."
Student No. 5	"Plan; rough copy; good copy; story; colour."
Student No. 6	"Edit; revise; read it over; conference."
Student No. 7	"Editing; capitals and periods; special punctuation; student edit; teacher edit; good copy."
Student No. 8	"Plan; conference; rough copy; conference; do re-edit; teacher edit; good copy; publishing-typed; publishing." (See note below table re-"typed").
Student No. 9	"Plan; rough copy; editing; revising; conferencing; good copy."
Regular Classroom Students:	
Student No. 1	Gave no response.

TABLE 35 Cont'd

Student No. 2	"Self edit; put in capitals and periods; circle words you don't know."
Student No. 3	"Plan; conference; edit yourself; teacher edit; published."
Student No. 4	"Punctuations; teacher edit; plans; conferencing with a partner."

*It should be noted that although the segregated paper and pencil teacher indicated at the beginning of the study that she had "no time to teach computers," the paper and pencil teacher did take the time to have a teacher aide type all student stories and make two photocopies, one for students to put in a booklet to read, the other for their writing file. Therefore the two teachers took advantage of the benefits of the computer technology, but were unwilling to allow students to become involved with that same technology, in spite of their obvious acknowledgment of the advantages regarding neater presentation, making for easier reading, for students and others.

Observations

In order to obtain further information regarding differences between computer and paper and pencil groups, direct observation was utilized during the writing of "best" stories in order to gather information concerning quantitative changes indicated by both length of stories as well as amount of time spent writing.

Length Of Stories

The average number of words written per story for each of the four groups is shown in Table 36. Although all groups increased the length of their stories over time, the average number of words per story increased the most for the process only groups.

Time Spent Writing

Additional quantitative changes were monitored by recording the actual amount of time spent writing by all students in all groups as indicated in Table 37. All groups increased the amount of time they spent, however the average number of minutes spent writing increased the most for the process only groups. At post-testing the two ability groups,

irrespective of the method, spent the same amount of time writing. Overall, the computer groups spent the most time on story writing.

TABLE 36

	Average Number Of Words Per Story			
	Pre-Test Length		Post-Test Length	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV
COMPUTER A	138.48	76.18	182.24	101.80
COMPUTER BA	105.65	44.74	151.22	48.46
PROCESS A	125.67	45.11	205.07	62.08
PROCESS BA	109.44	43.87	187.89	80.51

TABLE 37

	Average Number Of Minutes Spent Writing			
	Pre-Test Time		Post-Test Time	
GROUPS	Mean	STD. DEV.	MEAN	STD. DEV
COMPUTER A	31.56	6.06	36.20	7.40
COMPUTER BA	32.44	5.05	39.44	1.67
PROCESS A	26.27	4.91	35.13	13.73
PROCESS BA	25.78	3.38	39.89	12.96

Qualitative Analysis Of The Test Of Written Language

As "final" food for thought this current study applied Morton's (1985) research to attempt a qualitative analysis of some of the quantitative data generated from the TOWL. As Morton (1985) compared TOWL pre and post-test scores of groups with learning disabilities, the present study utilized a similar population for purposes of conducting this analysis. Results from the Word Usage subtest were selected to study changes in-depth as suggested by Morton (1985). As this evaluation generated much useful data the results have been made available in Appendix IX.

Using a combined contextual and developmental approach it becomes apparent that both groups with learning disabilities made significant improvements over time. Furthermore upon close examination of the test responses of students with learning disabilities, differences between the two groups emerged, such as, students using word processing had more correct responses overall than the students using only paper and pencil.

Summary

The results of this study found that two dependent variables, the Test of Written Language and the Diagnostic Evaluation of Writing Skills (three way Anova for monthly stories) provided support for the superiority of the computerized process group. Although the interactions were not statistically significant, the data indicates trends in the hypothesized direction. The remaining dependent variable, the four-point holistic rangefinders, did not indicate definitive trends.

The second research question explored the differential effects of the computer. Would students identified as weak writers benefit more from the combination of process instruction and computer, and would the performance for above average writers be comparatively similar under both methods? The three-factor repeated measures analyses of variance for the DEWS criteria applied to monthly stories indicated a significant ability-by-time interaction such that the below average groups improved more than the average groups. The ability-by-method interaction, although not statistically significant is important as at post-testing the weak writers on the computer had fewer errors than even the average

writers using paper and pencil. However, several main effects for ability, and a significant ability-by-time and ability-by-method interaction, did not provide support for the superiority of the computerized process approach for below average writers.

The third research question assessed differences in writing attitudes and practices between computer groups and paper and pencil groups. Questionnaire data revealed several recurring themes for computers. Differences between groups were reflected in students' stated preference for computers. The cooperative nature of the computer appeared to be beneficial to the students using the writing process as they appeared more comfortable collaborating together. However, process-only students indicated that the cooperative atmosphere may be more intrusive with paper and pencil. Based on data generated from the interviews, computer students with learning disabilities were found to lack fluent keyboarding skills. Interview responses from computer students in the regular classroom, indicated that they had been able to internalize the writing process, whereas the paper and pencil students appeared to have merely memorized the steps of the writing process. Observations made during

the writing of the student "best" stories are documented quantitatively in a comparison of the average number of words written per story, and the the actual amount of time spent writing. A qualitative analyses of the Test of Written Language is presented as a suggestion that a learner's test responses can be viewed as partially correct rather than totally wrong (Morton, 1985). In the next chapter a discussion of these results is presented.

CHAPTER VI

DISCUSSION

Computer Effects

Exploration of the first research question revealed that the writing skills of students improved through the use of the computer between pre-testing and post-testing on the TOWL more than the other treatment group using paper and pencil only. However, group differences were not significant. This finding is consistent with Dalton and Hannafin (1987) and Crealock et al., (1985) who found that differences for writing treatments (computer versus paper and pencil) were not significant.

The lack of a significant interaction in the present study could be explained by the fact that students who composed stories on the computer throughout the year were asked to switch mediums and work with paper and pencil for pre and post-testing on the TOWL. The adverse effects of this phenomenon are also discussed by Dalton and Hannafin (1987). The possibility may also exist that unlike Kerchener and Kistinger's (1984) research findings, word processing

skills are not transferring to paper and pencil tasks automatically. Crealock's et al., (1985) work also disagreed with Kerchner and Kistinger's results as researchers did not find significant differences between computer and paper and pencil groups. Van Deusen and Donham's (1986-1987) finding that transfer from one learning situation to another is not automatic, but must be teacher directed, may warrant future consideration. In addition using Morton's (1985) qualitative analysis, progress was evident among the groups with learning disabilities which was only minimal, at best, using the standardized test results in the expected quantitative style. This finding is ccnsistent with that of Crealock and Sitko (1990) who found scores for students with learning disabilities did not change significantly on the TOWL over a one year period. This perhaps suggests a re-evaluation of our current method of measuring educational growth, viewing learner's test responses as totally wrong, rather than partially correct.

A further factor is that some research interference occurred in April, 1989. A psychologist hired by the Edmonton Public School System administered the "story" subtest of the TOWL to four out of the nine segregated

students with learning disabilities, one week prior to the post-testing for this current study. Possible solutions that may prevent this extraneous variable from being introduced into future research projects are improved communication between classroom teachers and support staff, and use of revised TOWL with alternate forms for pre and post-testing.

As substantial keyboarding skills are required for word processing, a significant interaction may not have been obtained using the Holistic Scoring (1985) or the DEWS (1984) error analysis due to lack of fluency in keyboarding skills by the students using computers. In the current study, two months' duration (September and October) was allowed for acquiring keyboarding familiarity. According to Wetzel (1985) this time period should have been sufficient, as he recommends twenty days of instruction for thirty-five minutes each day in order for students to become proficient at the keyboard. However, Thorpe, Chiang and Lubke (1987) found that students with learning disabilities, in particular, may require more time to master keyboard operations. However in the present study, the differences in keyboarding skill may not be an LD/non-LD issue, but simply be due to the fact that the regular computer class had more

opportunities to actually work on the keyboard. These students also used computers for other subject areas such as mathematics, whereas the students using the computer lab were limited to access to the computers at specific times. To obtain more positive results, a longitudinal study over two to three years to monitor progress especially of pupils with similar classroom settings may be required. Additional support for conducting a longitudinal study is provided by an observation made by the regular classroom computer teacher. As of April, 1991, (two years after post-testing), she noted that students involved in the study were now "automatically" editing at the keyboard. Wetzel (1985) presents a realistic set of criteria in order for students to achieve at least minimal proficiency in keyboarding as presented in Figure 15.

Insert Figure 15 about here

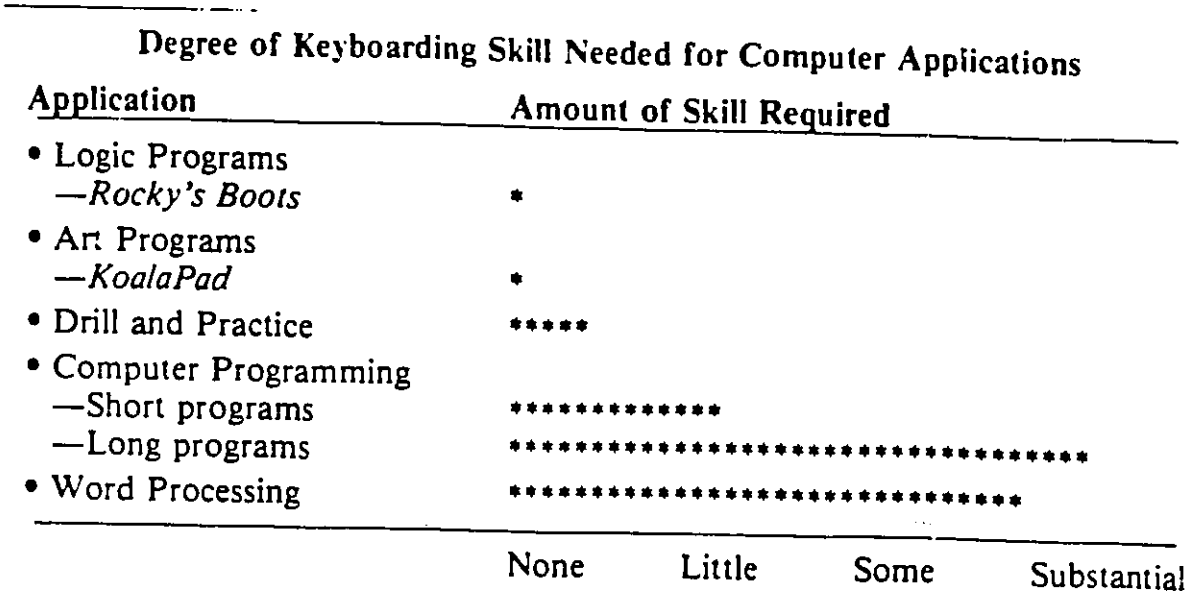
The strategy of collecting "best" stories to determine if there was a difference in the internalization of the writing process by students may not have resulted in a significant interaction between pre and post-testing for students combining the writing process with word processing

due to the short length of time between testings (February and April). However, in the current study pre-tests using the TOWL could not ethically take place prior to November 19, 1988 (following successful completion of the candidacy exam). As well, the Christmas period was avoided at the recommendation of Crealock et al., (1985) as students were found to be somewhat distracted and unmotivated.

A second strategy involved the collecting of monthly stories completed by all students in their normal classroom environment, with their regular teacher. As only those months could be used in which all classes completed stories following the process approach, several groups of stories were omitted from this analysis due to discrepancies in how some of the writing samples were obtained. (One month a

FIGURE 15

Degree of Key Boarding Skill Needed For Computer Applications



group of stories had only been peer edited; another month, due to time constraints with the computer lab, not enough sessions had been available for students to complete a story). Therefore again the short duration of time between pre and post-tests (November and January) may have precluded more dramatic results.

A further factor may be that students' performance differs under the formal atmosphere created in the classroom by the use of a standardized test such as the TOWL from a free writing situation where students may not feel obligated to use their time as efficiently (Crealock et al., 1985). As the collection of both "best" stories and monthly stories were essentially "free writing" exercises, the less formal atmosphere may have affected students' performances adversely. Finally, the lack of a significant interaction may be explained in part, by the findings of Bruce, Michaels and Watson-Gegeo (1985). They suggest that as the writing system of all students in the writing (with computers) process groups involved one computer per student, their computer work may have looked more like an ordinary handwritten draft, due to having fewer opportunities to "mill" about and read each other's work than would ordinarily

be available in the usual one computer classroom. However, based on informal observations made during collection of the "best" stories this would not appear to be an appropriate explanation in the current study, as the computer students in both the regular classroom and the computer lab appeared quite comfortable both in viewing other's work, and letting others view their work, as well as asking others questions about their story writing.

Differential Effects of Computer

The second research question, questioned whether students identified as weak writers would benefit more from the combination of process instruction and computer, than from process only instruction; and speculated that the performance for the average and above average writers would be comparatively similar under both methods. Exploration of this area revealed a significant ability-by-time interaction. The ability-by-method interaction is also important as the progress of the below average computer group was such that at post-testing the weak writers on the computer had fewer errors than even the average writers using paper and pencil.

This interaction is consistent with Dalton and Hannafin's (1987) marginal achievement-by-writing technique interaction. Post-test comparisons revealed that although different writing techniques resulted in similar performance for high achievers, word processing was superior to conventional instruction for low achievers.

This finding also lends tentative support to the attribute-treatment interaction (ATI) research which indicates that students should be matched with the

instructional method and program that they are best able to learn from. Studies have found that while specific strategies and programs may be of benefit to certain students, those same techniques can actually be counterproductive for other groups of students. (Pascarella, 1987; Woodruff et al., 1981-82).

The lack of a significant interaction between pre and post-testing with students monthly stories using Kopp's holistic scoring criteria may be due to several factors such as teacher characteristics, setting variables, pupil characteristics and nature of treatment, (Ysseldyke & Algozzine (1982). Differences in teaching style, commitment and personality may have influenced intervention effectiveness adversely. Additionally, the logistics involved in the use of a computer lab for the group with learning disabilities could have affected the results adversely. Similar findings were discovered by Dalton and Hannafin (1987) in their research in this area. Also as the paper and pencil group with learning disabilities was in a segregated setting, exposure to posters, stories and other writing material may have adversely affected results.

A further factor which warrants discussion is that,

based on the results of pre-testing with the TOWL, there was not a group of above average writers available from within the sample selected for this study. This is significant as the second research question explored whether the superiority of the writing process using the word processor would be greater for some types of students than for others. Specifically, it was asked whether students low in writing ability would do better under the combination of computer and process approach than under the process approach to writing alone and students high in writing ability, or above average, would be able to do just as well under either method. Therefore, although there was an interaction effect for below average writers with computers, and average writers using paper and pencil, the progress of above average writers has yet to be seen.

Finally, as much of the research in the area of computers and writing has not obtained a significant main effect for computers using a holistic scoring system (Crealock et al., 1985; Crealock & Sitko, 1990; Vacc, 1987; Woodruff et al., 1981-82), it may be that the scoring system itself creates a problem. As significant improvement in a student's writing is required to increase a score to the next

category in a four or five-point scoring system, use of a holistic criteria may not be the most appropriate means of measuring gains in writing, given the short duration of much of the previous research. Indeed, Wetzel (1985) found that studies of less than four months duration did not obtain significant qualitative differences between groups.

Results from students' "best" stories using both holistic scoring as well as the DEWS criteria revealed significant interactions between pre and post-testing that indicated that average writers had improved more than below average writers. This finding is consistent with Crealock et al. (1985) who found an interaction between groups and time for spelling errors, with SLD students with serious problems in written language increasing their errors at post-testing where the average groups had decreased their number of errors. This result is confirmed further by the more recent work of Crealock and Sitko (1990) who found that LD students with a written language deficit, had not improved their technical skills of punctuation, spelling and grammar or holistic scores over a one year period. As the superiority of the computer for below average writers is not supported statistically, these results are disappointing. However, as

this present study was designed as field research, these analyses do provide useful information aimed at answering questions as opposed to rejecting or accepting an hypothesis. Additionally, when conducting analysis of variances with unequal N's, the amount of power in a test of significance tends to be overstated, especially when samples with small N's come from populations with larger variances (Glass, Peckham and Sanders, 1972). Yet as research conducted in the behavioural sciences cannot be as exact as in the ideal world of the physical sciences, the phenomenon of unequal N's is often a reality. Therefore any significant interactions should be discussed with caution.

However, the discrepancy in findings may simply be explained by the fact that the paper and pencil groups may have spent more time on writing. Both paper and pencil groups had access to two, sixty minute periods of writing per week, as did the regular computer class. However, the paper and pencil groups were team taught and allotted themselves an additional thirty minute period per week specifically for process writing. This is a significant time difference, especially as the Resource Room computer groups only had access to the computer lab for three, fifty minute periods in

a six-day cycle. This factor may have adversely affected the results of this study.

Qualitative Data Analysis

Questionnaire Data

The third research question assessed differences in attitudes and practice between computer groups and paper and pencil groups using both questionnaire and interview questions. As the several recurring trends generated from the questionnaire data were consistent across all groups, these data would seem to give support to the benefits of using the writing process over traditional methods. Certainly students appear to feel good about writing and perhaps because of this are willing to share of themselves with fellow students. Additionally it seems that students who are learning to write are also learning to articulate their thinking more efficiently.

Although the above trends were common amongst all students regardless of grouping, a significant difference does appear between the computer and pencil groups. Specific responses to the questionnaire from students in the paper and pencil group give support to Woodruff et al.'s conclusion that the computer lends itself to communication with others, which would be intrusive with paper and pencil (1981-82).

Interview Responses

Data generated from the interviews also revealed several recurring themes which indicate differences between the students with learning disabilities and their "normal" counterparts.

Four out of five students with learning disabilities were still concentrating on skills required to master keyboarding skills instead of focusing on the steps involved in the writing process. This observation confirms Thorpe, Chiang and Lubke's (1986-87) finding that the LD group had not mastered keyboard operations as fully as the non-LD groups. This finding also lends support to a recommendation cited earlier suggesting that learning disabled students would require longer periods of time to acquire mastery of keyboard operations. Indeed, the difference between the two groups' abilities to gain control over the keyboard may also indicate the need for students with learning disabilities in particular to have continuous access to computers as opposed to using computer labs. However as discussed previously in this present study, keyboarding fluency may not be an LD/non-LD issue, but may simply reflect the fact that due to

differences in computer accessibility, the regular computer class had more time to practice keyboarding.

Finally, the need for a longitudinal study in this area, is further demonstrated with the data accumulated from the interviews with the regular classroom students who had access to computers, as the majority of those students were able to focus on the writing process as opposed to concentrating on keyboarding skills.

Upon further qualitative analysis, a significant difference also appears between the computer and paper and pencil groups. As writing is a thinking skill, it may follow that an increase in one leads to an increase in the other.

Beyer's research into improving thinking skills suggests that any skill is best learned when learners:

1) are consciously aware of what they are doing and of how to do it.

2) are not distracted by other inputs competing for attention.

3) see the skill modeled.

4) engage in frequent but intermittent (not massed) practice of the skill.

5) use feedback received during this practice to correct their use of the skill.

6) talk about what they did as they engaged in the skill.

7) receive guidance as how to use a skill at a time when they need the skill to accomplish a content related goal.

8) receive guided opportunities to produce the skill in context other than that in which the skill was introduced.

(1984, p. 558)

Principles one through six are certainly teaching strategies involved in the writing process model applied in this research. However, a critical step in the learning sequence appears to be lacking for one of the groups in the study. The computer students had opportunities to practice the process approach in other mediums such as paper and pencil, whereas the process-only group relied solely on one context in which to practice their writing process skills. This factor appears to be especially relevant according to interviews that occurred following the post-testing, which was done with paper and pencil by all groups. This task required students using computers, to apply the skills or strategies learned with word processors to another situation. These students appeared to be much more aware of what they were actually doing while writing their stories, than the

paper and pencil groups.

According to Beyer,

> Metacognition requires individuals, in effect to stand outside of their own heads and be aware of how they are going about their own thinking so that they can better accomplish what it is they are trying to accomplish.
>
> Thus, when engaging in decision making, for example, an expert remains conscious of the goal being sought, plans in advance what kinds of thinking operations must be undertaken, and monitors how he or she is carrying out these operations as thinking progresses.

Cognitive thinkers are concerned with product, whereas metacognition seeks to interpret the thinking processes utilized to make that product. As thinking about how one is thinking is a much more arduous task than simply thinking for meaning, individuals who are able to engage in metacognitive functions are rated as superior in their thinking and are seen as more effective and efficient thinkers (Beyer, 1987, p. 24).

The key factor in explaining the differences between the level of functional thinking obtained by the two groups involved in this current study may be that computers can assist in creating a more manageable environment in which the

focus can be placed on teaching processes such as thinking skills (Van Deusen & Donhan, 1986-87). The writing process alone may encourage classroom experiences in writing to become organized sufficiently to enhance the thinking processes. However, it seems that with the addition of computer technology and word processing, specifically, it allows for skills to be explicitly and systematically taught with provisions for practice and applications in writing stories.

Observation

A key finding was that the process only groups wrote longer stories in the same amount of time as the computer groups, yet there was no difference in the quality of the stories between the two groups. Additional evidence for the importance of efficient keyboarding skills, as well as support for the use of the computer in developing more efficient thinking skills is offered through the observations made during collection of "best" stories.

This data appears to both contradict, (Crealock & Sitko, 1990; Vacc, 1987 and Woodruff et al., 1981), and support, (Crealock et al., 1985; Vacc, 1987, and Daiute, 1985), previous research findings. For example, although Crealock (1990) found that LD students increased their quantity of writing more using the computer, she found that both groups increased the number of words written (Crealock et al., 1985; Crealock & Sitko, 1990). Vacc (1987) reported that although subjects using computers spent more time and wrote longer texts, in this case, letters, the average number of words written per minute was higher for handwritten letters. Daiute (1985) found that students wrote

more with pen and paper than on the computer in a fifteen minute period. She attributed the differences between the groups to lack of efficient keyboarding skills. Support for that argument can be found in this present study. The average computer group took less time, yet wrote longer and better stories, than the below average computer group. As interview responses revealed a difference of keyboarding skill achieved between the two computer groups, the higher level of comfort with word processing felt by the average computer group appears to be a significant factor. Yet, perhaps the need to gain more efficient keyboarding skills is not the only solution to the discrepancy in quantitative changes between computer and non-computer groups. Flavell (1977) suggests that learning to use time efficiently is an important skill to be mastered. Therefore it may be that the computer groups were simply using their time more efficiently, as the process-only groups took more time, wrote longer stories, but had just as many errors.

Another distinction becomes apparent upon closer inspection. Previous studies were conducted outside the regular classroom, under "hothouse" conditions, (Crealock et al., 1985; Crealock & Sitko, 1990; Vacc, 1987; Woodruff et

al., 1981-82). However Daiute's (1985) research, as well as the present study, took place within students' natural writing environments. Therefore, it may be that students' normal writing behaviour is not the same as under laboratory conditions.

Implications For Practice

Data gathered in response to the first research question indicate that teachers already utilizing some form of the process approach to teaching writing in their classroom may want to combine that with the word processor. As sufficient time must be taken to teach efficient keyboarding skills, especially if working with students with learning disabilities, school boards must take the responsibility of providing appropriate in-servicing for their teachers. To assist with the implementation of classroom service and consultation, appropriate personnel should investigate the brief proposal submitted by Burrows and Mowatt (1988).

Information collected in analyses of the second research question as well as discussions of previous findings in this area should encourage educators to re-think the current practice in a one-computer classroom of allowing access to word processing only when students have completed assigned school work. This all too frequent practice allows above average students to gain access to a tool when they may have already developed their own efficient strategies for

writing. Perhaps instead, below average writers should be encouraged to make use of the computer technology available in the classroom. This conclusion is supported by the work of other researchers in the area, (Crealock & Sitko, 1990; Dalton & Hannafin, 1987; Spence, 1986; Wetzel, 1985).

Qualitative analysis of data generated from student questionnaire responses revealed that all students using the process approach, regardless of medium, felt positive about writing. Therefore teachers who have been struggling with traditional methods to teach writing, may be encouraged to introduce a process approach into their classroom. Indeed, as a measure such as the DEWS, which addressed mainly traditional lower level corrections, proved to be useful in evaluating student's writing, it may be that "product and process teaching are complementary and not mutually exclusive teaching strategies." (Gerard & Junkala, 1980, p. 54). Henceforth teachers may be less reluctant to integrate a process writing program into their existing methods.

Responses from student interviews indicated differences between computer and paper and pencil groups in the area of thinking skills. Teachers may want to make use of the benefits of the process approach to teaching writing combined

with the word processor to establish an appropriate environment to promote an increase in student's thinking skills, both cognitive and metacognitive.

Finally as the test's authors claimed, the TOWL proved to be effective in identifying average and below average writers for the purposes of the study. Educators should be encouraged to utilize this instrument in the future to discriminate between levels of writing ability within regular and special education classrooms. However, teachers should keep in mind Morton's (1985) observation that a learner's test response can be partially correct rather than totally wrong.

Implications for Future Research

The duration of six months for the purposes of this study was a significant improvement over much of the research in this area, (Crealock et al., 1985; Kopp, 1985; Wetzel, 1985; and Woodruff et al., 1981). However, a major implication which arises from this research is the need for a longitudinal study over the course of two to three years. This recommendation is supported by other studies in the area of computers and writing which have concluded that children may write less while composing on the computer until they become as comfortable with typing as they are with handwriting, (Crealock & Sitko, 1990; Daiute, 1985; Spence, 1986; Wetzel, 1985). Allowing students to fully master word processing skills seems to be especially important for students with learning disabilities who may require longer periods of time to master keyboarding operations. This is a significant finding as below average writers appear to benefit more from composition taught via word processing than conventional instructional methods. These observations are consistent with the findings of several other researchers in the area of computers and writing (Crealock & Sitko, 1990; Dalton & Hannafin, 1987; Spence, 1986).

Additionally, as students made significant gains on a standardized measure, yet little growth was evident utilizing a holistic scoring criteria, the need for longitudinal research may be further indicated. As Crealock and Sitko (1990) suggest, qualitative changes in students' writing requires a much longer time period.

Future research endeavours in this area should also consider that the results of this study may have been influenced by the different learning environments experienced by the students. Replications of the study might control for such variables by choosing subjects in self-contained classrooms only. This recommendation is reinforced by the findings of other researchers (Kerchner & Kistinger, 1984).

An additional factor which should be addressed in future studies is the problems associated with gaining access to computers in computer labs. As Dalton and Hannafin (1987) suggest, the untimely process and associated complications can be avoided through effective planning. Perhaps the confusion of scheduling two classes in one lab at the same time can also be eliminated.

A further implication generated from this study is that

when using the TOWL or any other standardized testing material to measure educational gain, future researchers should adhere to Morton's (1985) recommendation and consider errors constructively. A qualitative approach to evaluate standardized test responses from students with learning disabilities, which included both contextual and developmental considerations, proved to be a worthwhile procedure for measuring changes in writing over time, and could be appropriately applied across regular classrooms for all students.

As the TOWL proved useful in measuring gains in writing, it's continued use is recommended. In future, however, use of the revised TOWL, the TOWL-2 with alternate Forms A and B would be preferred for purposes of pre and post-testing.

Additionally, as a teacher's checklist for the process approach (See Appendix X) proved useful in the six week pilot study, (Pearce-Burrows, 1988) future researchers may want to develop a similar instrument to assist teachers who are unfamiliar with the writing process. A classroom recording system similar to Atwell's (1987) strategy (See Appendix III) could also be utilized. As well, although Kerchner and

Kistinger's (1984) eight stage process approach was adopted for purposes of this present study, researchers in the future may want to study the effects of applying Pellegrini and Inglis (1986-87) writing process, which focuses on modelling in the classroom.

As the results of this study indicated a possible link between an increase in writing skills using the computer and a subsequent increase in thinking skills, future research should attempt to either verify or dispute this claim. Indeed researchers may investigate whether students using word processing have actually developed more efficient thinking skills. Certainly it would appear that students who use the computer for writing are able to use their time more efficiently as the word processor eliminates the task of recopying text, since changes to the text do not require that acceptable text be written out again (Baldursson, 1988; Daiute, 1983; Sitko, 1986). It may be that students using computers are more actively involved with learning (Woodruff et al., 1981-82). Daiute (1983) found that writers had to attend more to the text as the computer executed instructions precisely and meaning could get lost without due care. In addition, she found that due to the interactions of the

computer text editor, writers must be objective about their own writing. Students writing on the computer are stimulated to evaluate their work and find mistakes by taking the reader's point of view (Daiute, 1983). At present the idea of a link between improving writing skills with the computer, and improving thinking skills, is speculative. However discovering unforeseen or unexpected patterns in data leads to gaining insight into new directions for future research (Borg & Gall, 1983). Therefore studies should be conducted which indicate whether students make higher level revisions (Kopp, 1985) such as changes in meaning.

To decide whether students' attempted to define a more difficult writing task than before, the use of a category system of revision such as that offered by Van Hooydonk (1986) may be useful. Students' individual revisions can be identified as one of the following: Content--development of ideas; organization - coherence of thought; style--sentence structure and length. Mechanics--grammar, spelling and punctuation. Revising is a difficult process because it demands planning and evaluation which involves thinking about thinking (Daiute, 1983). Therefore future research should investigate whether attempts were made to use

higher level thinking skills as well (Wetzel, 1985). Finally, as lack of fluency in keyboarding skills appears to be a major factor cited in most of the previous research in this area, future research projects should involve not only a paper and pencil computer group, but a group of students who have already fully mastered word processing skills.

Crealock and Sitko (1990) addressed this issue by studying two groups of students, one receiving keyboard training for fourteen, forty minute sessions, and six sessions of word processing skills during the study, and the other group receiving no direct training on the computer. Yet Wetzel (1985) recommends at least twenty days of specific keyboard training consisting of thirty-five minute periods. His research indicates that after this amount of practice, students in grade three to five will average 10 gross words per minute (GWPM). His findings further reveal that word processing training can begin once students can type 10 GWPM. According to Wetzel's (1985) criteria, students involved in Crealock and Sitko's (1990) group 1 were not even fluent in keyboarding at post-testing (Group 1: September-2.8 GWPM, May-7.1; Group 2: September-4.5; May-15.7 GWPM). Other researchers have concluded that students will not be

comfortable at the keyboard until their typing rate equals that of their handwriting rate (Daiute, 1983; Vacc, 1987; Wetzel, 1985). Wetzel's studies indicate that students in grades four to six can copy by hand at the rate of approximately 7-10 GWPM. Therefore future research endeavours in this area should introduce a third group of students who are efficient at keyboarding skills (rate of 10 GWPM) at pre-testing.

Limitations

In many of the previous studies in the area of writing and computers, subjects have been removed from their natural writing environments, (Crealock et al., 1985; Crealock & Sitko, 1990; Vacc, 1987 and Woodruff et al. 1981-82). This current research project was designed to offer valuable insight into whether conclusions reached under laboratory conditions pertain to students in their normal classroom environments. Hence, threats to external validity have been greatly reduced. However, there are factors which affect intervention effectiveness such as teacher characteristics and setting variables which must be considered with any interpretation of these results (Ysseldyke & Algozzine, 1982).

Differential mortality did not pose much of a threat to validity as only one student dropped out during the research study. However, some data was lost through student absences. Only data collected from students who were present for pre and post-testing was analyzed. Therefore students moving in during the course of the research study couldn't be included in the sample. As well, data from one student from the LD

paper and pencil group could not be used as a dramatic change in performance was evident at different testing times depending on whether he was taking his medication, ritalin, or not.

Additionally, despite the demonstrated equivalence of the treatment groups on age scores, intelligence scores, and written language scores, as random assignment procedures were not used, the design of this study should be considered as a factorial quasi-experiment (Borg & Gall, 1983). This type of design demands that the findings be interpreted with considerable caution in terms of casual inferences.

Although it may be difficult to generalize to all teachers based on this study alone, the use of four teachers, three schools and two school boards greatly enhances the generalization of these findings.

As well this type of preliminary research can lead to improved future research (Borg & Gall, 1983). Although the results of this investigation, while not conclusive in themselves, nevertheless suggest that attribute treatment interaction may provide a fruitful approach to this inquiry.

Overall, the procedure for selection placed some

limitations on the degree to which results could be generalized. A second limitation was that although all groups generally had access to equal amounts of time for writing, constraints due to timetabling and gaining access to computer laboratories may have precluded more dramatic results. This made it difficult to attribute results solely to the treatment. Teacher characteristics and setting variables were potential sources of invalidity in this study

Conclusion

Despite the limitations of the study, some intervention effects, however minimal, have been demonstrated in relation to the benefits of the combination of process writing with the computer, to improve writing skills. However the potential of the superiority of word processing and process writing for weak writers has yet to be seen.

Specifically, it has been shown that in order to obtain significant qualitative differences between computer and paper and pencil group, researchers using holistic scoring systems should consider longitudinal studies of two to three years, as higher level changes in text appear to require longer periods of time to develop (Crealock & Sitko, 1990). Additionally as students tend to initially focus on lower level revision (Crealock et al. 1985), scoring criteria such as the Diagnostic Evaluation of Writing Skills should be considered in studies measuring technical or mechanical changes in students' writing skills.

The Test of Written Language has proven to be a useful instrument in the identification of weak writers. The TOWL as in previous research studies, (Crealock & Sitko, 1990;

Kerchner & Kistinger, 1984), has been further validated as an appropriate standardized measure for testing written language skills. Further, consideration should also be given to Morton's (1985) qualitative analysis of standardized test results.

Additionally, as statistical analyses revealed four main effects for ability; this factor should be considered further in future research projects in the area of writing and computers. As well these findings should encourage educators to identify student needs in the classroom based on specific academic strengths and weaknesses in order to ensure that "maindumping" is not a result of present philosophical shifts in special education.

As data generated as a result of this present study suggest that as writing is a thinking skill, it may follow that an increase in one area leads to an increase in the other. The computer may offer an appropriate environment in which to develop both of these thought processes (Van Deusen & Donham, 1986-87).

Finally, it is recommended that the recurring issue of lack of fluent keyboarding skills be addressed in future, by

studying the effects of computer and paper and pencil groups along with a third group of students who at pre-testing have already mastered the keyboard to the level suggested by Wetzel, (1985), of 10 GWPM.

Tell me and I forget,
Show me and I remember,
Involve me and I understand.

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APPENDIXES

Appendix I
A WRITING PROCESS THAT WORKS

One of the main roles of the teacher using this approach is that of a model. Modeling is having the teacher lead the class by example through each stage of the writing. It is through modeling that the ground rules for the process are demonstrated. The following steps illustrate how a week might flow when the teacher gets a class started on the process. The class might spend an hour writing on the first day, and about 30 to 40 minutes per day thereafter.

Step 1 On the board or overhead, the teacher lists four topics that might be written about, and talks about each one. Using class input, the teacher chooses one topic to write about.

Step 2 Each student writes down four things that she or he could write about.

Step 3 Each person talks about topics to the rest of the class or in small groups. Each may add to her or his list and share the list with others.

Step 4 Each person selects one topic. Everyone writes without concern for form or conventions. The teacher does the same on the board or overhead.

Optional The students form groups of four, and each student tells about or reads what she or he has written. Each can then continue with the same topic or begin another one.

Step 5 The teacher models "receiving" the piece with the class. The author reads and the partner tells what she or he has heard. The students form groups of two. Each person takes a turn reading to a partner. The partner receives the piece.

At this point, the teacher can decide to repeat the above steps or to continue. This decision should be based on how comfortable the students are with sharing.

Step 6 Using a story on the board or overhead, the teacher has the class ask questions to help clarify or improve the content of the writing. (This is a good time to discuss what kinds of questions are helpful.) The teacher marks her own writing in various ways to show these questions or suggestions.

Step 7 The students form groups of two and repeat receiving and questioning a piece.

Step 8 The teacher and the students make a "good" copy of the writing, incorporating changes that they wish to improve their piece. The teacher's copy is put on the board and should include mistakes in grammar, spelling, and so on.

Step 9 The class proofreads the teacher's writing. (At this time, a set of proofreading symbols can be devised by the class to be used in editing.) The teacher marks errors with symbols.

Step 10 The students form groups of two and edit each other's work, using symbols. (For peer editing such as this, students should have their work edited twice.)

Step 11 The teacher and the students make a "final" copy of their writing.

Once the student begins to write about a topic, the piece of writing might go through three stages: a very rough draft, a copy for editing, and a final published copy. Changes in drafts are often made as a result of input during conferences. To facilitate this organization, we color-code each draft: white for rough, yellow for second, and blue for published. And, of course, each draft is date-stamped so that the teacher is able to review the student's progress and identify special problems at each stage of the manuscript's development. Each draft is kept in a similarly colored file folder. Folders give each child something to "own" and work on. With folders, no child can say that she or he has nothing to do. Students always have a list of additional topics. If they tire of working on one, they work on another.

(PELLEGRINI AND INGLIS, 1986/87)

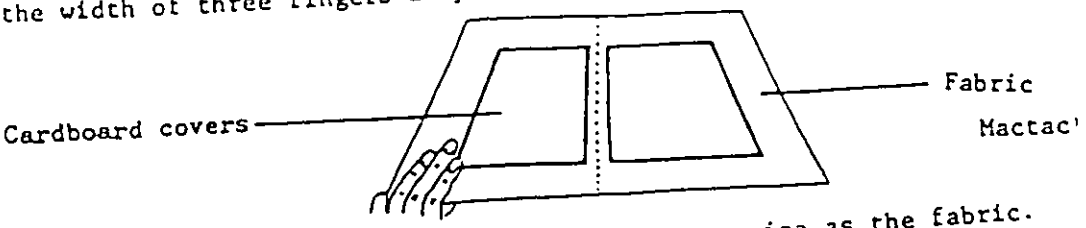
Appendix II

MAKING HARD-COVER BOOKS

PREPARING THE COVER

1. Decide on the size of the cover for your book. Using the paper cutter, cut a front and back cover of heavy cardboard.

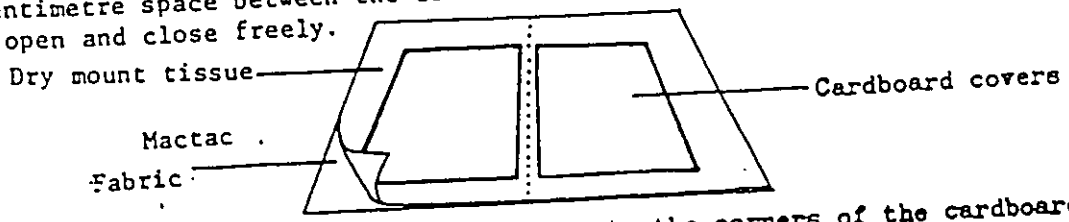
2. Select the desired fabric, wallpaper or mactac. Lay the front and back cover on the fabric. Cut the fabric approximately the the width of three fingers away from the edge of the covers.



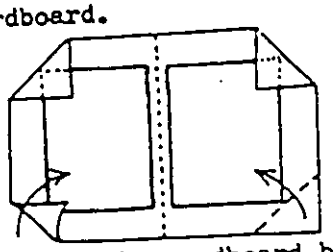
(OPTIONAL)

3. Cut a piece of dry mount tissue exactly the same size as the fabric.

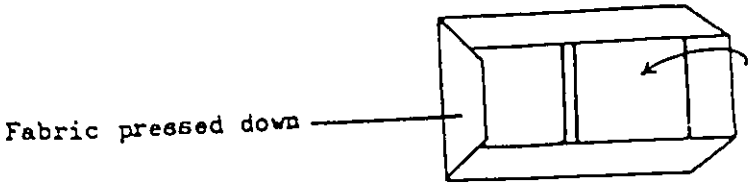
4. On the ironing table, first place the fabric, then the dry mount tissue. Place the cardboard covers side by side on the dry mount tissue or on the sticky side of the mactac, allowing approximately 1 centimetre space between the covers to allow the spine of the book to open and close freely.



5. Lift each of the four corners diagonally onto the corners of the cardboard. Press until stuck to the cardboard.



6. Then press all four sides up onto the cardboard being sure all parts are securely fastened to the cover.

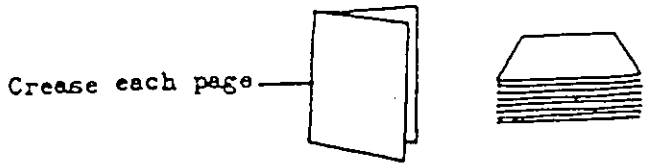


(Brown, 1987)

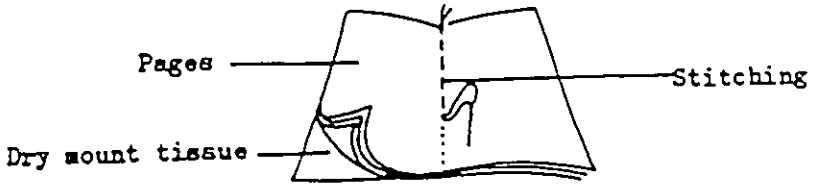
Appendix II Cont'd

PREPARING THE PAGES

7. Select the paper for the pages, making sure that the paper is approximately 2 centimetres smaller than the overall size of the book cover. Allow enough pages to have the first and last page for pressing down onto the cover, and end papers which can be decorated. Fold pages in half, forming a crease for the spine. Cut a piece of dry mount tissue exactly the same size as the pages, when opened out flat.

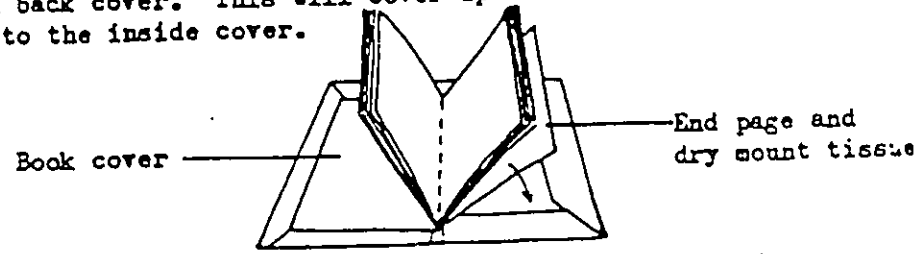


8. With dry mount tissue on the bottom, stitch with the machine through the center crease to hold all the pages and dry mount tissue together. Backstitch to secure at beginning and end of stitching.

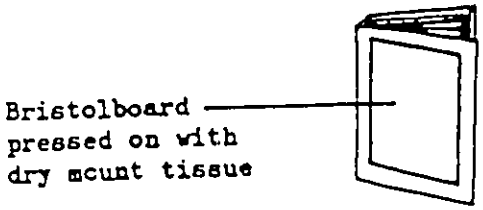


COMPLETING THE BOOK

9. Lay the prepared pages and dry mount tissue on top of the prepared cover, being certain that the stitching is exactly centered in the space between the front and back cover. Using the iron, press down one piece of paper on the front and back cover. This will cover up the fabric and give a neat appearance to the inside cover.



10. Since you cannot do the necessary printing and decorating on fabric, use dry mount tissue and bristolboard and iron the bristolboard onto the front cover. This can be suitably lettered and illustrated to make an attractive cover.



Be sure to include end papers, a title page with publisher, copyright date, and dedication if desired. Non-fiction books require a table of contents and index.

Appendix III

Status of the Class

8C 4/2

	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY
Rachel	ab.	D.1 - "Superman"	S.E. poems D.1 "Superman"	ED CON REWRITE(S)	D.1 "Superman"
Luanne	Yearbook poetry D.1 of essay	Fin. poetry	D.1 - Essay	Essay (S)	Revise D.1 of essay
Michelle	D.1 - new topic	D.1 - short story / Res.	Conf. self Response	Revise D.1	Ab.
Carol	D.1 - "Aerosmith"	D.1 - "Yrbook Story"	D.1 - Yrbook	D.1 - Yrbook Response	D.2 - Yearbook
Scott	D.3 - poem	S.E. poem	ED CON REWRITE	Ab.	D.1 - new poem
Ernie	Fin. D.2 - "Pomariscoye"	Response D.3? (S)	S.E.	ED CON REWRITE	D.1 - parody
Tony	Revise "Today" parody	S.E.	Finish S.E.	ED CON REWRITE	Start D.1 - new topic
Jane	Poetry poster	D.1 - new topic	Cont. D.1 - "Tracy's Party"	Response Revise?	Revise S.E.?
Jon	S.E. "Sugarloaf"	Fin. S.E. D.1 - new top.	ED CON REWRITE	Revise poem - format	S.E. / D.1
Jennipher	D.1 - "Art Club"	Revise "AC"	Conclusion - "AC" (S)	Cut & paste S.E.	ED CON REWRITE
Jamie	D.1 - Essay Contest	D.2 - poem	D.2 - poem	Revise poem	DUE TO / S.E. ME TO after EDIT / School
Arelitsa	D.1 - "Greek Church" (S)	Cont. D.1 - "G.C."	Revise Boothbay Project	D.1 - "Greek Church"	Revise D.2?
Steve	Revise parody	D.1 - s.story	D.1 - s. story	Cont. D.1	Response Cont. D.1
Bean	Fin. petition	S.E.	ED CON REWRITE	D.1 - Computer piece	Cont. D.1
Suzy	ED CON REWRITE	D.1 - new poem (S)	Poem	Poem - D.2	S.E.
Tracy	D.1 - play	Cont. D.1 - play	Ab.	Ab.	Cont. D.1 - play (S)
Shane	Ab.	D.2. of letter	S.E. letter	ED CON REWRITE	Add. envelope, mail, D.1
Dede	D.1 - poem or story?	Cont. D.1 - s. story	Conf. self Revise?	D.1 - part 2 (S)	Fin. D.1
Mike	Suspended	D.1 - "Next Day"	Cont. D.1	Cont. D.1	Response
Hilary	Revise S.S. Response	Revise S.S.	Conf. self D.2?	Ab.	Ab.
Leslie	ED CON REWRITE	D.1 - new poem	Cont. D.1	Conclusion of poem	S.E. poem
John	Finish final	D.1 - book review	Cont. D.1	Revise D.1 so far	Cont. D.1
Darren	Fin. D.1 - "Who Did It?"	Response Revise?	S.E. D.1 - Résumé	EDCON R.D.1 - REWRITE Resume	Fin. rewrite
Patrice	—	—	D.1 - S. Story	Cont. D.1	D.1 Response

KEY TO ABBREVIATIONS

D.1 : FIRST DRAFT
D.2 : SECOND DRAFT, ETC.
ED CON REWRITE : EDITING CONFERENCE WITH THE TEACHER, THEN WRITING FINAL COPY OF THE PIECE
RESPONSE : CONTENT CONFERENCE
(S) : SCHEDULED FOR GROUP SHARE
SELF-CONF : CONFERRING WITH SELF
S.E. : SELF-EDITING

Appendix IV

EDITING CHECKLIST

NAME _____ DATE _____

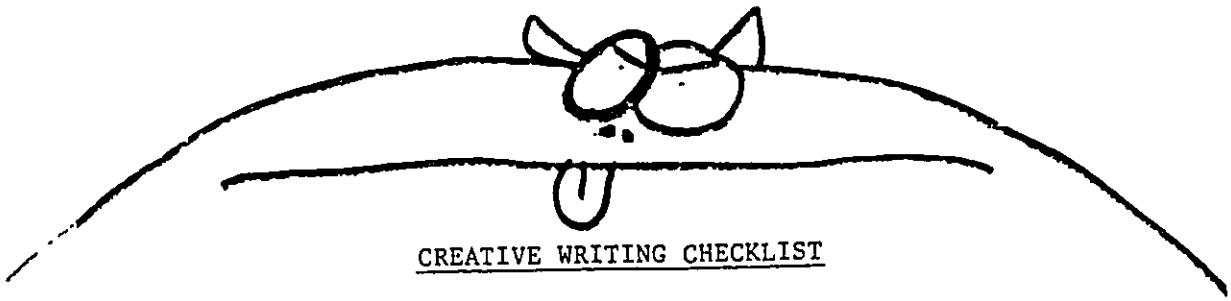
TITLE _____

NOTE: Put a check (✓) under YES or NO for each question. If you check NO, make corrections before you turn in your work.

	YES	NO
CAPITAL LETTERS Have I capitalized:		
1. the first word of each sentence?	___	___
2. proper nouns?	___	___
3. the word "I"?	___	___
PUNCTUATION Have I remembered to use:		
1. end marks (. ! ?)?	___	___
2. commas		
a. in a series? EXAMPLE: "Buy apples, peaches, pears, and ice cream for dessert."	___	___
b. of address? EXAMPLE: "John, your cat is inside."	___	___
c. to set apart explanation? EXAMPLE: "Paul, my brother, is sick."	___	___
d. before or after quotation? EXAMPLE: Mark said, "I am leaving." EXAMPLE: "I am leaving," said Mark.	___	___
3. apostrophes		
a. in contractions? (he'd, we'll)	___	___
b. to show ownership? EXAMPLE: dog's bones (one dog) EXAMPLE: dogs' bones (more than one dog)	___	___
4. quotation marks at the beginning and end of quotations?	___	___
PARAGRAPHS Have I indented the first word?	___	___
SPELLING Have I circled all words I don't know how to spell?	___	___
TITLE Does the title go well with the story?	___	___

(Hernandez, 1987)

Appendix V



CREATIVE WRITING CHECKLIST

1. Listen and look at each group of words to be sure it is a good sentence. Make sure that you kept your sentences apart.

2. Listen and look for mistakes in punctuation. Be sure that you have put in punctuation marks only where they are needed. Did you end sentences with the mark required?

3. Listen and look for mistakes in using words correctly. Be sure that you have said what you mean and that each word is used correctly with other words. Is there any incorrect verb or pronoun usage?

4. Look for mistakes in using capital letters. Did you capitalize the first words and all important words in the title? Did you begin each sentence with a capital letter? Did you capitalize words when it wasn't necessary?

5. Look for misspelled words. Use the dictionary to check the spelling of any word about which you are not sure.

6. Check for legibility of writing and directions about spacing, title, and the like.

Appendix VI

TOWL

WORD USAGE Instructions: The sentences written below have one word missing. Read each sentence and n the missing word. Be sure to write or print neatly.

Sally has a party dress and a school dress. She has two _____.

We have done that work already. We _____ it yesterday.

Jim is very tall. Jim has _____ three inches since I last saw him.

Before dinner Mother asked Brenda to _____ the table.

John is a good player. Bill is a better player than John. But Tom is the _____ player of all.

Bob is a child. Mary is a child. They are two _____.

It is autumn. The _____ on the trees are turning brown.

Will you _____ me how to read?

I wish I _____ seen the movie.

The brown dog is small; the gray dog is smaller; but the white one is the _____.

I have one mouse here and one mouse there. I have two _____.

If you are tired, _____ down on the chair.

Joe throws a ball every day. Yesterday he _____ the ball.

Yesterday Tina and Marie _____ walking down the street.

What time does the sun _____ in the morning?

One woman was talking to another woman. The two _____ were talking to each other.

Bill has a sheep. Patti has a sheep. Together they have two _____.

When the game ended, two men _____ left on base.

One deer is by the barn. Two other _____ are by the trees.

The hungry dogs have _____ all the food.

One child is throwing the ball to the other child. The two _____ are playing with the ball.

Dad gave the present to us. He gave it to Sandy and _____.

I know you gave the doll away. To _____ did you give it?

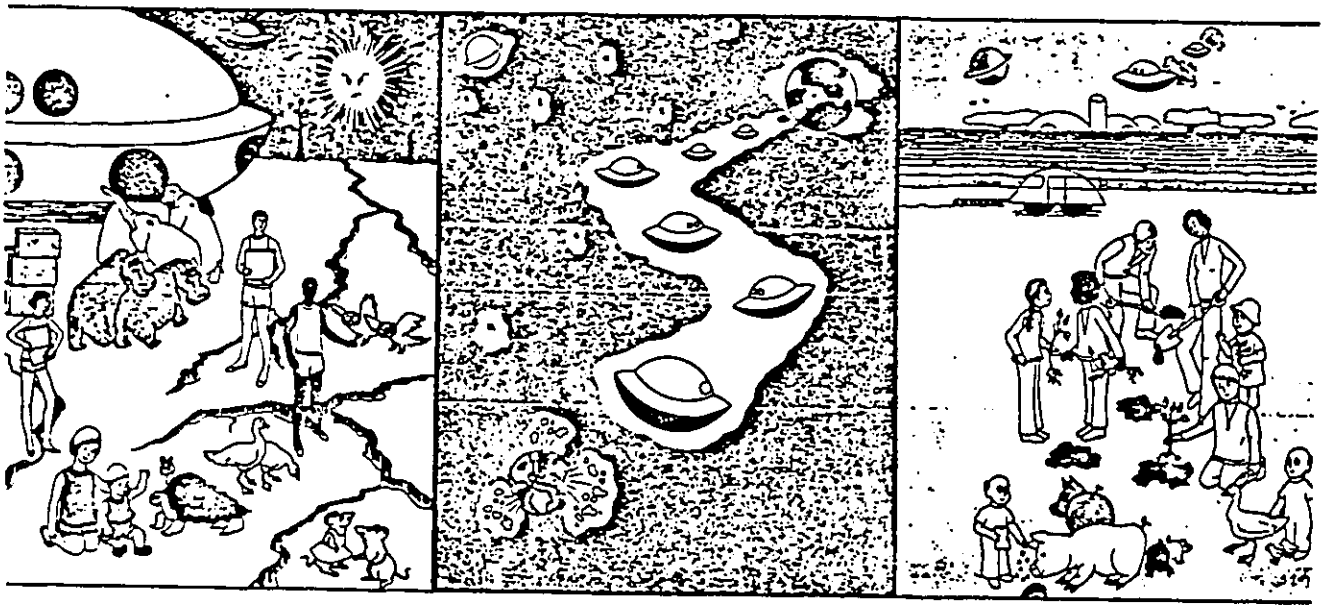
We built the bridge all by _____.

The clowns were so funny that Jack _____ out laughing.

Donald D. Hammill & Stephen C. Larsen

Appendix VI Cont'd

STORY Instructions: Look at the three pictures below and make up a good story to go with them. Take about five minutes to think about your story. Be sure to write a complete story using all three pictures. It is best to plan a whole story before you begin to write.



Appendix VI Cont'd

SPELLING Instructions: Write the words you hear in the space below. Try to spell each word correctly. Be sure to write or print neatly.

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____
9. _____
10. _____
11. _____
12. _____
13. _____
14. _____
15. _____
16. _____
17. _____
18. _____
19. _____
20. _____
21. _____
22. _____
23. _____
24. _____
25. _____

Appendix VI Cont'd

STYLE Instructions: These sentences are written without any punctuation or capital letters. Rewrite each sentence in the space provided. Be sure to use correct punctuation and capitals. Please write or print neatly.

1. the boy ran
2. the book is red
3. her name is mary
4. today is tuesday
5. he is mr smith
6. i was born on may 4 1972
7. didnt tom live in canada
8. its a sad day
9. he joined the british team
10. his name is john t hill
11. betty lives on oak road
12. my sister goes to washington high school
13. the girl lives in paris texas
14. the boys meet at 4 30 pm
15. there are twenty five children in the class
16. the teacher quietly said you did a fine job
17. they are carols books
18. yes john did sail on the pacific ocean
19. the war ended in 73
20. after playing ball with the team for four hours we were very tired
21. how many as did you get
22. you should bring the following people john sally mary and bill
23. the name on the report card read smith james t
24. you ran fast but the russian was the fastest runner of them all
25. oh lauras mother said in surprise

Appendix VI Cont'd

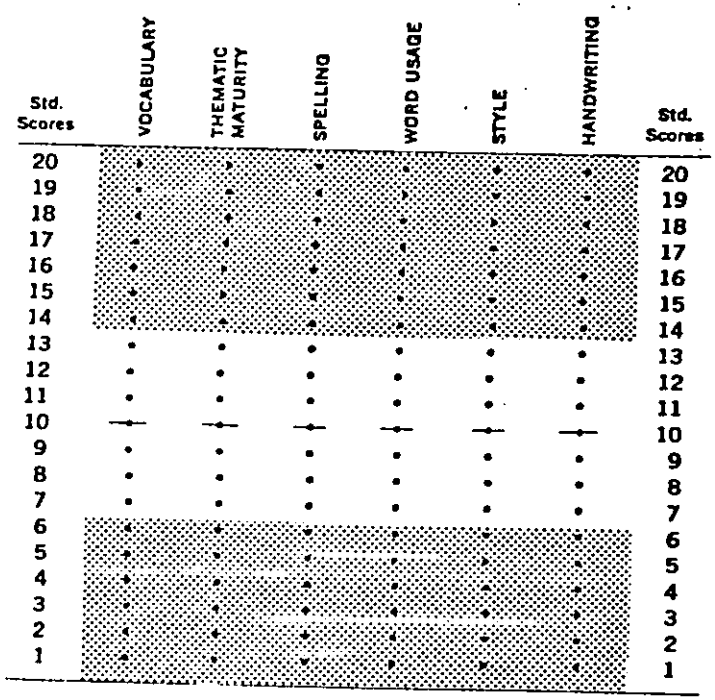
SECTION I RECORD OF SCORES

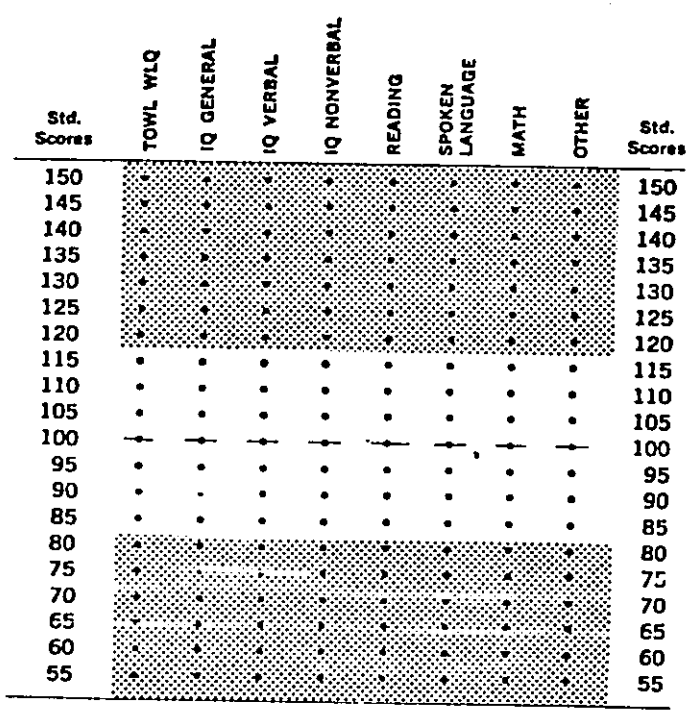
	SUBTESTS	Raw Scores	% iles	Std. Scores
I	Vocabulary			
II	Thematic Maturity			
III	Spelling			
IV	Word Usage			
V	Style			
VI	Handwriting			
	Sum of Standard Scores		=	
	Written Language Quotient (WLQ)		=	

SECTION II OTHER TEST SCORES

NAME	DATE	STD. SCORE	TOWL EQU

SECTION III PROFILE OF SCORES





SECTION IV OBSERVATIONS

Appendix VI Cont'd

Questions for Scoring Thematic Maturity

___ 1. Paragraphs?
___ 2. Name Objects Pictured?
___ 3. Gives Personal Names to Main Ccharacters?
___ 4. Gives Proper Names to Robots, Planets, Animals, etc.?
___ 5. Why Environment Hostile?
___ 6. All 3 Pictures?
___ 7. Dream Sequence?
___ 8. Definite Ending?
___ 9. New Life Story?
___ 10. Role of Spacelings Explained?
___ 11. Gives Personal Names to Spacelings?
___ 12. Where Spacelings Came From?
___ 13. Live in Harmony?
___ 14. Uses Some Futuristic or Space Language?
___ 15. Expresses a Moral or Philosophic Theme?
___ 16. Title?
___ 17. Dialogue?
___ 18. Attempts Humor?
___ 19. Adds a Sequence or Subplot?
___ 20. Develops a Character's Personality?
___ Total

SECTION VI
ADMINISTRATION CONDITIONS

TOWL administered in:
One session _____
Two sessions _____
Three sessions _____
Four or more _____

B. Tested individually _____

or

Tested in group.
Size of group _____

Administered by
experienced examiner _____

By other:
Specify (aide, trainee, etc.) _____

Departure from directions
in Manual. Explain. _____

ENVIRONMENTAL CONDITIONS

A. Place tested _____

	Interfering				Not Interfering
B. Noise level	1	2	3	4	5
C. Interruptions	1	2	3	4	5
D. Distractions	1	2	3	4	5
E. Light	1	2	3	4	5
F. Temperature	1	2	3	4	5

G. Notes and other considerations _____

SECTION VIII
STUDENT RELATED CONDITIONS

	Poor				Good
A. Energy level	1	2	3	4	5
B. Attitude toward test	1	2	3	4	5
C. Rapport with examiner	1	2	3	4	5
D. Perseverence	1	2	3	4	5
E. Visual acuity	1	2	3	4	5
F. Hearing acuity	1	2	3	4	5
G. State of health:					
General	1	2	3	4	5
During testing	1	2	3	4	5

H. Notes and other considerations _____

SECTION IX
INTERPRETATION AND RECOMMENDATIONS

Appendix VII

October, 1988

Dear Parents:

This is to inform you that your child is being given the opportunity to participate in a study dealing with improving students' writing skills.

This program will take place as part of the regular program with the regular classroom teacher and will involve all students in the class.

Progress results will be made available by June, 1989.

Please sign below to acknowledge that you have received this note and would like your child to be considered as part of this program.

Sincerely,

Audrey Burrows, B.A., B.Ed.,
Counselling Specialist, M.Ed.,
Ph.D. Candidate

G. M. Kysela, Ph.D.,
Professor & Associate Dean

AB/GMK/je

I would like my son/daughter (circle one) to be included in this program.

_____
Parent's Signature

Appendix VIII

1	01	21	102	100	23.82	11.00	21.62	04.00	4323
2	02	21	092	099	18.19	06.00	05.94	11.20	3323
3	03	21	087	086	28.77		06.59		33
4	04	21	085	092	19.89	28.00	22.65	22.00	3222
5	05	21	094	114	21.64	17.00	02.07	14.00	3422
6	06	21	094	093	41.95	27.00	00.98	17.00	1322
7	07	21	098	118	13.54	22.00	04.32	14.00	3322
8	08	21	095	094	30.28	31.00	09.62	35.00	2321
9	09	21	092	102	42.16	18.00	03.11	14.00	1222
10	10	21	089	130	15.05	12.00	02.64	07.00	2434
11	11	21	092	114	23.75	23.00	07.20	27.20	2222
12	12	21	099	116	19.67	12.00	05.79	11.00	2122
13	13	21	095	121	22.22	17.00	04.00	09.00	2323
14	14	21	115	113	23.12	14.00	01.97	14.00	23
15	15	21	108	132	37.83	05.00	01.52	09.00	2434
16	16	21	105	139	20.28	09.00	02.64	05.00	23
17	17	21	094	114	09.09	12.00	02.98	11.00	3322
18	18	21	097	121	18.61	10.00	02.94	04.00	2232
19	19	21	099	118	46.24	16.00	00.82	28.00	1223
20	20	21	092	098	29.80	25.00	11.21	13.00	2222
21	21	21	097	103	61.71	25.00	04.00	10.00	1222
22	22	21	085	101	28.00	25.00	06.00	19.00	3222
23	23	21	092	114	43.04	36.00	11.28	27.00	2221
24	24	21	113	133	12.20	05.00	01.62	07.00	3344
25	25	21	100	101	17.02	08.00	02.38	11.00	2433
26	26	21	113	115	18.00	16.00	03.51	11.00	2432
27	27	21	094	106	17.64		12.59		33
28	28	11	084	100	34.31	23.00	10.52	09.00	2212
29	29	11	075	105	36.46	29.00	10.06	11.45	1321
30	30	11	082	089	40.99	28.00	10.46	25.00	1211
31	31	11	070	102	72.58	26.00	11.96	29.00	1222
32	32	11	075	086	67.86	49.00	10.13	51.00	1211
33	33	11	072	089	45.78	31.00	07.51	30.30	1111
34	34	11	080	091	40.74	35.00	09.01	36.00	2311
35	35	11	068	075	66.29	25.00	03.66	40.00	1211
36	36	11	073	078	55.26	14.00	12.69	25.00	1221
37	37	22	092	092	66.67	31.00	21.22	25.00	2212
38	38	22	091	094	36.60	16.00	13.04	12.00	3422
39	39	22	092	098	91.20	42.00	07.45	27.00	2412
40	40	22	105	102	74.75	49.00	10.80	31.00	1312
41	41	22	101	113	29.51		06.51		3322
42	42	22	099	115	21.98	15.00	08.67	07.00	2322
43	43	22	099	113	14.52	13.00	07.68	03.00	2332
44	44	22	091	100	41.49	14.00	11.27	09.00	2222
45	45	22	086	102	36.99	18.00	35.63	25.00	2223
46	46	22	098	109	53.43	23.00	08.80	18.00	2322
47	47	22	093	094	35.37	29.00	21.57	20.00	2221
48	48	22	098	113	27.48	21.00	07.01	19.00	2422
49	49	22	093	102	37.44	22.00	17.24	18.00	1222
50	50	22	089	106	20.69	17.00	07.73	10.00	2312
51	51	22	119	109	23.66	09.00	12.86	03.00	2324
52	52	22	122	107	41.72		23.45		12
53	53	12	082	082	88.53		21.13		23
54	54	12	074	087	98.16	33.00	18.58	31.00	1212
55	55	12	082	094	54.18	28.00	14.83	48.00	1322
56	56	12	080	086		32.00		43.00	1311
57	57	12	075	094	57.35	60.00	18.40	50.00	1221
58	58	12	084	101	36.25	22.00	11.50	16.00	2322
59	59	12	080	102	43.28	23.00	14.76	18.00	1222
60	60	12	079	094	30.85	24.00	13.82	27.00	2222
61	61	12	084	094	84.13	25.00	53.51	12.00	2322
62	62	12	076	098	74.19	16.00	22.73	15.00	2322

Appendix IX

Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	bresses	dreses	s	
2. Did	d d	did	s	
3. Grown	gowen	growen	+	Spelling
4. Set	Set	Set	s	
5. Best	best	best	s	
6. Children	children	childeran	-	Spelling
7. Leaves	lefs	bark	-	Semantic
8. Teach	show	teache	+	Semantic
9. Had	hud	have	-	Syntax
10. Smallest	Smolest	Smallist	s	
11. Mice	her	mice	+	Semantic
12. Sit	tide	lay	+	Semantic
13. Threw	throw	hit	-	Semantic
14. Were	bient	were	+	Spelling
15. Rise	Comeup	rise	s	
16. Women	wimin	womin	+	Spelling
17. Sheep	Sheep	lames	-	Semantic
18. Were	—	were	+	Semantic
19. Deer	deer	deer	s	
20. Eaten	—	ate	+	Semantic
21. Children	children	childern	s	
22. Me	me	me	s	
23. Whom	how	home	s	
24. Ourselves	arselfs	areselfs	s	
25. Broke	cryd	berst	+	Semantic

Appendix IX Cont'd

Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	dress	dresses	+	Syntax
2. Did	did	did	S	
3. Grown	shes	grew	+	Semantic
4. Set	Set	set	S	
5. Best	best	best	S	
6. Children	Childin	Children	+	spelling
7. Leaves	leeaes	leaes	+	spelling
8. Teach	show	teach	+	Semantic
9. Had	could	had	+	Syntax
10. Smallest	smallist	smallest	+	Spelling
11. Mice	mice	mice	S	
12. Sit	sit	sit	S	
13. Threw	throw	threw	+	Syntax
14. Were	talk	where	+	Semantic
15. Rise	shine	shine	S	
16. Women	ladys	wowmen	+	semantic
17. Sheep	sheep	sheep	S	
18. Were	were	had	-	syntax
19. Deer	deer	deer	S	
20. Eaten	ate	eat	S	
21. Children	childin	children	+	Spelling
22. Me	me	me	S	
23. Whom	someone	how	+	Syntax
24. Ourselves	blocks	oreself	+	Semantic
25. Broke	jump	died	+	Syntax

Appendix IX Cont'd

Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	dresses	dresses	S	
2. Did	did	did	S	
3. Grown	grew	grew	S	
4. Set	set	Set	S	
5. Best	best	best	S	
6. Children	children	Children	S	
7. Leaves	leaves	leaves	S	
8. Teach	show	teach	+	Semantic
9. Had	goneand	had	+	Semantic
10. Smallest	smalest	smallest	+	spelling
11. Mice	mice	mice	S	
12. Sit	sit	lay	-	semantic
13. Threw	threw	Threw	S	
14. Were	went	were	S	
15. Rise	come up	rise	S	
16. Women	woman	women	+	syntax
17. Sheep	sheep	sheep	S	
18. Were	were	were	S	
19. Deer	deer	deer	S	
20. Eaten	ate	almost	-	syntax
21. Children	children	children	S	
22. Me	I	us	-	Syntax
23. Whom	youre freind	who	+	semantic
24. Ourselves	wood	hand	+	semantic
25. Broke	bursted	bursted	S	

Appendix IX Cont'd
Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	dresses	dresses	S	
2. Did	did	did	S	
3. Grown	growen	growen	S	
4. Set	Suit	clean	+	Semantic
5. Best	best	beast	−	Spelling
6. Children	Childeren	children	+	Spelling
7. Leaves	leafs	leafs	S	
8. Teach	teach	tell	−	semantic
9. Had	had	saw	−	syntax
10. Smallest	Smallest	Samllest	−	Spelling
11. Mice	mouses	meuses	S	
12. Sit	sit	lay	−	Semantic
13. Threw	throw	threw	S	
14. Were	were	were	S	
15. Rise	rises	rise	S	
16. Women	ladys	women	+	semantic
17. Sheep	sheep	sheeps	−	syntax
18. Were	were	went	−	syntax
19. Deer	deers	deers	S	
20. Eaten	eaton	not	−	Semantic
21. Children	childeren	Children	+	Spelling
22. Me	I	I	S	
23. Whom	how	how	S	
24. Ourselves	ourselfs	areslefs	−	Spelling
25. Broke	—	broke	+	semantic

Appendix IX Cont'd

Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	dresses	-dress	-	Syntax
2. Did	did	did	s	
3. Grown	—	grow	+	Semantic
4. Set	Seat	Set	+	Spelling
5. Best	best	best	s	
6. Children	child	kids	-	Semantic
7. Leaves	leafs	leafs	s	
8. Teach	show	show	s	
9. Had	had	can	-	Semantic
10. Smallest	Smallest	Smallest	s	
11. Mice	mice	mice	s	
12. Sit	la	lay	+	Spelling
13. Threw	thraw	threw	+	spelling
14. Were	were	went	s	
15. Rise	Shine	rise	+	Semantic
16. Women	woman	woman	s	
17. Sheep	Sheeps	Sheeps	s	
18. Were	had	went	s	
19. Deer	—	deers	+	Semantic
20. Eaten	—	—	s	
21. Children	child	kids	-	Semantic
22. Me	me	I	-	Syntax
23. Whom	—	who	+	Semantic
24. Ourselves	hand	areself	+	Semantic
25. Broke	—	died	+	Semantic

Appendix IX Cont'd

Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	dressis	dresses	+	Spelling
2. Did	done	finisht	+	Semantic
3. Grown	grown	tall	−	Semantic
4. Set	Sete	Set	+	Spelling
5. Best	biest	best	+	Spelling
6. Children	childrin	cildren	S	
7. Leaves	luvs	leavs	+	Spelling
8. Teach	tethe	tech	+	Spelling
9. Had	hade	had	+	spelling
10. Smallest	Smallist	smalist	−	Spelling
11. Mice	muse	mise	S	
12. Sit	site	sit	+	Spelling
13. Threw	trow	hite	−	Semantic
14. Were	went	whent	−	Spelling
15. Rise	rise	come up	S	
16. Women	Woman	Woman	S	
17. Sheep	Sheep	Sheep	S	
18. Were	wore	——	−	Semantic
19. Deer	deer	deer	S	
20. Eaten	moste	eat	+	Semantic
21. Children	cidrin	cildren	+	Spelling
22. Me	mom	I	+	Semantic
23. Whom	howe	home	S	
24. Ourselves	ar silf	the lake	−	Semantic
25. Broke	brstid	berst	+	syntax

Appendix IX Cont'd

Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	greseses	dress	-	syntax
2. Did	bonityestrday	dun	+	Semantic
3. Grown	3 inches	graine	+	Semantic
4. Set	zet thetall	set	+	spelling
5. Best	dest	best	+	spelling
6. Children	sitldretdll	childs	+	Semantic
7. Leaves	leis	leev's	-	syntax
8. Teach	pleeshole	treech	+	Semantic
9. Had	seen	cordof	+	Semantic
10. Smallest	deegest	smallist	+	Semantic
11. Mice	moses	mowses	S	
12. Sit	foll	lae	+	semantic
13. Threw	thre	thurgh	-	Semantic
14. Were	stlet	wiut	+	Semantic
15. Rise	of thbeon	rise	+	semantic
16. Women	menteo	woman	+	Semantic
17. Sheep	zegr	sheep	+	Semantic
18. Were	wat	—	-	Semantic
19. Deer	ders	deer	+	syntax
20. Eaten	et	ate	+	spelling
21. Children	srgien	childs	+	Semantic
22. Me	bll	us	+	Semantic
23. Whom	baeyou	hoe	+	Semantic
24. Ourselves	osbe	are self	+	spelling
25. Broke	brst	brsted	-	syntax

Appendix IX Cont'd

Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	dresis	dreces	S	
2. Did	did	finished	S	
3. Grown	growing	growd	+	syntax
4. Set	Set	set	S	
5. Best	best	best	S	
6. Children	kis	childrin	+	semantic
7. Leaves	leas	leds	-	spelling
8. Teach	Sow	Show	+	spelling
9. Had	gotte	Cold	S	
10. Smallest	Smolist	smalist	+	spelling
11. Mice	mlys	mice	+	spelling
12. Sit	sit	Sit	S	
13. Threw	throw	tick	-	semantic
14. Were	wer	were	+	spelling
15. Rise	ris	go up	-	semantic
16. Women	tok	wimin	+	semantic
17. Sheep	shep	sheps	-	syntax
18. Were	goot	just	-	semantic
19. Deer	ders	ders	S	
20. Eaten	eten	ayt	-	Syntax
21. Children	are	childrin	+	semantic
22. Me	me	me	S	
23. Whom	how	how	S	
24. Ourselves	awrself	aur seles	+	Syntax
25. Broke	brst	Sraremd	-	Semantic

Appendix IX Cont'd

Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	dress	dress	S	
2. Did	did	did	S	
3. Grown	grown	grown	S	
4. Set	Sit	Seat	S	
5. Best	best	best	S	
6. Children	kids	children	+	Semantic
7. Leaves	laves	leves	+	spelling
8. Teach	teck	teach	+	spelling
9. Had	had	had	S	
10. Smallest	Smallest	Smallest	S	
11. Mice	mice	mice	S	
12. Sit	lay	lay	S	
13. Threw	throw	Throw	-	Syntax
14. Were	were	were	S	
15. Rise	raese	rises	-	syntax
16. Women	woman	Weman	-	spelling
17. Sheep	sheep	sheeps	-	syntax
18. Were	where	stad	-	Semantic
19. Deer	deers	deers	S	
20. Eaten	have	amost	-	Semantic
21. Children	kids	children	+	semantic
22. Me	me	me	S	
23. Whom	how	who	+	Spelling
24. Ourselves	Sulf	hand	+	Semantic
25. Broke	brest	breast	S	

Appendix IX Cont'd
Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	pars	dress's	+	Semantic
2. Did	did	did	S	
3. Grown	growne	grun	-	S
4. Set	Sat	sat	S	
5. Best	bust	best	+	Spelling
6. Children	child's	children	+	Syntax
7. Leaves	bark	leave's	+	Semantic
8. Teach	tech	tell	-	Semantic
9. Had	had	had	S	
10. Smallest	Smallest	Smallist	-	Spelling
11. Mice	all together	mouse's	+	Semantic
12. Sit	lay	lay	S	
13. Threw	throw	throw	S	
14. Were	stood	went	+	Semantic
15. Rise	come up	rise	S	
16. Women	woman	women's	S	
17. Sheep	sheep	sheep's	-	Syntax
18. Were	were	are	-	Syntax
19. Deer	deers	deer's	S	
20. Eaten	ate	eaten	+	syntax
21. Children	kids	children	+	Semantic
22. Me	me	me	S	
23. Whom	how	hown	+	Syntax
24. Ourselves	areself	wood	-	Semantic
25. Broke	hrast	bristed	-	Syntax

Appendix IX Cont'd
Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	dress	dress	S	
2. Did	done	done	S	
3. Grown	—	gane	+	Semantic
4. Set	kien	clen	+	Spelling
5. Best	best	best	S	
6. Children	child	child	S	
7. Leaves	levs	levs	S	
8. Teach	tchr	teach	+	Syntax
9. Had	—	was	+	Semantic
10. Smallest	smles	smallist	+	Spelling
11. Mice	mouse	mouse	S	
12. Sit	tiefb	sit	+	Semantic
13. Threw	hit	throses	—	Syntax
14. Were	wükt	went	+	Syntax
15. Rise	heu	come	+	Semantic
16. Women	woman	woman	S	
17. Sheep	sheep	sheep	S	
18. Were	—	leve	+	Semantic
19. Deer	deer	dees	—	Syntax
20. Eaten	allofthe	no	S	
21. Children	child	childrn	+	Syntax
22. Me	us	Sande	—	Semantic
23. Whom	me	how	+	Semantic
24. Ourselves	aresllef	wood	—	Semantic
25. Broke	klrd	shouted	+	Semantic

Appendix IX Cont'd
Qualitative Evaluation for the Word Usage Subtest of the Tow

1. Dresses	dressis	dress	−	syntax
2. Did	finishr	done	−	Syntax
3. Grown	tall	grow	+	Semantic
4. Set	Set	Set	S	
5. Best	best	best	S	
6. Children	child's	children	+	syntax
7. Leaves	les	leves	+	Spelling
8. Teach	tech	tech	S	
9. Had	cod of	—	−	semantic
10. Smallest	smallist	Smallist	S	
11. Mice	mouseis	mice	+	Syntax
12. Sit	laey	lay	+	Spelling
13. Threw	threw	throw	−	Syntax
14. Were	was	went	+	Syntax
15. Rise	come up	rise	S	
16. Women	waman	woman	+	Spelling
17. Sheep	sheep	sheep	S	
18. Were	bell	—	−	Semantic
19. Deer	three	deer	+	Semantic
20. Eaten	aet	ate	+	Spelling
21. Children	cildrin	children	+	Spelling
22. Me	me	us	−	syntax
23. Whom	how	how	S	
24. Ourselves	areselvs	self	−	syntax
25. Broke	lewd	stared	+	semantic

Appendix IX Cont'd
Qualitative Evaluation for the Word Usage Subtest of the TOWL

1. Dresses	dresses	dresses	S	
2. Did	did	did	S	
3. Grown	gron	grown	+	Spelling
4. Set	set	set	S	
5. Best	best	best	S	
6. Children	cidren	childeren	+	Spelling
7. Leaves	leves	leaves	+	Spelling
8. Teach	tech	teach	+	Spelling
9. Had	had	had	S	
10. Smallest	smallestd	Smallest	+	Spelling
11. Mice	mice	mice	S	
12. Sit	sit	sit	S	
13. Threw	trew	Throught	—	Semantic
14. Were	went	were	S	
15. Rise	come up	rise	S	
16. Women	wemen	wimen	S	
17. Sheep	sheep	sheep	S	
18. Were	—	were	+	Semantic
19. Deer	deer	deer	S	
20. Eaten	—	eaten	+	Semantic
21. Children	chideren	children	+	Spelling
22. Me	me	I	—	Syntax
23. Whom	how	who	+	Spelling
24. Ourselves	areselys	areselves	+	Spelling
25. Broke	derst	berst	+	Spelling

Appendix IX Cont'd

Qualitative Evaluation for the Word Usage Subtest of the Towl

1. Dresses	dres	pic one	—	Semantic
2. Did	handitag	did	+	Semantic
3. Grown	one	grow	+	Semantic
4. Set	Seth	set	+	Spelling
5. Best	best	best	S	
6. Children	jun	cids	+	Semantic
7. Leaves	levs	levse	S	
8. Teach	halp	teche	+	Semantic
9. Had	kud	codof	+	Spelling
10. Smallest	bigs	simolist	+	Semantic
11. Mice	mney	here	+	semantic
12. Sit	lid	liwe	S	
13. Threw	hit	throw	+	Semantic
14. Were	hrd	went	+	Semantic
15. Rise	up	comup	+	semantic
16. Women	tecing	—	—	semantic
17. Sheep	hap	shepe	+	Semantic
18. Were	Sod	woer	+	semantic
19. Deer	sanding	dheer	+	Semantic
20. Eaten	ating	at ne	S	
21. Children	basing	cidrin	+	semantic
22. Me	mes	me	+	Spelling
23. Whom	sheg	how	+	Semantic
24. Ourselves	matll	are self	+	semantic
25. Broke	hesting	brst	+	Syntax

Appendix X

CHECKLIST FOR PROCESS APPROACH

STAGES:	WEEK 1	WEEK 2	WEEK 3	WEEK 4	WEEK 5
1. Pre-writing Conference					
2. Composing					
3. Printing A Draft					
4. Editing Conference					
5. Revision and Proofreading					
6. Printing final copy					
7. Illustrating					
8. Provide an Audience					

STRATEGIES:

1. Half Sheets					
2. Main Idea Rule					
3. C.C.P.S.					
4. Hammill, Bartel & Bunch					