WORD PROCESSING TO AID REVISION IN THE WRITING OF

LEARNING DISABLED ADOLESCENTS

by

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WORD PROCESSING TO AID REVISION IN THE WRITING OF LEARNING DISABLED ADOLESCENTS

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ABSTRACT

Composition with the use of a word processor has received considerable attention in the field of education, but little research has been conducted into its use in the secondary school classroom. The purpose of this intervention study was to observe in students if the use of a word processor 1) would result in compositions of greater quality or quantity, 2) would change the nature of revision or 3) would motivate students to write. This study involved two groups of Grade 8 students, normally achieving and learning disabled, and two modes of writing, pen-and-paper and word processor. Students were given a writing pre-test, a motivation survey and an in-depth interview before the commencement of the intervention. Students were then taught descriptive writing from a process approach. Students wrote three copies each of five descriptive essays. At the end of the intervention, students completed a post-writing test, a motivation survey and a second interview.

Results indicated that both normally-achieving and learning disabled students who used a word processor wrote longer essays. Improvements in quality measured by wholistic ratings and T-unit length were not significant, however. The use of a word processor was a significant factor in preventing students from making new errors from their second to their third copy of their essays. However, students using a word processor (both normally-achieving and LD) made significantly fewer revisions of all kinds than did students using pen and paper. Finally, this study found that a word processor was a motivator for students and helped them to enjoy writing.

The results indicated the effectiveness of a word processor in increasing the length of essays for both average-achieving and LD students. The results also indicate that a word processor positively affects students' motivation to write. There is a need for parallel training of students in revision skills on a word processor, however.

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CHAPTER I

INTRODUCTION OF THE PROBLEM

If written expression constitutes an important dimension in evaluations of a student's secondary school performance, then the quality, character and speed of a student's writing must necessarily affect his/her course marks. In addition, since composition is almost invariably the medium by which students show what they have learned, it follows that the skill with which they physically and mentally create their compositions ultimately affects judgements of their academic and creative ability.

But how do we ensure that the quality of a student's composition reflects the best that they can do? In fact, we cannot. Many learning disabled (LD) students, the target group for this study, seem unable to express their knowledge and creativity in a way that results in high levels of performance. The problem addressed by this study is to determine if use of a word processor can aid LD students' development of composition skills.

For LD students, composition is often a task they do poorly and abhor. Their problems seem to lie in three areas:

1. the stress of the physical task of writing (and re-writing)

2. the difficulties of having the motivation to compose, both in beginning the task and in attaining suitable length, and

3. the necessity of learning to revise work to improve its quality.

Can LD students improve their writing skills if some of the physical stress of writing is removed? Will increased motivation lead to improved compositions for LD students? Can LD students improve their writing skills if they learn that revision is an integral part of composing, and if writing and revision is made physically easier for them? These questions highlight the three major problems (the physical task of writing, motivation and revision) facing the adolescent student in the area of composition and each problem may be ameliorated with the application of a word processor in writing. Research dealing with the effects of word processing on students' writing seems promising, both for normally-achieving and LD students, in increasing the amount of writing and motivation. However, related research seems unclear in the area of revision.

The specific purpose of this study was to compare students using word processing and traditional writing methods, considering factors of quantity written, quality of work, number and kind of revisions made, and motivation to write. Both average-achieving and LD students were studied.

Overview

The statement of the research problem and its significance has been given above. Chapter II discusses more detailed aspects of the problem, and examines related research. Chapter III describes the methodology of the study. This includes the design of the instructional component of the study, the sampling plan and the

statistical methods. Chapter IV provides the analyses and results of the study.

Chapter V draws conclusions, and discusses recommendations and limitations of

the study.

CHAPTER II

REVIEW OF THE LITERATURE

Chapter 1 isolated three major problems LD students face when they write: stress of the physical task of writing (and re-writing), motivating students to compose, and teaching students to revise their work to improve its quality. This chapter considers these three areas in more detail. Specifically, this chapter summarizes research in composition instruction, both with and without the use of the computer, that deals with these writing difficulties.

ASPECTS OF THE PROBLEM

Cursively transcribing ideas to paper seems a natural and easy task for many adults. Unfortunately, adolescent LD students often have difficulty with the simple mechanics of writing. Handwriting presents problems for the general population, which, although not well documented (Hagin, 1983), appear to persist well into junior high school. But illegibility, poor spacing, cramping and labouriousness in writing are particularly identified with the LD adolescent (Deshler, 1974, Meltzer et al, 1985). The physical task of writing is related to significantly more problems for LD adolescents than for average adolescents in the areas of fine motor skills, and more specifically, with copying skills. For instance, Whyte's (1984) adolescent subjects reported that their ability to express themselves manually was a serious difficulty in

language and communication. Thus, mechanical skills problems, such as handwriting, could easily contribute to LD students' writing problems (Barenbaum, 1983). If this is true, then for many LD students, slow, painful, illegible writing will inevitably affect their course marks and attitudes towards written tasks.

Alley (1979) calls facility with written expression "a prerequisite for successful performance in the secondary school" (p. 104) and Schumaker and Deshler (1984) repeat that competence in secondary schools is largely measured through written products. The physical difficulties LD students encounter in writing affects evaluations of their work and motivation. Poor cursive writing is difficult for teachers to read and understand, and can be seen by teachers as a mark of poor composition. Because of their low level of proficiency, LD students may see writing as "a skill (having to be learned) by repetition and revision" (Irmscher, 1979, p. 241). Frustrated by the need to produce work that is coherent, neat and clean, well -organized and correctly spelled, LD students may simply give up (Deshler, 1984). Or they may hand in work that does not meet the requirements of a formal presentation. Consequently, final marks may not show the true creative abilities of LD students.

Handicapped by their difficulties in writing, LD students may not be able to write enough to fully answer an assignment. Bereiter and Scardamalia (1982) have shown repeatedly that the number of words a student writes is highly correlated with many indicators of writing quality, i.e. maturity of writing. The lack of "body" or length

and quality of composition increases the likelihood that LD students will remain at the lower end of their classes. Thus, the first problem area for LD students (the mechanics of writing) is closely tied to evaluative aspects of writing, and to the second problem area, motivation toward composition.

The third problem LD students encounter is with revision. It has been found that expert writers spend the majority of their time revising, rather than composing their thoughts (Hayes and Flower, 1979). Yet, for LD students, to learn and effectively use revision techniques is to confront their physical and motivational problems head on. The directive to revise, and hence, re-write, can be perceived as a devious means of punishment and pain inflicted for not writing the assignment "right" in the first place. Arms (1984) found that for dyslexic students, both rereading and rewriting are troublesome. If students anticipate having to recopy to revise, then brevity, rather than length, becomes intrinsically rewarding because of the tediousness of recopying textual changes. Yet shorter and unrevised work, as shown by Bereiter and Scardamalia (1982) is related to lower assessments.

Revision is difficult for most normal students (Cronnell and Hayes, 1971) and is engaged in only to a limited extent by inexperienced writers (Dauite, 1983). For LD students, the lack of writing ability, and attendant debilitating attitudes, make revision especially difficult. As most researchers assume (e.g. Beach, 1976, 1979), more revision produces better compositions, then it follows that lack of effective revision would lower a composition's evaluation.

Revision and techniques to prompt revision can apparently be taught, however.

Matsuhashi and Gordon (1985) used the simple cue to "add" and found that

inexperienced college writers made more text-based revisions. Some researchers

have had success in changing how beginning writers revise. Bereiter and

Scardemalia (1979), using the prompt "people may not understand what you mean

here", found that children could evaluate and improve their sentences. Cuing could

be one technique that can help LD students improve their writing and revision skills.

It is recalled that in Chapter 1, the direction of this study established three major

problems facing the adolescent student in the area of composition (the physical task

of writing, motivation and revision). This section, Aspects of the Problem, has given

some background to these writing difficulties faced by LD students. The summary of

the research literature in the remainder of this chapter will indicate that writing with a

word processing system may serve as an ameliorative. Research on the effects of

word processing on students' writing seems promising, both for normally-achieving

and LD students, in increasing the amount of writing and motivation. However,

related research seems unclear in the area of revision.

WORD PROCESSING AND THE PHYSICAL TASK OF WRITING

If students have basic keyboarding skills, some of the strain in the physical task of

writing and rewriting may be eliminated. A word processing system provides a

reduction in the amount of copying, as the original text can be manipulated without having to be re-entered. Clean, neat copies can be produced at any stage of the writing process. Thus, word processing (WP) seems to deal with the first of the LD writers' composition problems, that of the physical task of producing text.

But learning to compose on the WP is not instant nor automatic. Too often, short -term studies have ignored the careful training necessary to effectively use WP technology, and the results of these studies may reflect this deficit. Studies which have dealt with students who could type are rare (Bean, 1983, is one) and only a few studies carefully and consistently trained students in keyboarding skills or typing. For example, Bradley's (1982) study allowed only one one-hour session to teach her sixth-grade subjects typing and word processing. Crealock et al (1985) devoted only one-half hour of four to six sessions to teach typing using a typing tutor. These subjects may lack the keyboarding skills necessary to produce quality and quantity changes in writing as a result of the use of word processing.

But it is not clear how much time, or what level of instruction is necessary for "mastery" of word processing. Gerlach (1987) found no significant difference in several measures of composition with her 4th graders, half of whom were given fifteen 25-minute sessions to learn to type, and only three months to learn and apply typing, WP and revision skills. Dauite's (1986) research concluded that junior high students apparently needed more than one hour a week for six months to become skilled in keyboarding and WP skills, and both she and Gerlach concluded that their

subjects may not have been sufficiently trained.

Although many studies recognized the new and unique nature of the computer as an aid for composition, word processing skills training, an area of study beyond keyboarding skills, seems to be as neglected as keyboarding skills training. Most recently, Kurth's (1986) study of above-average high school writers provided little time for keyboarding training, or training to use a word processor. The lack of significant change in the length, amount and quality of revisions in this study may have resulted from the need for her WP group to both learn the WP system and submit the same number of essays as her pencil group. Even Collier's (1983) four subjects - who could touch type, but were computer-naive - received only two sessions to familiarize themselves with the terminals and functions of the computer used. And, in fact, Collier found that subjects with the weakest typing skills and text-editing dexterity preferred a handwriting format. By not carefully training their subjects, it seems that the authors of these studies have not controlled a clearly confounding factor in the study of composition with a WP.

The studies cited in this section on physical problems of writing have largely dealt with average or good students, generally well motivated to write. These students bring with them abilities and writing strategies which will influence the effect the WP has on their progress as writers (Rodrigues, 1985) Factors of motivation may have allowed these students to more quickly make productive use of the WP program. But not all students are well equipped for the quick acquisition of WP and typing skills. Crealock et al (1985) noted that students with special needs must devote

considerable time and energy to learning both a WP system, and keyboarding skills, in order for WP skills to benefit their writing appreciably. For instance, MacArthur and Schneiderman (1986) found that typing presented a barrier to LD students working on a WP. Daiute (1983) noted that with inadequate training, students using the computer may find writing more difficult. Research that incorporates careful keyboarding and WP training and focuses on composition is thus critical, but lacking, especially for those with learning problems.

WORD PROCESSING AND MOTIVATION

Although motivation is a clear factor in learning, little research has been done on the role of motivation in the composition classroom. Williams and Alden (1985) cite extensive "ad hoc and anecdotal" evidence on motivation in the composition classroom. They concluded that

> given the dearth of empirical investigations into the motivation of students in composition classes, it seems unreasonable to assume that young writers have an innate urge to write...(page 250)

Equally loaded with anecdotal evidence, but in a different context, is further research on the motivational powers of WP. Following early work by Fisher (1982) and Norman (1982), researchers and writers have lauded the use of WP for composition. Later research has been somewhat more cautious, but continuingly optomistic. For instance, Woodruff, Bereiter and Scardamalia (1981/82) noted that their normal students found their own writing easier, better and more enjoyable, all motivating factors for them to write and edit.

Particularly positive have been studies with LD students. One interesting and topical study with LD students from the ages of 7 to 16 found that these children, many of whom had refused to do any kind of writing, began writing enthusiastically when permitted to use word processors (Kleiman and Humphrey, 1982). MacArthur and Schneiderman (1986) found that their eight LD student subjects wrote "eagerly and continuously" on a WP. Thus, WP as a motivator for writing for students of many ages and writing competencies seems to be one clear finding in the "computers and composition" research, although much of the evidence is anecdotal. Thus, if Deschler (1984) is correct that LD students are less motivated to perform well, or even expend effort on in-school tasks, WP may serve as a powerful ammeliorative.

WORD PROCESSING AND REVISION

The quality of students' work may also be affected by the use of word processing. While lamenting the dearth of research, Fisher (1982) reviewed several anecdotal reports of normal students and concluded

> teachers report...that students using word processors write longer papers and revise and edit their work more often and more carefully... (They) think their students' writing is better when done on a word processor. (p. 88)

Why is this? Apparently, students using word processors have a new view of revision, that of "playing" and experimenting with their text. Using the various editing strategies of a WP program, students may rework and refine their writing many times. This restructuring is easy to do using a WP. Inserting, deleting and rearranging are

all part of the process that students go through as they develop control over written language, and this is what the word processor does best. "Shuffling" text may seem somewhat magical and frightening to adults, but most children (especially those between 11 and 15, Norman, 1982) are not afraid of computers. Norman (1982) stated that young children feel that computers are fun, and that by manipulating language with computers, they learn how written language works. Revisions can be made up to the last minute, and clean copies can still be produced.

Work in the area of writing, revision and WP since Fisher's remarks in 1982 has not clearly supported WP for composition. Whether revisions on a WP result in improvements in the quality of a composition is still at issue, and contradictory results abound. For instance, Hawisher (1986) maintained that her advanced college freshmen did not increase the amount of their revision or the quality of their essays when working on a WP. Beal and Griffin (1987) found that their Grade 3 and 4 subjects made very few revisions which affected the meaning of their work, and instead mostly corrected typing errors. Kane (1983) concurred that most revisions made by his eight grade subjects were not meaning-changing, but corrections of spelling and punctuation. MacArthur and Graham (1987) found that both their LD and normal students (Grades 5 and 6) made a majority of surface-level changes, which had little impact on their compositions. These findings are consistent with earlier studies with inexperienced writers (and conventional writing), whose revisions usually involved only minor changes (Nold, 1981). Most difficult to understand, however, is Bracewell, Scardamalia and Bereiter's (1978) study, which

found a significant tendency for students at the Grade 8 level to change their compositions for the worse!

The conclusions of these studies, that students revise superficially or poorly when using a WP, is not consistently borne out. For instance, Daiute's (1983) research suggested that because minor revisions are easy to do on the WP, students could concentrate on higher-level changes. Balajthy, McKeveny and Lacitignola (1986/87) concluded that students using WP were motivated to make higher level revisions beyond spelling and punctuation corrections. Lutz's (1987) experienced and professional writers made more text changes when using a WP and made revisions of a different nature. In a study using an editing program, Keifer and Smith (1983) noted that students who worked on errors they habitually made in their own text were able to correct these errors as well as becoming sensitive to language. Further to this argument, Watt (1982) concluded that students on word processors gained a tolerance for making errors. His students became aware of the ease of correction, and recognized that they were not evaluated for revisions, but only on the neat copy. A natural result of this was positive feedback from the reader (Watt, 1982), and that in itself could be highly motivating. Finally, McAllister and Louth (1987) concluded that their sample of college basic writers did show higher quality revisions when working on the WP.

Clearly, research remains to be done in the areas of motivation and revision using word processing.

INSTRUCTIONAL CONCERNS

There seems to be a good basis for research in teaching word processing to students. Most studies cited in this chapter dealt with segments of the general school population, and all noted some success in the areas of student motivation, quantity and/or quality of writing. It would seem that LD students, as well, could use word processing to its best advantage in a composition classroom. In addition, LD students generally are given little time and opportunity for creative writing (Leinhardt, Zigmond and Cooley, 1980). Most specifically, Dalton and Hannafin (1986) found that relatively low achievers benefitted more from composition taught via WP than conventional instructional methods. Word processing instruction could be of great benefit to LD students, because of their difficulties with the physical task, motivation, and revision.

But where should word processing and composition instruction begin? For LD students, instructional priorities for writing must emphasize writing as an "active exploratory process" (Roit and McKenzie, 1985). Writing instruction must be relevant to the student, and it must involve the student. Moreover, instruction must have clear and immediate positive feedback, especially for the LD adolescent, who from experience, anticipates failure at writing. Finally, instruction should be in an area necessary for writing improvement in English and in the LD students' other school subjects.

Effective instruction should be in a mode of discourse from which the student can benefit. Further, because the use of narration, description or exposition affects the writer's work (Calkins, 1984), the mode of discourse must be controlled if the sentence structure of the writer is to be analysed. Instruction must also be appropriate to the student's grade level, age and writing ability.

In British Columbia, the Ministry of Education has outlined the goals for students in Language Arts and English. At the elementary level (Elementary Language Arts Curriculum Guide, 1978) these goals touch lightly on the use of the narrative, descriptive and expository modes of writing. By Grade 8, however, descriptive writing appears more emphasized. Narrative and expository writing are considered in the Guide, but Goal Six, "Providing Students with Opportunities for Writing Various Types of Prose" (English 8, 1978) contains three clear prescriptions involving writing at a descriptive level. By Grades 9 and 10, the emphasis on writing mode has shifted to expository work. Although giving directions, describing and narrating continue to be prescribed, the range of more formal exposition is expanded, and includes supporting opinion, news, critical analysis and personal business writing.

Thus, in a very general way, narration seems to be a natural area for instruction at the elementary grades. Argumentation and exposition appear to be instructionally most valid at the high school level, and description seems to be appropriate for the junior high school student.

Instruction in the area of description seems to meet many of the needs of the instructor in finding an area of writing suitable for introducing the WP. The nature of descriptive writing allows concise and easily deliniated topics, and planning and writing skills are generally easier to teach in this format. Organizational strategies, for instance, including writing in order of time or space, lend themselves to descriptive writing (Irmscher, 1979).

Adolescent LD students, who frequently lack writing skills which enable them to compose good description, would clearly benefit from instruction in descriptive writing. Description should properly play a major role in good narration, a writing mode still practiced in the junior high school composition classroom. To a lesser extent, description plays a role in exposition, a mode necessary for the more academic writing of the higher grades. Descriptive writing is often necessary to obtain passing grades in junior and senior-high school English. Further, for many students, careful description is not an easy mode of discourse to master. It needs to be taught at the junior high school level, as it can be challenging to both the average and the LD adolescent. For the LD student, even basic descriptions of familiar objects, people or scenes require physical effort, motivation and revision, and present the difficulties of length, neatness and cohesiveness against which the LD student must struggle. Finally, new skills in descriptive writing could transfer to descriptive writing in other courses, providing what the LD adolescent in school needs most, success.

SUMMARY

LD adolescents seem to have trouble with the physical, motivational and revision aspects of composition. Research shows that word processing can be effective in aiding composition but carefully controlled studies with subjects trained in keyboarding and WP skills need to be done. Experiments measuring length, revision techniques and quality may clarify the conflicting studies cited in this chapter and direct the use of WP in the composition classroom.

CHAPTER III

METHOD

The purpose of this study was to determine whether the use of a word processor could enhance the amount and quality of writing for learning disabled adolescents. The study intended to replicate previous studies and anecdotal reports which suggest that students using a WP write more and enjoy writing more. Additionally, the study sought to determine if WP could be used to encourage LD adolescents to make more revisions in their work, and to better judge the quality of those revisions. Thus, this study posed the following research questions:

1. Do LD adolescents write more when they use a WP system?

2. Do LD adolescents improve the quality of their composition as a function of learning and using word processing skills?

3. Do LD adolescents make a greater number of revisions to their work when using a WP?

4. Do LD adolescents using a WP system make revisions which enhance the quality of their work?

5. Are LD adolescents better motivated to write when using a WP system?

SUBJECTS

Thirty-two Grade 8 students participated in the study. These students were selected from two distinct groups of incoming Grade 8 students. Sixteen were students who

had tested two or more grades behind their grade level in reading (using the

Stanford Diagnostic Reading Test). These students had been identified in their

elementary school as LD: that is, students who showed significant discrepancy

between their achievement and their learning potential. Each of these students had

been recommended by their former elementary teacher as being a student who

might benefit from either learning assistance or a modified English program, where

placement is determined for students requiring special help with reading and writing

skills. Further, each of the first sixteen students had been designated by one or more

of their Grade 8 teachers as a "problem writer"; that is, a student whom the teacher

(or teachers) judged to be of normal intelligence but who appeared to show a

discrepancy between their oral and written achievement in the subjects of English,

Social Studies or Science. Students who fit all three of these stipulations (low

reading score, recommended for modified or assistance courses and judged a

"problem writer") were selected to participate in the study. This group was

designated the learning disabled (LD) group.

The second group of sixteen students consisted of Grade 8 students randomly

selected from a group of students who scored at or above their grade level in

reading (using the Stanford Diagnostic Reading Test). These students were each

judged to be of normal intelligence by their teachers, and were seen by their

teachers as students whose writing appeared to reflect accurately their oral

achievements in their English, Social Studies and Science courses.

The thirty-two students selected were scheduled into two English classes. Not all students in the classes participated in the study although all received the same instruction. Generally, average students were in one class and the learning-disabled students were in another. But there was an overlap: one LD student was placed in the average class and two average students were in the LD class. Within these classes, the average and LD students were randomly split into two groups: one designated a word processing group and the other a pen-and-paper group. Thus, there were four groups with eight students in each group. These groups were named AWP (average-achieving students using the word processing system), LDWP (learning-disabled students using word processing), APP (average-achieving students using pen and paper) and LDPP (learning-disabled students using pen and paper).

All students and their parents gave their informed written consent to take part in the study. No students were included who had previously failed Grade 8. Several subjects were eliminated in the process of this study. One student was eliminated because of low intelligence which appeared to be the major influence on his reading and writing abilities. One student was inadvertently selected twice for the study, and was registered in both English classes. When she moved from the school, she represented two lost subjects. One other student moved before the end of the study and was consequently eliminated as a subject. Thus, of the thirty-two subjects originally selected, twenty-eight remained at the conclusion of the study.

Several students missed short periods of instruction during the course of the study, due to illness or suspension from school. Most were able to make up the classes missed in learning assistance, which meant that they missed an option block (usually a Physical Education class), but not their English class. One subject, however, missed all of the "Person" essay (three sessions) and much of the "Directions" essay (two sessions) due to a lengthy suspension.

SELECTION AND TRAINING OF INSTRUCTORS

Two of the three teachers of English 8 in the selected school volunteered to instruct the students in their classes according to the requisites of the study. One teacher had completed his master's degree, and the other was working on his at the time of the study. Both teachers had a clear understanding of the requirements of the experiment, and both endeavored to consistently instruct their students in the spirit of the study. The teachers reviewed with the researcher the essay topics, proposed teaching methods for the study, and made several suggestions for modification before the beginning of the study. In addition, both instructors made suggestions as the study progressed in an effort to maintain consistency and efficacy of instruction between classes. The teachers instructed their students in the "process of writing" and presented four of the five topics to their own classes. For one of the five topics, each teacher instructed both classes.

PROCEDURE

Prior to composition training, subjects completed several activities. Each was

personally interviewed, and answered questions about their writing using an

instrument, <u>Children and Adolescents' Conception of Writing (Composition)</u>

developed by Dr. Bernice Wong. (This questionnaire appears in Appendix 1.) Each

student also completed the questionnaire consisting of 10 likert-type rating scale

items dealing with their willingness to write in different situations. (This instrument

was developed by the author, and appears in Appendix 2.) Finally, each student

wrote a short descriptive paragraph as a pre-test.

WORD PROCESSING INSTRUCTION

All students were instructed in the use of the typewriter keyboard in fifteen 60-minute

sessions before the beginning of the study. This unit of keyboard instruction was

judged sufficient for teaching students basic touch-typing skills. At the conclusion of

keyboard instruction, all students could locate the letters of the alphabet quickly, and

could touch-type most of them.

At the end of the typewriting instruction, students in the WP group (both LD and

average students) were instructed in the use of the Apple microcomputer hardware,

and were made familiar with diskettes, moniters and printers. Using classroom

lecture and demonstration, as well as hands-on practice, students were taught to use

the Magic Slate word processing software. This training was given in five 60-minute

sessions. During this time, students were given two short written quizes (see

Appendix 4) and several oral quizes. Any areas which were not understood were

reviewed. Upon completion of this training, students demonstrated their

understanding and ability to use six editing commands (typeover, delete, get, insert, find and replace), five block commands (mark, unmark, move, delete and copy) and the use of menus for creating new files, loading, editing and saving work. Most students also mastered the commands for printing. As well, students were given clear and accurate handouts in class to be used as notes or reference. Students were allowed to refer to these handouts at any time during the study.

Students in the pen-and-paper group continued to work on typewriters for the five hours that the other group received WP instruction. Thus, both groups had virtually equivalent time on the keyboard.

Learning to use the word processor was not difficult for any of the students in the WP group. Maintenance of word processing skills was also good. An informal check after the Christmas break (during the third session of the fourth essay and before the last essay) showed that students in the WP group were still well able to use the menus, the editing commands and, with a reminder or two from their peers, the block commands. Their reference notes were evident during writing, but not used frequently. Further details of this training are included in Appendix 3, and the quizes used to test the material from the WP tutorial appear in Appendix 4.

WRITING INSTRUCTION

All students received instruction in composition skills, with a focus on descriptive writing, for two to three 45-minute classes a week for eight weeks (a total of 25

classroom sessions). All students were given group instruction based on the theory of writing as a process: that is, preparing for writing, writing and revising.

The students were introduced to the writing unit with explanations about the nature of writing and a variety of "warm-up" activities (including timed listing games, for example). As well, several provocative examples of good descriptive writing were given. The first writing assignment was introduced in the second lesson, and a rough copy of the essay was begun.

After receiving group instruction, students in the pen-and-paper group wrote the descriptive essays assigned in the writing unit in long hand. Students in the WP group went to the typing room and wrote their essays on the computer.

Students working on word processors received personal data disks when they arrived. All equipment was ready for them, and the master program was booted up, so little time was wasted in initially preparing to write. Students were expected to "pack up" about three minutes before the end of the period, and this was consistent with the pen-and-paper group.

In a further attempt to ensure consistency of instruction, the researcher spent time in each classroom for most of the classes. Any differences noticed were discussed with the instructor, and remediated. One example of this occurred when an instructor, in answering a question in the pen-and-paper class, outlined a writing strategy not

presented in the initial instruction. He was asked to present the strategy to the work -processing group down the hall, as well as to the teacher of the other class, who conveyed it to his students.

The instructors collected the copies of essays done by the pen-and-paper group for the researcher. All essays (both PP and WP) were duplicated and returned to the instructor.

The second class was devoted to self and peer-editing. All students received a hard (printed) copy of their work and were asked to reread it and note any revisions needed. They were then instructed to ask another student to read and make suggestions about their work. That done, students were asked to make a second copy of the essay. This meant re-writing for the PP group, and editing and re-saving for the WP group.

The second copy of the student's essay was read by the student's teacher, usually after the second class. The teacher indicated difficulties by writing a "?" in the area of concern. The question mark identified major and minor errors of composition. If the student did not understand a difficulty, the teacher either pointed out what was wrong ("That's a spelling error") or asked the student to clarify what she or he wrote by asking two questions:

Is what you wrote what you meant to say?
How could you make this section clearer for your reader?

The students, with the second essay (teacher-edited with question marks) in hand revised their work in the third class, and recopied their essays. This was then submitted at the end of the class period to the teacher for marking. Each essay was numbered. For example, a student's first copy of the accident topic was Accident 1, the second copy Accident 2, and the final copy Accident 3.

Students handed in their work at the end of each class. No additional class or out-of -school time was given for work on the essays. Generally, students were able to complete essays to their satisfaction in class time.

Both classes of students received six lessons (covering five paragraph topics) on writing paragraphs, including pre-writing exercises. In addition both classes received an equal amount of time to write their assignments. Usually this was 20 - 25 minutes for the first copy, 40 minutes for the second copy (with peer editing) and 40 minutes for the final copy. Students who were absent from a class made up the time and instruction in a learning assistance block within one week.
All students wrote a post-test essay in longhand.

WRITING ASSIGNMENTS

1. ACCIDENT

Students were asked to write a detailed description of a traffic accident. This topic was chosen as the first of the series because students find it interesting and relevant. It was also judged as the easiest of the five assignments by the participating

teachers. Students were given the objective of writing an essay so that an outside reader could determine who was to blame for an accident. Brainstorming was done at a class level to elicit action words and adverbs appropriate for this paragraph. These words were listed on the board and included in a "word cache" in the student's notes. As well, students were given a written example of the type of paragraph required. For this assignment, as for the others, students completed classwork together.

2. DESCRIBING A PERSON

In the second assignment, the teacher used one of a collection of pictures to elicit a descriptive word list from the class. These words were mainly adjectives, describing the person in the picture. The teacher showed the students several different organizational strategies, including writing from strongest impression, or from top to bottom. As these pictures were taken from National Geographic, the variety of people made for an exciting and interesting work. Students were asked to write in such a way that another student would be able to clearly identify his or her picture from the stack of pictures given to the class. This assignment encompassed three classroom hours.

3. DIRECTIONS

This assignment was more structured than assignment 1 or 2, and although still fairly concrete, was more difficult for the student. The writer was asked to provide directions from Horseshoe Bay to his or her house to a student travelling to a party.

Students were familiar with the route, and could orally provide general directions. The challenge of this assignment was that the student was required to be fairly specific and precise. Teachers tended to act as "devil's advocate", pointing out how the student's audience could go wrong because of unspecified directions. Word cache items included directional words and clearly recognizable landmarks. The "directions" assignment took three classroom hours.

4. MY FAVORITE PLACE

This assignment did not use pictures, as did assignment 2; but it continued with a concrete task by asking students to describe their favorite place (real or imaginary). The teacher orally presented an example, filling in visual and aural, as well as other sensory impressions. Words written in to a word cache included visual examples, such as color, as well as words indicating such attributes as texture or sound. This assignment, with the production of three copies of the essay, took three class periods.

5. STANLEY REAL BOZO

This was seen as the most difficult of the five assignments by the teachers. Students were asked to imagine, as a class, a new student. "Stanley Real Bozo" became a character developed by the class, and was given physical and personality characteristics, which were noted on the board. The teacher elicited information from the students by asking such questions as: What would Stanley look like? Where does Stanley live, work and play? What is Stanley's conversation like?

The teacher listed the characteristics on the board, and students copied them into their notes. The students were then asked to compose a description of Stanley using both their notes and their imagination.

At the end of the composition unit, students wrote a paragraph by hand with a topic like that of the pre-test.

DURATION OF THE STUDY

The selection of the instructors and the sample was completed by September 15, 1986. Typing and word-processing instruction was completed by October 30, 1986. The writing instruction intervention began in the second week of November and ran for eight school weeks. The last essay was completed January 15, 1987.

DEPENDENT VARIABLES

Both quantatitive and qualitative data were collected in this study. Variables included were word count, number of thought-units, kind and number of revisions, number of errors, quality of revision and overall ratings of each final essay. Each is explained below.

WORD COUNT

The number of words in each essay written was counted. One marker scored each essay twice, with three months between scorings. Over 95% of the counts were

consistent. Most errors dealt with one or two words. All discrepancies were resolved by a third count. Essay titles were rare, but when included, were not counted; neither were the words "the end" or letters used for decoration at the end of an essay. Students were on two occasions querried about what they had written when their hand-writing made essays difficult to read. In these cases, the researcher wrote the unreadable words at the end of the essay. Of the words counted, hyphenated or incorrectly joined words were considered as one word, and incorrectly separated words were counted as two words. Figures of one, two or three digits were counted as one word. Hyphenated figures, or those over three digits were counted as two words. (Thus a license plate PDD-005 was counted as two words, but the car name TR7 was counted as one word.) Word counts were done on all copies of all essays. Also calculated was the greatest number of words written in any copy of a single topic per subject.

THOUGHT-UNITS

A thought-unit (or T-unit) is composed of an independent clause with all dependent clauses attached to it. The lengthening of sentences, and increased use of subordination clauses has been seen as an indication of syntactical maturity (see, e.g., O'Hare, 1971) and T-length has been used as a measure of the complexity, and by extension, quality of writing (Hunt, 1965). In this study, the third copies of the three essays "Accident", "Person" and "Bozo" were each analysed for the number of t-units in each. Words not included in t-units were subtracted from the total word count of each essay, and the ratio of words per t-unit was calculated for each of the three

final essays. These measures were compared across subject, treatment and condition.

ERRORS

Each copy of the three essays ("Accident", "Person" and "Bozo") was marked for errors, and these were counted. No distinction was made between minor or major errors, although major sentence errors (run-ons or fragments) were counted as lacking punctuation and capitals - thus several minor errors rather than a sentence error.

REVISIONS

Revisions are defined as changes or alterations in text from one copy to the next. In this study, revision was viewed as a linear process. This did not allow the measurement of "in-process" revisions, those occuring in the act of composing. In-process revisions are beginning to be explored by researchers (see, for example, Flower and Hayes, 1980; Sommers, 1980) and require fairly sophisticated analysis techniques. This study deals with the more traditional, but doubtlessly less accurate view of revision as it occurs from one draft to another.

Revisions in this study were classified using the taxomony developed by Faigley and Witte (1981) and adapted by Daiute (1986). This view of revision considers both surface and global changes in text, and rests on the clear distinction made between revisions which do not change the meaning of the text from those which do. These

separate types of revision are termed Surface Changes and Meaning (or Text-
based) Changes. The following table (Table 1) shows the adaptation of Faigley and
Witte's (1981) classification of revisions which was used to categorize the revisions
made for each copy of the two essays("Person" and "Place") assessed in this study.

Table 1.

A CLASSIFICATION OF REVISION CHANGES
(Adapted from Faigley and Witte, 1981 and Daiute, 1986)

SURFACE CHANGES

A. FORMAL CHANGES
1. Spelling, capitals
2. Tense, modality, number
3. Punctuation
4. Other

B. MEANING-PRESERVING CHANGES
1. Additions within text
2. Additions at end of text
3. Deletions
4. Substitutions, permutations,
distributions, consolidations

MEANING CHANGES

C. MICROSTRUCTURE CHANGES
1. Additions within text
2. Additions at end of text
3. Deletions
4. Other

D. MACROSTRUCTURE CHANGES
1. Additions within text
2. Additions at end of text
3. Deletions
4. Other

Surface Changes, the first category, seemed to be the easier type of revision for markers to classify. There are two general subcategories: Formal Changes and Meaning-Preservation Changes. Formal Changes (coded as an "A") included most copy-editing changes. Faigley and Witte's original five categories were compacted into four by the elimination of the category "abbreviations", and were numbered for coding. Thus, an "A1" designated a spelling or capitalization change, and "A2" indicated a change in tense, modality, or number.

Meaning-Preservation Changes are changes that "paraphrase", or say the same thing without altering the concept. A distinction has been made (following Diaute, 1986) between additions made within the text and those made at the end of the text. Also, the categories of substitutions, permutations, distributions and consolidations have been combined.

Meaning Changes represent adjustments of a minor or major scope which alter the expression of ideas. The most difficult distinction in classification was that of level in the Meaning Changes category. Markers were asked to consider if a change would affect the summary or "gist" of an essay. If the Meaning Change was incidental, or of such a nature that the intent of the paragraph did not change, it was classified as a Microstructure change (C). However, following Faigley and Witte (1981), if the concepts involved in a particular change affected the reading of other parts of the text, or the overall direction or view of the paragraph, this was classified as a Macrostructure Change (D).

Faigley and Witte (1981) noted that when a revision change spanned more than one sentence, each sentence was analysed separately. This posed some difficulty for analysis in this study because of the poor sentence structure of some writers. Thus, a further adaptation was made in one catagory. "D2" classifications (Macroadditions at the end of the text) were only counted as one revision, no matter what the length.

Two markers considered each copy of the three targeted topics (Accident, Person and Bozo). To do this, the second copy of each essay topic was compared with the first copy, and any changes were noted on the individual papers and on a chart. Then the third copy was compared with the second, and again any changes were noted. Examples of each type of revision change are noted in Appendix 5.

Each marker scored each essay. The first five essays were marked jointly, in close consultation with the researcher. When full agreement was reached on the five essays (and at least one example of each type of revision had been considered) each marker marked the rest of the essays individually. Results were compared and errors, omissions or differences of opinion were resolved so that consensus was reached on the classification of each change.

Also noted were the number of successful and unsuccessful revisions made in existing text between the second and third copies of the three essays. "Successful" revisions occurred when an error in the second copy was clearly corrected (not

simply changed) in the third copy. An "unsuccessful" revision was narrowly defined as a new error, that is, an error made in text which had been correct in copy two. This did not include errors introduced in what was new material, but did include the substitution of an incorrectly-spelled word for a correct word. Thus, analysis attempted to ensure that the changes considered were conscious and not incidental changes. Only exact phrases or words where a change was clear from second to third copy were considered. Consequently, the reworking of text which seemed to incidentally remove an error was not considered in this measure of revisions. Neither was the substitution of a mispelled word with another viewed as a clearly conscious revision of an error, and was not considered. The marker color-coded the corrected and new errors on the third copy of each of the three essays, and remarked each paper two weeks later. Few differences were found on remarking.

OVERALL RATINGS

The same two markers rated the pre-test and the third copy of each of the following essays: Accident, Place and Bozo. Both markers have taught English at the Grade 8 level in the last two years. Markers were instructed to rate each essay wholistically for the ideas presented. They were asked to ignore errors. Originally they were asked to use a whole number (between 0 and 10) to rate the essays; however, one rater felt she needed to use half marks. Markers rated the essays in the following order: Marker 1 rated the pretest, Person, Bozo and Accident; Marker 2 rated Bozo, the pretest, Accident and Person.

MOTIVATION

Students' motivation to write was measured using the instrument reproduced in Appendix 2 as a pre- and post-test. As well, student's conceptions of the writing process was surveyed using an instrument developed by Dr. Bernice Wong, Children and Adolescents' Conception of Writing (Composition) given in interview form before the study and at its conclusion (see Appendix 1).

DATA ANALYSES

Methods of data analyses in this study include: frequency distributions along with calculations of mean and standard deviations, reliability, Pearson correlation coefficients and one-way analysis of variance for estimating the significance of difference among groups.

SUMMARY

This study selected two groups of students (LD and average), divided each group randomly, and taught each group composition using the descriptive essay. Students then wrote five descriptive essays using either pen-and-paper or word processing. The study compared the writing produced by the subjects in several ways. Table 2 summarizes the essays written, and how each was analysed.

Table 2

Design of the study

Analysis	Essay Assignments						
	Pre	1	2	3	4	5	Post
Word Count	•	•	•	•		•	•
T-unit count		•	•			•	•
Ratings	•	•	•			•	
Number of errors		•	•			•	
New and corrected errors		•	•			•	
Types of revisions		•				•	

The topic for Essay 1 was "Accident", Essay 2 was "Person", Essay 3 was "Direction", Essay 4 was "Place" and Essay 5 was "Bozo". Essay 4 was eliminated from analysis because of the difficulty of the topic, and the large number of missing essays for this topic.

The word counts of each student for the five study essays, and the pre- and post-test essays was the first comparison made (see Table 2). The change, if any, in the amount each student wrote over time and training was noted. Secondly, the study compared the number of words per essay written when using handwriting or a WP. The third comparison dealt with complexity of language, using t-units as a measure. The number and kinds of revisions made by the students in both groups was a fourth comparison. Finally, this study compared the results of the attitude and conceptional instruments to determine if instruction in writing, and/or the use of the WP influenced students' feelings about and understanding of their writing.

CHAPTER IV

RESULTS AND DISCUSSION

In this chapter, the results of the descriptive writing instruction are presented and discussed. Data analysis determined whether the correlation between the factors of rater, rating, topic, copy, number of words or number of errors was meaningful. Auxilliary analyses determined if significant differences existed between four groups of students on measures of number of words, number of errors, rating, topic, copy and T-length. Specifically, kinds of revisions made in copies of essays were analysed to examine differences between students using WP versus PP conditions, as well as differences between LD students and average achieving (A) students.

The results are presented in six sections. First, assumptions made about the study in general are tested. Then each of the five research questions are considered.

Tests of Methodology

The first analysis of the data was a Pearson correlation coefficient run on the essay ratings, to determine inter-rater reliability. This involved comparing the ratings by two independent markers of the pre-test (a paragraph writing assignment) and the third copies of the essay topics Accident, Person and Bozo. For the Pretest ($r = .85$, n = 28), the Accident essay ($r = .87$, n = 26) and the Bozo essay ($r = .95$, n = 27) the probabilities were less than .001 for the test of a zero correlation. In the essay Person ($r = .49$, n = 27), the probability was less than .005. These results indicated

significant reliability in the markers for these four essays.

In their ratings, markers were instructed to ignore errors and to read and rate the "gist" of each essay. In an effort to ensure that the markers were able to do rate essays without being influenced by students' errors, the correlation between an essay's overall quality rating and the errors made on the essay was tested. These results appear in Table 3, and show no significant relationships at the .05 level. This indicates that the markers were able to score the essays without close reference to errors. However, the positive correlations found for both raters for the essay Person and the essay Bozo, and the close, although not statistically significant positive relationship [$r = .29$; $p < .08$] between rating and errors for the second rater on the second essay, Person, indicates that a greater number of errors was correlated with higher overall quality ratings. This result seemed counterintuitive. On further reflection, it seemed possible that length was an issue in this result; the longer essays, while containing more errors, perhaps contained a smaller proportion of errors to words written, and received a higher rating because of content.

Table 3

Correlations and P-values between rating and errors made on three essays

	ACCIDENT	PERSON	BOZO
RATER 1	-0.0146	0.2425	0.2762
	(p=0.473)	(p=0.121)	(p=0.091)
RATER 2	-0.0372	0.2902	0.2063
	(p=0.431)	(p=0.08)	(p=0.161)
CASES	24	25	25

To determine if this was the case, a second correlation was examined, between rating and the **ratio** of the number of errors made per words written for each of the three essays. The results are contained in Table 4, and indicate that for both raters and for each of the three essays, there was a negative relationship between rating and the ratio of number of errors per words written. This relationship was significant for the essay Bozo for both raters: Rater 1[$r = -.52$; $p < .05$] and Rater 2 [$r = -.55$; $p < .05$].

Table 4

Correlations and P-values between Ratings and the Ratio of Errors Made to Words Written for Two Raters and Three Essays

	ACCIDENT	PERSON	BOZO
RATER 1	-0.1994	-0.2462	-0.518
	(p = 0.350)	(p = 0.236)	(p = .008)
RATER 2	-0.0372	-0.0595	-0.546
	(p = 0.144)	(p = 0.778)	(p = .005)
CASES	24	25	25

It seems clear that the number of errors made, whether in total, or as a ratio to words written, affected the raters to a greater or lesser extent. Students who made more errors per length of essay in their third copies of their essays tended to be the students who received lower ratings on these essays. This was especially significant for the last essay of the study, Bozo.

Do LD adolescents write more when they use the WP system?

A 2(Groups) x 2 (Methods) x 3(Copies) factorial analysis of variance was used to analyse the data for length (number of words) for each essay (see Table 5). Four of the five essays were used for this analysis; the essay "Direction" was eliminated due to unanticipated difficulties students encountered, and to missing data. When all copies of the four essays (12 assignments per subject) were considered, no significant difference in length of essay due to Method emerged [$F(1,24) = 1.598$; $p > .10$]. However, on within-subject measures, a Copy effect [$F(2,48) = 9.772$; $p < .001$)] and a Method by Length effect [$F(2,48) = 4.301$, $p < .05$] were found. Table 5 and Figure 1 display the means for this analysis. Method (Word Processing vs Pen and Paper) was found to have a significant effect on the length of the third copy of the five essays. All subjects wrote more in their second draft (x = 148.6) than their first draft (x = 117.4) But on their third copies, students (both LD and A) using a WP wrote more than those using pen and paper. The mean number of words written on the third copy was about 157 for LDWP, 182 for AWP, 113 for LDPP and 138 for APP (see Table 6). It is important to note that LDWP students remained below average

students (both PP and WP) in length of essay until the third copy, where they wrote more, on average, than both groups of PP students. LDPP students made little changes in the length of their essays over the three copies, and APP students actually wrote an average of about 22 words less on their third copies.

If the ability to judge when a paper is complete is a discriminating factor between LD and non-LD students, as suggested by Englert, Raphael, Fear and Anderson,(1988), then it appears that in this study, WP skills may have aided students in their decisions about when their final copies were finished. LDWP students wrote more on second and third copies than LDPP students, and wrote a mean number of words per essay which was similar to the average students in the study. The improvement in LD students' ratings suggests that they were better able to judge the completeness of their papers.

Table 5
Variation between the Mean Number of Words
For Three Copies of Four Essays

SOURCE OF VARIATION	DEGREES OF FREEDOM	F RATIO	PROBABILITY
Between subject factors			
Group (LD/A)	1	2.532	0.125
Method (WP/PP)	1	1.598	0.218
Group by Method	1	0.005	0.946
S-Within	24		
Within subject factors			
Length (by Copy)	2	9.772	0.001**
Group by Length	2	1.575	0.218
Method by Length	2	4.301	0.019*
Group by Method by Length	2	0.064	0.938
CS-Within	48		

*   Significant at p < .05
**   Significant at p < .001

Table 6

Mean number of words per Essay for each of three copies
of Four Essays
By Group, Method and Copy

Group and Method	Mean number of words		
	Copy one	Copy two	Copy three
LD Word Processing	110.7	138.5	156.9
LD Pen and Paper	113.9	118.8	112.6
A Word Processing	121.4	171.9	182.5
A Pen and Paper	122.1	160.7	138.0

FIGURE 1.
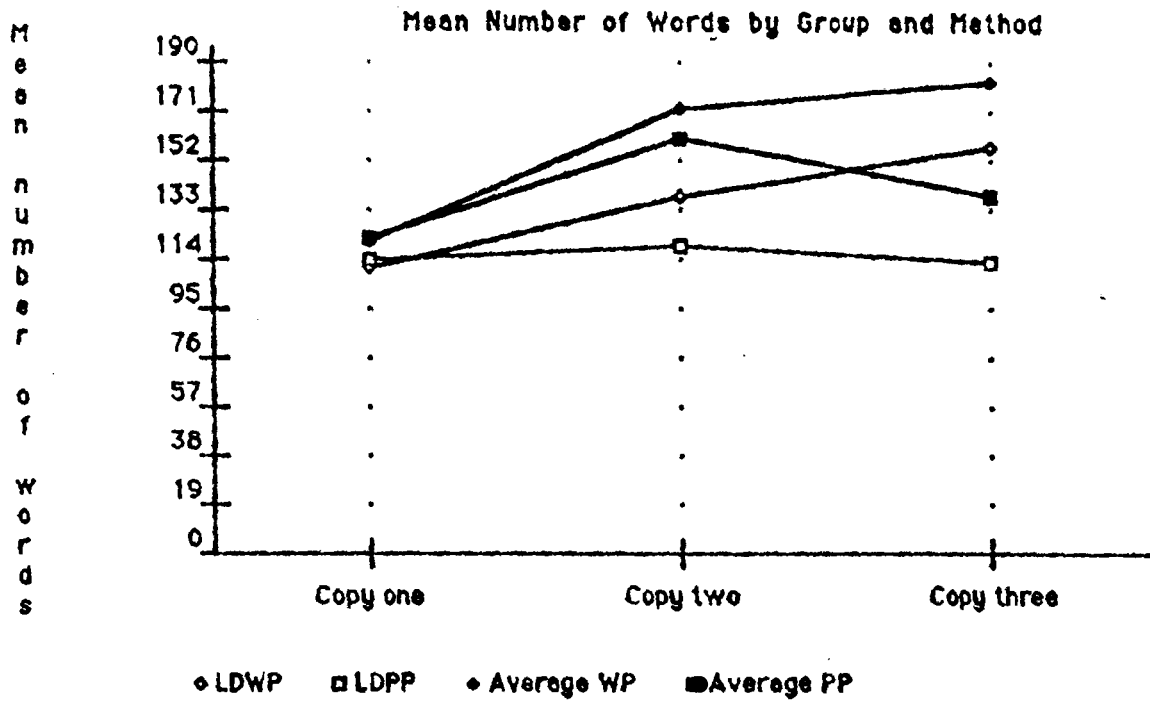
Mean Number of Words by Group and Method

Mean number of words

y-axis: 190, 171, 152, 133, 114, 95, 76, 57, 38, 19, 0

x-axis: Copy one   Copy two   Copy three

◇ LDWP   □ LDPP   ◆ Average WP   ■ Average PP

Do LD adolescents improve the quality of their composition as a function of learning and using word processing skills?

This question involved a comparison of the ratings of the overall quality of compositions across three of the assigned essays. The results of an analysis of variance appear in Table 7. It was found that the factor of Group was not significant [$F(1,21) = 3.675$; $p > .05$], nor was Method [$F(1,21) = 2.141$; $p > .10$]. But Topic had a significant effect on ratings of quality [$F(2,42) = 6.052$; $p < .001$]. As Table 8 and Figure 2 indicate, students' essays became better over the course of the study. This effect can not be attributed to a marker bias over time, as the essays were not marked in the order in which they were written. More likely to account for these improved ratings is the influence of practice. By the time students completed their third copy of the essay Bozo, they had completed fifteen essays (three copies each of five topics). The improved ratings probably reflect this subject practice over the course of the study.

Table 8 and Figure 2 show the mean ratings of the essays by Group and Method. Each group showed improvement with each subsequent essay, with the exception of the LDPP group, who maintained the same mean rating between the second and third essays.

Table 7

Analysis of Variance of the Means
of Ratings of the final Copies of Three Essays.
by Method and Group

SOURCE	DEGREES OF FREEDOM	F RATIO	PROBABILITY
GROUP (LD/A)	1	3.675	0.069
METHOD (WP/PP)	1	2.141	0.158
GROUP BY METHOD	1	0.013	0.909
S-WITHIN	21		
TOPIC (A,P,B)	2	6.052	0.001**
GROUP BY TOPIC	2	0.492	0.615
METHOD BY TOPIC	2	0.69	0.197
GROUP BY METHOD BY TOPIC	2	1.835	0.172
CS-WITHIN	42		

** Significant at $p < .001$

Table 8

Mean Ratings by Topic. Group and Method

Group and Method	TOPIC Accident	Person	Bozo
LD WP	3.9	6.2	6.7
LD PP	4.5	5.0	5.0
A WP	5.9	6.9	7.7
A PP	4.9	5.9	6.8

FIGURE 2.

Mean Ratings of Three Essays
by Group and Method

Topic

◇ LD WP   □ LD PP   ◆ A WP   ■ A PP
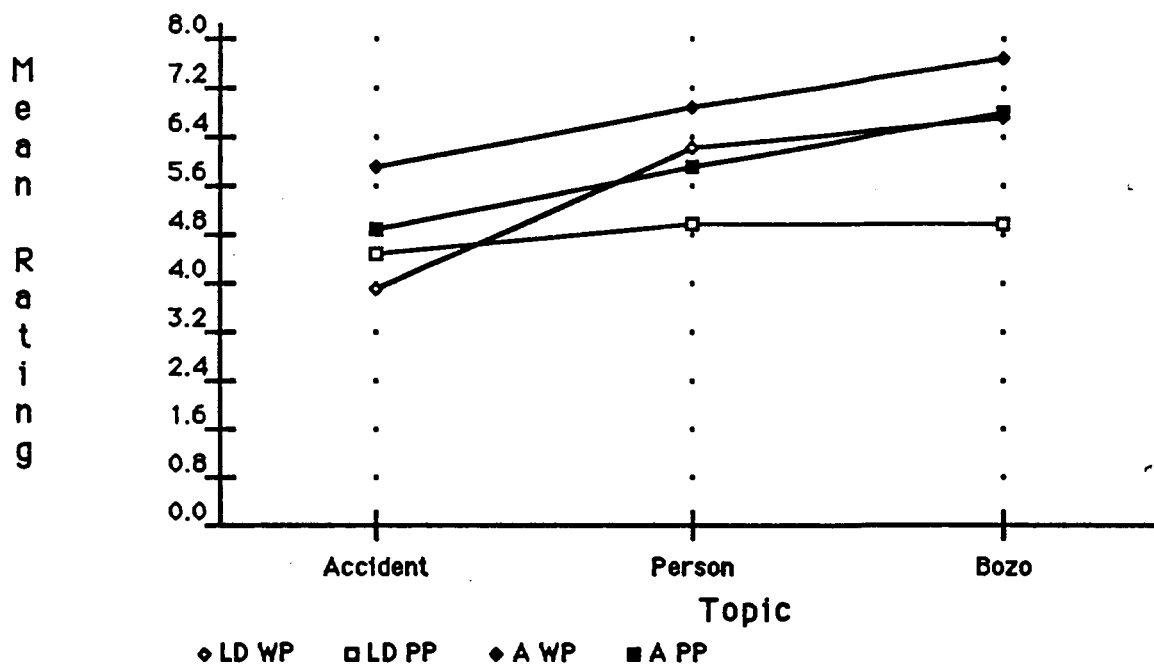
The use of the WP appears to have placed the LD students in the same range as the average students (and into the area of "passing" grades) by the second essay. This advantage was maintained on the last essay. LDPP students received the lowest ratings of the four groups, and made little gain over the course of the study on this measure of quality of writing. Further, their essays did not, on average, "pass"; that is, these students did not, on average, receive a grade of 50%.

Another measure of essay quality, T-length, revealed no significantly difference between Method, Group or Topic (see Table 9). Students' T-unit length means ranged from a low of 9.2 to a high of 12.8 words per t-unit. (T-unit means are shown

in Table 10 and Figure 3.) The results are comparable to those found by Hunt (1964) for students at this age level ($\bar{x}$ = 11.34), and by Blair and Crump (1984) for LD students writing in the descriptive mode ($\bar{x}$ = 9.26). These results may indicate that T-length is not a discriminating measure of syntactic maturity between students writing in the same discourse mode and in the same grade.

Table 9

Analysis of Variance of the Means of T-unit Lengths on the final Copies of Three Essays, by Method and Group

SOURCE	DEGREES OF FREEDOM	F RATIO	PROBABILITY
GROUP (LD/A)	1	0.563	0.461
METHOD (WP/PP)	1	0.093	0.764
GROUP BY METHOD	1	0.536	0.472
S-WITHIN	21		
TOPIC (A,B,C)	2	2.889	0.067
GROUP BY TOPIC	2	0.408	0.667
METHOD BY TOPIC	2	1.213	0.308
GROUP BY METHOD BY TOPIC	2	0.173	0.841
CS-WITHIN	42		

Table 10

Mean T-unit Length of the Final Copies of Three Essays by Method and Group

Group and Method	Accident	Person	Bozo
LDWP	10.6	11.0	9.2
LDPP	11.4	9.9	10.6
Average WP	12.8	11.3	10.7
Average PP	11.8	9.8	10.4

Figure 3.
Mean number of words per T-unit across 3 Essays
By Group and Method
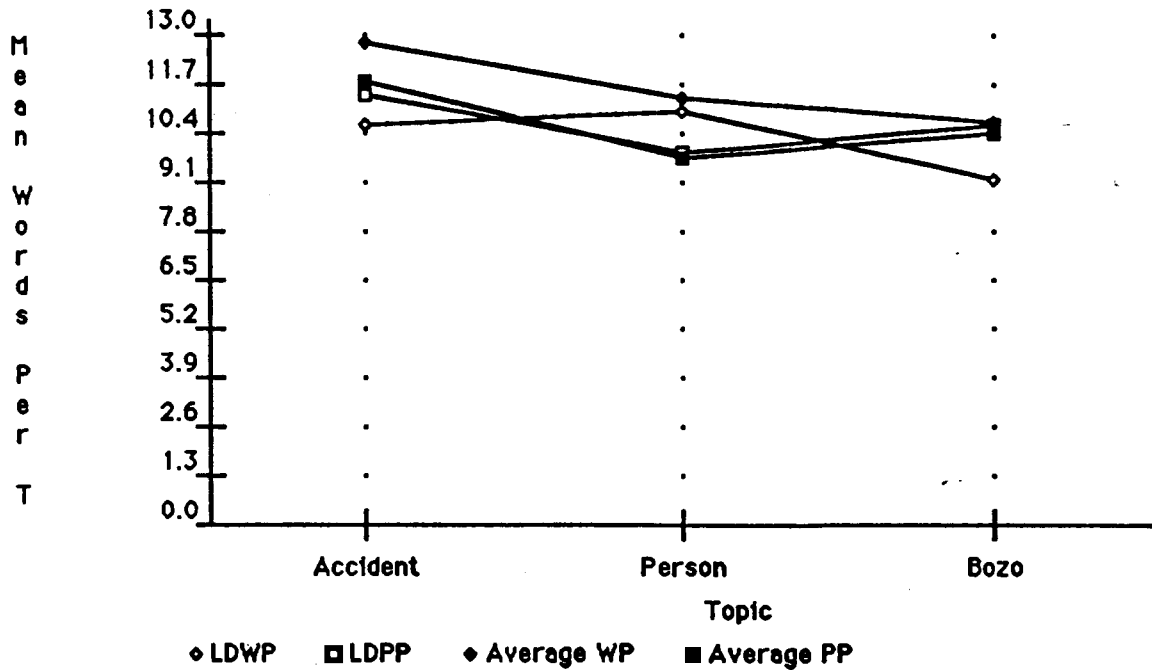
Do LD adolescents make a greater number of revisions to their work when using a WP?

The analysis first considered the total number of errors in the second and third copies of three essays. A Pearson correlation coefficient for the test of a zero correlation determined that there was a significant relationship (at the .05 level) between errors and number of words written for each of the essays. These values are listed in Table 11.

Table 11

Correlations and P-Values between Number of Errors and Number of Words Written for Two Copies of Three Essays

	ACCIDENT	PERSON	BOZO
COPY 2	0.42	0.44	0.38
	(p=.021)	(p=.014)	(p=.025)
CASES	24	22	27
COPY 3	0.71	0.36	0.55
	(p=.001)	(p=.043)	(p= .002)
CASES	24	24	25

Because of these significant relationships (see Table 11), as well as earlier analyses which showed that Method significantly affected Length (see Table 4), a ratio measure of errors was devised. Each error count was divided by the number of words in each essay, to obtain a relative score. This score was multiplied by 1000, to approximate the number of errors per 1000 words written. An analysis of variance was used to analyse the converted data (see Table 12).

The ratio of errors per words written was not significantly different between Groups [$F(1,24) = 1.473$, $p > .10$], Method [$F(1,24) = 1.152$; $p > .10$] or Copy [$F(1,24) = 1.006$; $p > .10$], as shown in Table 12.

Table 12
Mean Ratio of Errors made to Words Written by
Group, Method and Copy

SOURCE	DEGREES OF FREEDOM	F RATIO	PROBABILITY
GROUP (LD/A)	1	1.473	0.237
METHOD (WP/PP)	1	1.152	0.294
GROUP BY METHOD	1	1.006	0.326
S-WITHIN	24		
COPY	1	1.710	0.203
GROUP BY COPY	1	1.301	0.265
METHOD BY COPY	1	0.878	0.358
GROUP BY METHOD BY COPY	1	0.795	0.382
CS-WITHIN	24		

A second consideration was the number of errors which appeared in copy one and were corrected in copy two, or which appeared in copy two but were corrected in copy three of the essays. This measure was called "corrected errors". An analysis of variance (see Table 13) found one significant factor, Topic [F(1,28) = 6.88; p < .05]. The second topic, Person, contained fewer corrected errors (x = 2.6) than did the first topic, Accident (x = 4.4) and the last essay, Bozo (x = 7.6).

Table 13
Analysis of Variance in Numbers of Corrected Errors by Group, Method and Topic

SOURCE	DEGREES OF FREEDOM	F RATIO	PROBABILITY
GROUP (LD/A)	1	1.792	0.202
METHOD (WP/PP)	1	2.722	0.121
GROUP BY METHOD	1	1.187	0.294
S-WITHIN	14		
TOPIC	1	6.88	0.004*
GROUP BY TOPIC	1	0.397	0.676
METHOD BY TOPIC	1	0.575	0.569
GROUP BY METHOD BY TOPIC	1	0.168	0.846
CS-WITHIN	28		

* Significant at p < .05

The third consideration was whether students introduced new errors into text which had been correct. For this measure, the analysis of variance results are reproduced in Table 14.

Table 14

New Errors Introduced into Correct Text by Group, Method and Topic

SOURCE	DEGREES OF FREEDOM	F RATIO	PROBABILITY
GROUP (LD/A)	1	2.07	0.168
METHOD (WP/PP)	1	17.144	0.001**
GROUP BY METHOD	1	4.325	0.053
S-WITHIN	17		
TOPIC	1	0.173	0.682
GROUP BY TOPIC	1	3.921	0.064
METHOD BY TOPIC	1	3.592	0.075
GROUP BY METHOD BY TOPIC	1	1.023	0.326
CS-WITHIN	17		

** Significant at $p < .001$

Table 15

Mean Number of New Errors in Two Copies of Two Essays by Group and Method

Group and Method	TOPIC Accident	Bozo
LDWP	1.4	0.2
LDPP	2.3	2.0
Average WP	0.5	0.2
Average PP	3.2	5.8

Figure 4.

Mean Number of New Errors In Two Copies of Two Essays, By Group and Method
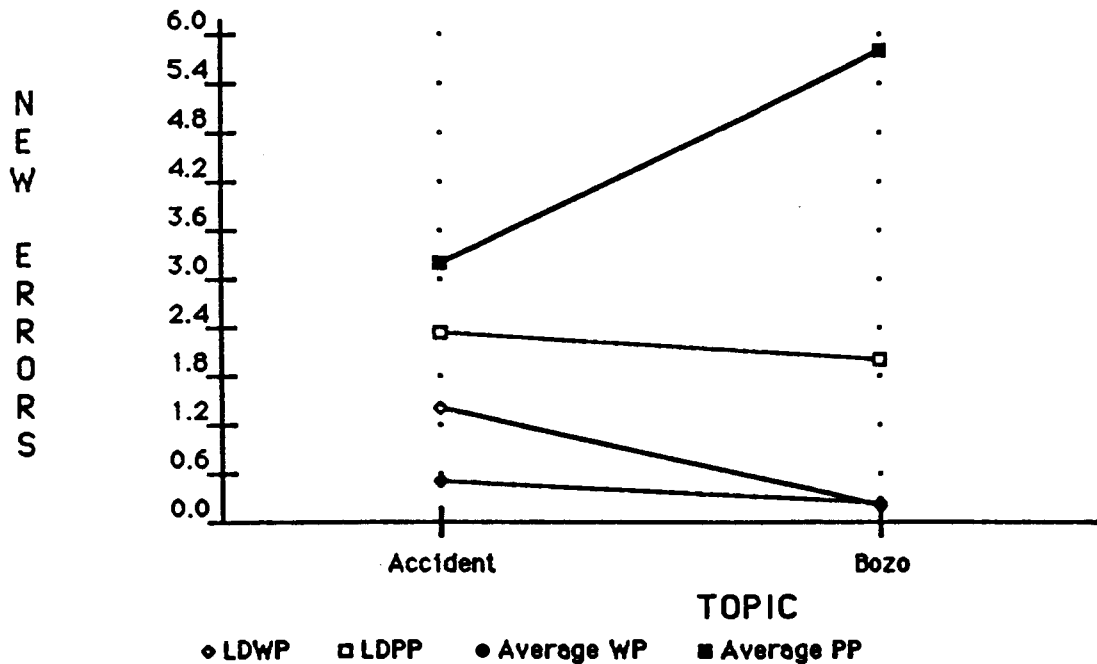
Analysis of new errors indicated that Method clearly influenced the occurance of new errors [F(1,17) = 17.144; p < .001]. Examination of the means (Table 15 and Figure 4) suggests that students using WP are introducing significantly fewer new errors into their text than students using paper and pen. This suggests that students who are not physically recopying their work run a smaller risk of introducing errors into correct text. It may also indicate that students using the WP are only superficially interacting with their work and leaving text intact, whether correct or incorrect. Clearly, the change in the tendency to introduce new errors into correct work affects the quality of the final edition. Both the average WP and the LDWP showed less

tendency to introduce new errors in their text.

Do LD adolescents using the WP make revisions which enhance the quality of their work?

Given that the PP groups introduced more errors in their texts, further analysis were done to determine why this may have occurred. A nested analysis of variance [2(Groups) x 2(Methods) x 2(Copies) x 2(Essays)] with repeated measures was used to analyse the data with respect to the nature of changes students made in their writing. These changes were discussed in the second chapter of the study (Method), are summarized in Table 1 (page 41), and are considered in more detail below. The categories for change originally contained four sub-categories each. For the purpose of analysis, these were collapsed into the above four catagories, and across the two essays.

The mean number of each type of change by Method and Group over two copies are summarized in Table 16 and Figure 5 below. Although it is clear that most students made more formal surface errors, it seems that students using the WP made fewer changes overall than did students using PP. Further information is difficult to derive from the table and graph of the total changes. To better understand the interactions of Group and Method, each type of error is discussed next.

Table 16

Means of Numbers and Kinds of Changes
By Copy, Method and Group
For Two Essays

	A*		B		C		D	
GROUP AND METHOD	1	2	1	2	1	2	1	2
LDWP	5.7	9.8	1.7	1.1	2.9	0.8	0.8	0.2
LDPP	8.3	8.2	3.6	3.5	3.0	3.8	1.7	1.4
AWP	1.6	5.4	0.3	1.3	0.6	1.6	0.6	0.5
APP	4.9	8.8	3.3	5.6	4.8	5.8	2.6	1.2

*A changes   - Formal surface Changes
 B changes   - Meaning-preservation changes
 C changes   - Microstructure meaning changes
 D changes   - Macrostructure meaning changes

Figure 5.

Means of Numbers and Kinds of Changes
By Copy, Method and Group
For Two Essays
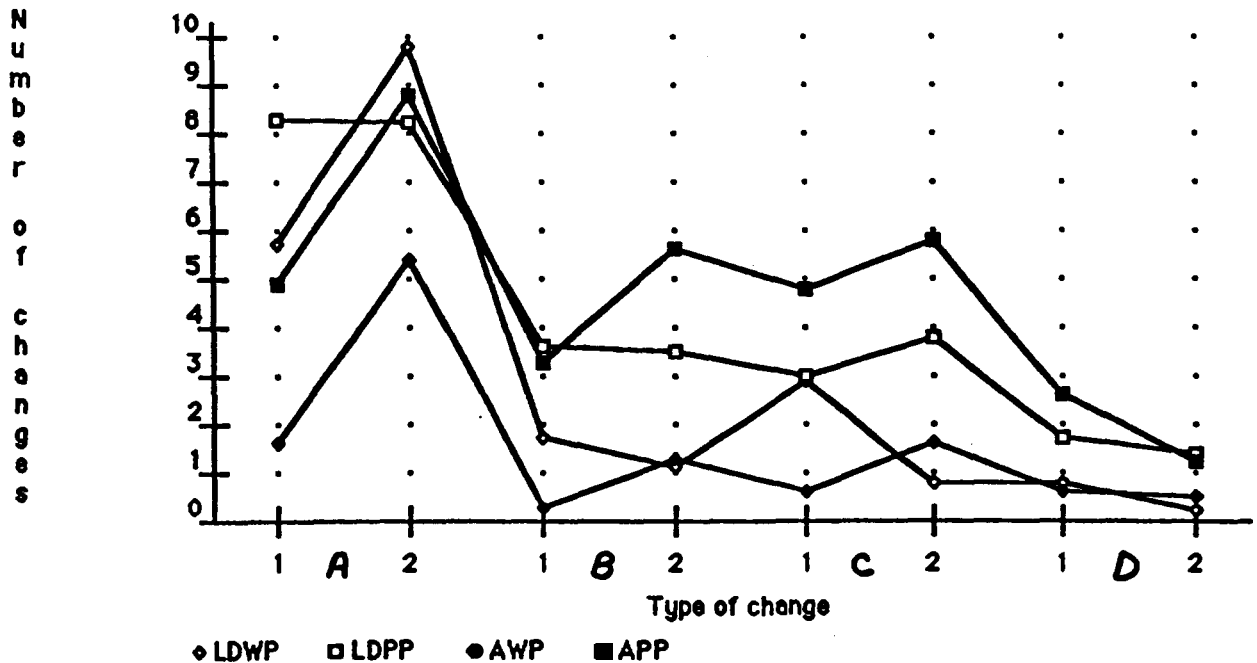
Formal surface changes:

The first type of changes (coded "A" changes in the analysis) include spelling and punctuation changes. Table 17 summarizes the analysis of variance, which indicated that formal surface changes did not differ significantly by Group $[F(1,20) = 3.735; p > .05]$, Method $[F(1,20) = 1.79; p > .10]$ or Group by Method $[F(1,20) = .926, p > .10]$ over the two essays analysed. However, the Copy factor (second or third) had an significant influence $[F(1,20) = 5.344; p < .05]$. The means for changes (reported in Table 16) indicate that more formal surface changes were made from copy 2 to 3 (mean = 7.8) than from copy 1 to 2 (mean = 4.7). Changes could have been prompted by the student or a peer editor (copy 2 changes) or by the student or a teacher editor (copy 3 changes). It would appear that the student and teacher editing was better able to prompt these type of changes.

The Group by Copy by Essay interaction $(F(1,20) = 4.59; p < .05]$ (Table 16) is difficult to explain. When the means are considered (see Figure 6), it appears that LD students made higher numbers of changes on the third copy of the first essay, and on both copies of the last essay. Average students, however, made about the same number of changes from second to third copy of the first essay, but made greater numbers of changes from the second to third copy of the second essay. The increases in formal surface changes seem episodic in nature.

Viewing all the means may perhaps clarify the interactions (Table 18 and Figure 6). All students made more formal changes from the second to the third copies on the

first essay. In addition, most students made more formal changes from second to third copies of the second essay. Only the LDPP students made fewer changes from second to third, but they still made a great number. Perhaps the self and peer editing was especially effective at activating changes for this type of error for LDPP students for the second essay.

Table 17

Analysis of Variance of
Formal Surface Changes on two copies of two Essays
By Group, Method, Copy and Essay

Source	Degrees of Freedom	F Ratio	Probability
Group	1	3.735	0.068
Method	1	1.79	0.196
Group by Method	1	0.926	0.347
S-within	20		
Copy	1	5.344	0.032*
Group by Copy	1	0.542	0.470
Method by Copy	1	0.654	0.428
Group by Method by Copy	1	0.711	0.409
CS-Within	20		
Essay	1	3.59	0.073
Group by Essay	1	0.417	0.526
Method by Essay	1	0.005	0.942
Group by Method by Essay	1	0.183	0.673
DS-Within	20		
Copy by Essay	1	0.001	0.979
Group by Copy by Essay	1	4.59	0.045*
Method by Copy by Essay	1	0.546	0.469
Group by Method By Copy by Essay	1	1.389	0.252
CDS-Within	20		

* Significant at p < .05

Table 18

Means of Formal Surface Changes in
Two copies of Two Essays by Group and Method

Group and Method	Accident Copy 2	Copy 3	Bozo Copy 2	Copy 3
LDWP	3.8	8.2	7.5	11.3
LDPP	3.2	8.2	13.5	8.2
Average WP	1.4	3.0	1.9	7.9
Average PP	5.8	6.4	4.0	11.2

Figure 6.

Means of Formal Surface Changes for Two Copies of Two Essays by Group and Method

M
e
a
n
s

o
f

A

C
h
a
n
g
e
s

14.0
12.6
11.2
9.8
8.4
7.0
5.6
4.2
2.8
1.4
0.0

Copy 2   Copy 3   Copy 2   Copy 3

Topic and Copy

◇ LDWP   □ LDPP   ● Average WP   ■ Average PP
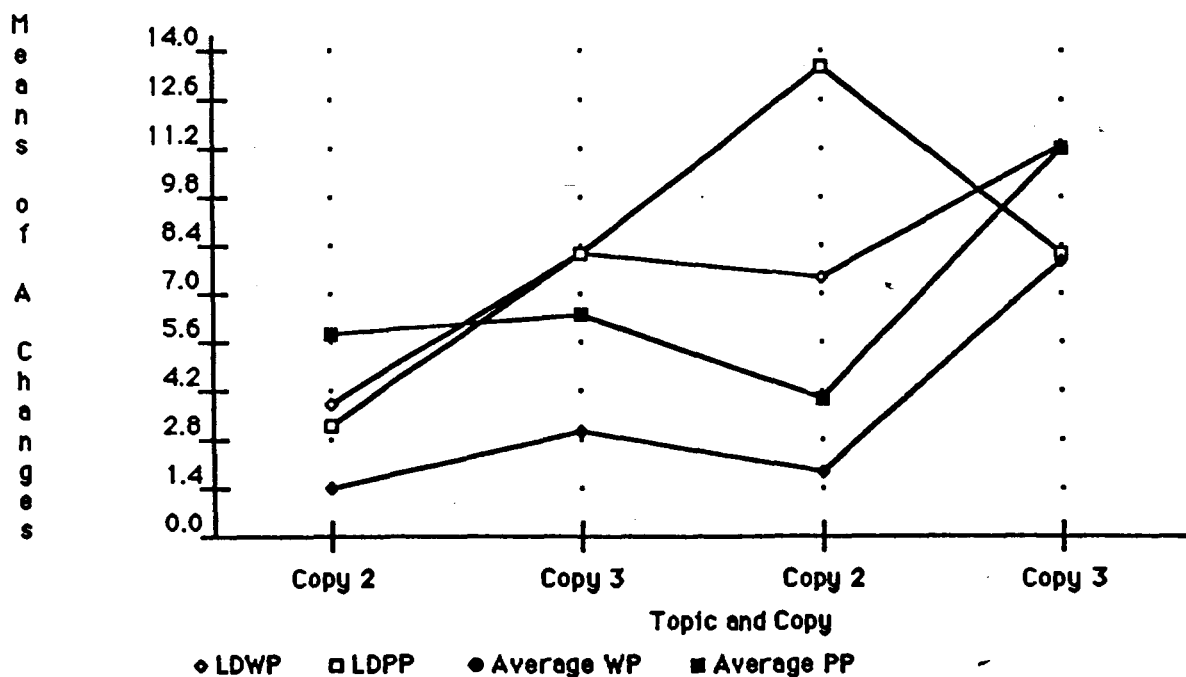
Meaning-Preserving Surface Changes:

The second type of change considered were those surface changes which involved meaning preservation (coded as "B" changes in the analysis). Examples of these kind of changes included additions within and at the end of the text, and deletions which did not change the "gist" of the essay. The analysis of variance for these changes is shown in Table 19.

The Method factor had a significant effect here [F(1,20) = 16.221; p < .001]. The means reveal that students in the WP group averaged about one meaning-

preserving change, but students in the PP group made an average of four of these types of changes.

Analysis of the Group by Essay interaction [$F(1,20) = 5.562$; $p < .05$] was also statistically significant. On average, the LD students made 1.8 changes in essay 1 and 3.0 in essay 2; the average students made 2.7 changes in essay 1, 1.7 in essay 2.

Table 19

Analysis of Variance of
Meaning-Preserving Changes on two copies of two essays
By Group, Method, Copy and Essay

Source	Degrees of Freedom	F Ratio	Probability
Group	1	0.045	0.835
Method	1	16.221	0.001**
Group by Method	1	1.06	0.316
S-within	20		
Copy	1	1.806	0.194
Group by Copy	1	4.118	0.056
Method by Copy	1	0.745	0.398
Group by Method by Copy	1	0.143	0.709
CS-Within	20		
Essay	1	0.005	0.944
Group by Essay	1	5.562	0.029*
Method by Essay	1	0.005	0.944
Group by Method by Essay	1	1.848	0.189
DS-Within	20		
Copy by Essay	1	0.143	0.709
Group by Copy by Essay	1	0.078	0.782
Method by Copy by Essay	1	0.055	0.817
Group by Method By Copy by Essay	1	0.087	0.771
CDS-Within	20		

* Significant at p < .05
** Significant at p < .001

Microstructure Meaning Changes:

Microstructure meaning changes include additions within and at the end of the text and deletions which change meaning, but do not affect the "gist" of the essay. An analysis of variance (Table 20) found that Method was again a significant factor in the these type of changes [F(1,20] = 9.194; p < .05], as it was with Meaning -Preserving changes. The mean scores reveal that the WP group averaged 1.4

microstructure meaning changes - the PP students averaged 4.4 of these changes.

No other measures were significant.

Table 20

Analysis of Variance of Microstructure Meaning Change on two copies of two essays
By Group, Method, Copy and Essay

Source	Degrees of Freedom	F Ratio	Probability
Group	1	0.37	0.550
Method	1	9.149	0.007*
Group by Method	1	1.913	0.182
S-within	20		
Copy	1	0.062	0.806
Group by Copy	1	1.499	0.235
Method by Copy	1	1.075	0.312
Group by Method by Copy	1	1.17	0.292
CS-Within	20		
Essay	1	1.047	0.318
Group by Essay	1	3.365	0.082
Method by Essay	1	0.183	0.673
Group by Method by Essay	1	0.818	0.377
DS-Within	20		
Copy by Essay	1	0.133	0.740
Group by Copy by Essay	1	0.469	0.501
Method by Copy by Essay	1	0.223	0.642
Group by Method By Copy by Essay	1	0.301	0.589
CDS-Within	20		

* Significant at p < .05

Macrostructure meaning changes:

Meaning Changes at the Macrostructure level are changes which affected the ultimate direction or "gist" of the essay. They included additions both within and at the end of the text, as well as deletions.

Table 21 shows the results of the analysis of variance. The factor of Method was significant [$F(1,20) = 24.997$; $p < .001$] for these types of changes. As with meaning-preserving surface changes and microstructure meaning changes, students using PP made over 3 times more changes (mean = 1.7) than did students using the WP (mean = 0.5). The factors of Copy [$F(1,20) = 5.027$; $p < .05$] and Essay [$F(1,20) = 6.342$; $p < .05$] were also affected as students were less likely to make these kinds of changes from the second to third copy (x = .75) than from first to second (x = 1.3). Also, students were less likely to make these changes on the second essay (x = 0.8) than on the first (x = 1.2). This finding perhaps reflects students' hesitancy in making major, meaningful changes (perhaps even to "start over") after two drafts of their work.

The tendency to make changes of one kind on essays correlated with the tendency to make other kinds of changes. A Pearson correlation coefficients analysis for the test of a zero correlation considered the 56 possible correlations between the types of errors made in the second and third copies of the two essays. Over half of the correlations were significant: 12 ($p < .001$) and 18 ($p < .05$) These results are contained in Appendix 7.

Table 21

Analysis of Variance of Macrostructure Meaning Changes on two copies of two essays By Group, Method, Copy and Essay

Source	Degrees of Freedom	F Ratio	Probability
Group	1	0.746	0.398
Method	1	24.997	0.001**
Group by Method	1	0.362	0.554
S-within	20		
Copy	1	5.027	0.036*
Group by Copy	1	0.252	0.621
Method by Copy	1	0.668	0.423
Group by Method by Copy	1	2.182	0.155
CS-Within	20		
Essay	1	6.342	0.020*
Group by Essay	1	0.039	0.845
Method by Essay	1	0.298	0.591
Group by Method by Essay	1	0.007	0.936
DS-Within	20		
Copy by Essay	1	0.939	0.344
Group by Copy by Essay	1	0.046	0.833
Method by Copy by Essay	1	0.780	0.388
Group by Method By Copy by Essay	1	1.546	0.228
CDS-Within	20		

* Significant at p < .05
** Significant at p < .001

Are LD adolescents better motivated to write using the WP system? This last question required an analysis that examined several views about "willingness to write".

Length was the first consideration. When looking at the length of all essays, Table 5 and Figure 1 clearly show that Method by Copy [$F(2,48) = 9.772$; $p < .001$] influenced the number of words, both for LD and average subjects. If increased length indicates a greater "willingness to write", then the WP helped motivate both LD and average students. The literature review (Chapter 2) indicated that there is a relationship between length and ratings of the quality of composition, and that LD students have difficulties attaining sufficient length in their writing. The added length LDWP were able to attain may also explain their improved ratings on the Person and Bozo essays.

A second indicator was derived from the motivation survey, which asked students to rate how they would feel in various writing situations. The results are shown in Table 22 and displayed in Figure 7. Although the analyses showed no significant effect for Group [$F(1,24) = .002$; $p > .10$] or Method [$F(1,24) = .126$; $p > .10$], the graph of mean scores (see Table 23 and Figure 7) does reveal that the LDWP group improved in their estimation of the writing tasks. Each of the other groups (LDPP, AWP and APP) dropped in their estimation of the writing process. (Higher scores indicate stronger negative feelings on this survey.) According to their reported results, the LDWP group was the least happy to write at the beginning of the study, and reported becoming slightly more happy to write at the end.

Table 22

Analysis of Variance between Pre and Post Attitude Scores on Likert-Type Rating Scale Items Involving Writing Tasks for Two Groups of students (LD and A) and Two Methods of Instruction

Source	Degrees of Freedom	F Ratio	Probability
Group	1	0.002	0.965
Method	1	0.126	0.726
Group by Method	1	1.414	0.246
S-Within	24		
Test (Pre vs post)	1	5.824	0.024*
Group by test	1	0.269	0.609
Method by test	1	2.552	0.123
Group by test by Method	1	3.447	0.076
CS-within	24		

* Significant at p < .05
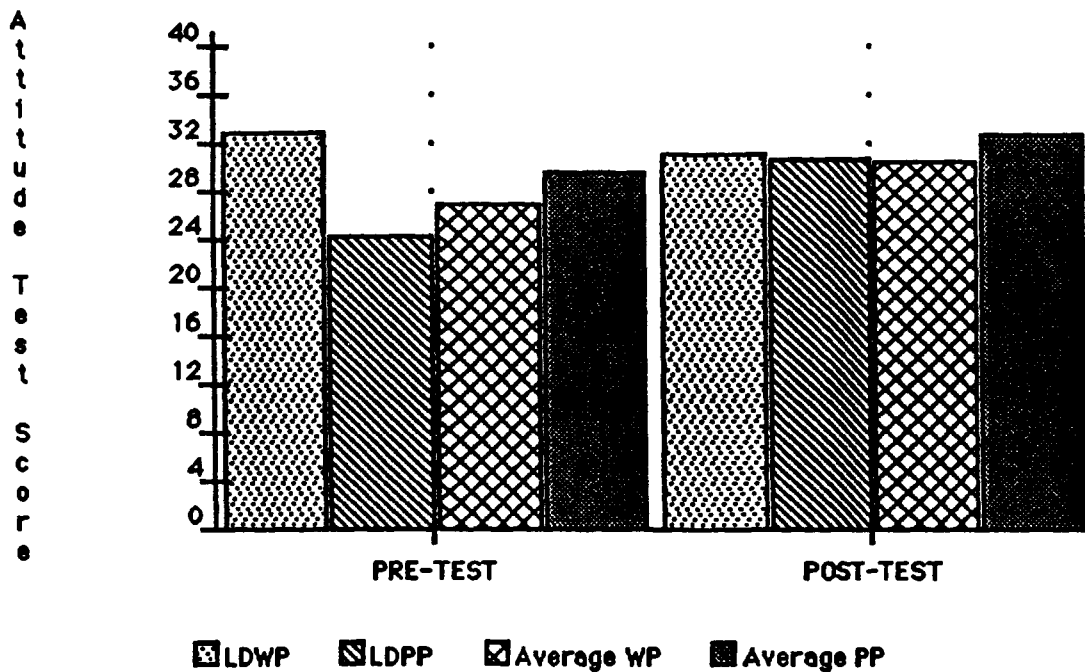** Significant at p < .001

Table 23

Mean Scores on Pre-Test and Post Test Attitude
on Likert-Type Rating Scale Items involving Writing Tasks
By Group and Method

Group and Method	PRE-TEST	POST-TEST
LDWP	33.0	31.2
LDPP	24.3	30.6
Average WP	26.8	30.5
Average PP	29.6	32.7

Figure 7.

Means for Attitude tests by Group

A third measure of motivation was collected in interview form, using an instrument designed by Dr. Bernice Wong, Children and Adolescents' Conception of Writing (Composition) (1986). This data was mainly qualitative, rather than quantitative. Questions were selected from the interviews which most clearly matched the objectives of the study. The responses to each question were entered into a spread sheet for ease in comparison. Students' names were omitted, but each answer was identified by subject number, as well as condition (LD or A) and the Method of instruction (WP or PP).

This interview format seemed to reinforce the results from the Likert-type rating scale survey, in that students' opinions about writing seemed to change for the worst over the course of the writing study. Questions 1 and 2 of the survey summarized these results. Question 1 asked, "Are there some things you like about writing?" Overall, most students stated that they liked some things about writing (88%) before the study, but only 62% liked some things about writing after the study. Twelve per cent of students felt there was nothing they liked about writing in the first interview, but this had risen to a 38% response by the second interview. The opposite question, "Are there some things you don't like about writing?" was agreed with by 71% of the responsents on the first interview and 92% on the second interview. The percentage of students who answered no to this question dropped from 29% in the first interview to 8% in the second interview. Each category of students (LDWP, LDPP, AWP and APP) had a higher percentage of subjects who felt that there were things they "didn't like" about writing after the study.

Being able to choose their own topic was an important consideration reported by many students. Because the topics were imposed, rather than chosen in this study, this feeling by many students may explain some of the negative results the writing study had on attitude. As well, students did an extensive amount of writing (15 copies in total) in this study, which may have affected their attitudes about writing as well.

Although the idea of steps in the writing process was not directly addressed by the interview or the study, it was an important component of the composition instruction. These ideas should not have been new to the students, as writing process instruction is incorporated into writing instruction at the elementary school level. In their descriptions of how they write, 50% of the average-achieving students mentioned some aspect of writing as process (pre-writing and/or revision) in the survey before the study, compared with 36% of LD students. In the post-survey, however, only four students (16%) mentioned any of the steps of writing (three LD students who had not mentioned process originally, and one average-achieving student who had mentioned process in the first interview). These low percentages echo the findings of Englert, Raphael, Fear and Anderson (1988), half of whose four and fifth-grade LD students could not state any steps in the writing process and were significantly different from both high- and low-achieving students in this study on this measure. The low percentages may also indicate that the view of writing as a process was not carefully presented or understood in the instructional component. This question was not asked directly, however, and the lack of response may

indicate measurement error. Further, this issue was not the instructional focus of the study.

The question which mentioned problems students have ("Is writing a hard thing for you to do? Why?") found some interesting results. One LD student mentioned spelling, two LD students mentioned writing legibility and two LD students mentioned punctuation. Thus, 35% of the LD sample, but no average-achieving subjects, expressed these concerns. The most common concern was "writer's block", mentioned about equally by both groups.

Question 4, "How good a writer would you say you are?" was not revealing, as most grouped themselves as average writers. The most common comment was "I'm not that good, but I'm not that bad."

Students had difficulty with the differences between Question 5 (What things does a person have to LEARN to be a good writer?) and Question 6, (What things does a person have to DO to be a good writer?) Because students expressed confusion about these questions during both interviews, these results were combined. LD students appeared to be different from the average students in this study in their stress of three factors:

1. the need to provide more detail (mentioned by 50% of the LD students, 20% of the average-achieving students.)

2. the need to learn to punctuate (43% of the LD students and 10% of the

average-achieving students in the pre-test; 29% of the LD students and

0% of the average-achieving students in the post-test)

3. the need to write exciting or interesting work (36% of the LD students, 20%

average-achieving students).

LD and average-achieving students were equally concerned with penmanship (12%

total on both the pre- and post-test), but the two LD WP students who mentioned

penmanship as a concern in the interview before the study did not mention it

afterward. Students in both groups were equally concerned with vocabulary

development.

Sentence formation concerns seemed to affect average-achieving students (50%

reported sentences were important) more than LD students (28% of whom reported

sentence concerns). The idea that practice was something writers needed to DO

was mentioned by 36% of LD students and 20% of average-achieving students.

These results seem to indicate that LD students share some concerns with average-

achieving students, but also evidence concerns not reported by average students.

Issues considered in the literature review were echoed by the LD subjects: spelling,

writing legibility, punctuation, the need for detail, and the need to write exciting or

interesting work.

A final aspect of motivation was considered using the subjective remarks made to

the researcher during the course of the study. Most students were enthusiastic about being selected to participate in the study, and most who were chosen to work on the computers were pleased. Students not chosen to use the word processors waited anxiously for "their turn". For more details, see Appendix 6.

Thus, using different measures of motivation, (the length measure, the Likert-type survey, composition interview and casual remarks), this study found that students were generally better motivated when using a WP to write. This finding seems especially important for the LD writers, for whom motivation has been shown to be a significant difficulty in writing.

CHAPTER V

CONCLUSIONS

The purpose of this study was to determine whether the use of a word processor could enhance the amount and quality of writing for learning disabled adolescents. The study was designed to replicate the findings of previous studies and anecdotal reports which suggested that students using a word processor write more and enjoy writing more. Additionally, the study sought to determine if word processing could be used to encourage learning disabled adolescents to make more revisions in their work, and to better judge the quality of those revisions.

CONCLUSIONS

This section will deal with the conclusions drawn from the results of this study, with particular reference to the purposes of the study as set out in Chapter 1 and more specifically in Chapter 3.

1. **Learning disabled adolescents wrote more when they use a word processing system, given the opportunity to review themselves, to peer review and to revise.**

Examination of the data revealed that students using a word processor wrote more on the third (final) copies of their essays than did students using paper and pen.

This finding is particularly significant for the learning disabled students using the word processor. It is recalled that these students typically wrote essaus which were too short, and that this affected teacher evaluations. Thus, the increase in length of essay is very significant for LD students. The length of the essays these students wrote moved within the range of the length of average-achieving students. As well, the ratings on the last two of the three essays for LD students using a word processor improved, not by a statistically significant factor, but sufficient to again place LD students using a word processor within the range of the ratings of the average -achieving students. Thus, a qualified conclusion of this study is that LD students wrote more when using a word processor, and their essays improved in quality, although not statistically significantly.

2. <u>LD adolescents did not make a greater number of revisions to their work when using a word processor.</u>

The major issue this study considered was the kinds of revisions students made using a word processor. Students who wrote their essays using pen and paper made significantly more meaning changes and meaning-preserving changes than did students using a word processor. Moreover, the data indicated that LD students showed an ability to almost eliminate unnecessary and inappropriate changes made in correct text (new errors).

These two results are not necessarily contradictory. It is possible that the findings may be two sides of the same problem - lack of in-depth revision by students using word processors. These students may be only superficially interacting with their work. They may leave text, correct or incorrect, intact while they proceed to add to it.

The results of this study show that LD students using a word processor do not make more revisions to their work; nor do they make qualitatively better revisions. These findings are very important for teachers and advocates of the use of a word processor in schools for the instruction of writing and revision, because they imply the need to teach LD students how to write, and the importance of emphasizing to them the relevance of revision.

In this study, LD students as a whole did not make more errors per 1000 words than average students. The tendency not to introduce new errors by LD students using word processors may have affected the ratio of errors made to words written, since only the second and third copies were considered in this analysis.

3. LD adolescents were better motivated to write using a word processing system.

The results of the motivation measures (the length measure, the Likert-type survey, composition interview and casual remarks) indicated that word processing was a motivator for LD students in this study. Students' opinions about writing generally

changed for the worst over the course of the study, with the exception of the LDWP group. If "the most important component of a writing program is getting the children to write" (Barenbaum, 1983, page 16), then this study has shown that word processing can be valuable in the writing instruction of LD students.

RECOMMENDATIONS

Recommendations for further study are divided into two main categories: practical recommendations for teachers and recommendations for further research.

The results from this study indicated that LD adolescents can write more, and with added length, can improve their essay ratings, given an opportunity to learn and use a word processor system. This is promising for teachers of LD students, especially those at the high school level, where composition is a critical aspect of evaluation. Teachers can promote the use of word processors for their LD students to improve motivation and length, while exploring ways to teach and activate revision skills.

Several research implications can be drawn from the results of this study. First, empirical research is needed to determine whether revision skills can be taught and/or prompted while students are using a word processor rather than by an instructor. Effort should be made to record and understand in-process revisions, without interfering with the classroom composition process. Videotaping may provide a means of accessing this measure. Clearly, the use of a word processor affected some revision strategies in this study, but the questions of how to best teach

and activate revision remain.

Secondly, research which allowed students more freedom to revise, but continued to control time factors seems to be indicated to better study the factors affecting revision.

LIMITATIONS

The small sample size (n = 28) combined with the difficulty of clearly identifying students with learning disabilities in the junior secondary school setting may limit the generalization of the results of this study to other populations of students. Further, the use of an inappropriate topic (Direction) and the absence of some copies of some topics may also limit the generalizability of the results of this study.

In this study, all students were required to write three copies of each essay topic. This constraint may have forced students to do a similar amount of revision, and may have artificially affected the number of revisions students would normally make.

Another limitation concerns the measurement of motivation. Two of the instruments in this study (Attitude Survey and Children and Adolescents' Conception of Writing (Composition) raise the difficulty, common to all questionnaire studies, of the validity of self-report data (Orsetti, 1985).

Finally, a study conducted over a greater length of time could determine when

students of this grade level reached "mastery" of a word processor and typing skills. When students, both average-achieving and learning disabled, use the computer with ease and expertise, the instruction of composition, and particularily revision, may dramatically change.

Appendix 1

Children and Adolescents' Conception of Writing (Composition)

Developed by Dr. Bernice Wong, Simon Fraser University

Name of adolescent _____

Birthdate _____

Interview Date: _____

School _____

Grade_____

1. Are there some things that you like about writing (composition)?

   Y   N   No response

   What are they:_____

   _____

   _____

2. Are there some things that you don't like about writing (composition)?

   Y   N   No response

   What are they:_____

   _____

   _____

3. Is writing (composition) a hard thing for you to do?

   Y   N   No response

   Why?_____

   _____

   _____

4. How good a writer would you say you are?

   Excellent   above average   average   below average   very below

   Why do you think so?_____

   _____

   _____

5. What things does a person have to LEARN to be a good writer?

6. What things does a person have to DO to be a good writer?

7. When a person in grade one is writing a story, is he/she doing the same thing as a person in (child/adolescent's grade)?

   Y   N   No response

   Why?_____

   _____

   _____

8. When a person in (child/adolescent's grade) is writing (a story/an essay), is he/she doing the same things as a grown-up?

9. Why do you think some children/adolescents have trouble in writing (stories/essays)?

10. What things do you need to learn to be a better writer than you are right now?

11. (b) FOR ADOLESCENTS in grades 6,7, and in high shcools

Many people think that writing (as in writing an essay) is one of
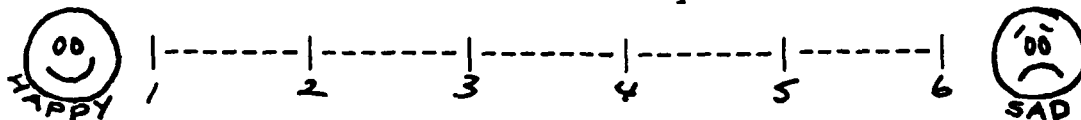the most important things that you do in school. What would one say
writing is about?

12. How do you write?

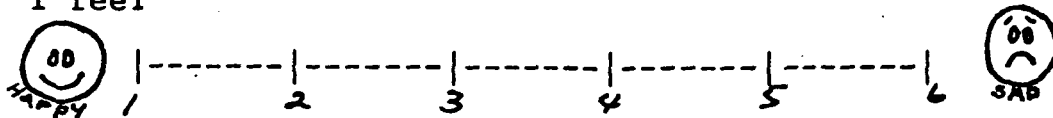13. What goes on in your mind when you write?

Appendix 2

How I Feel About Writing

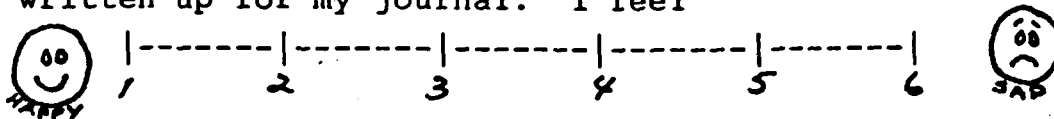1. I am asked to write a short essay. I feel

HAPPY 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 SAD

2. I receive a gift and want to write a thank-you note.
   I feel
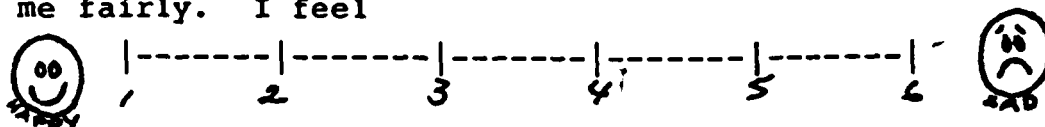
HAPPY 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 SAD

3. I am on a school hike and I see a beautiful scene of
   mountains, trees and sky. The teacher says it must be
   written up for my journal. I feel

HAPPY 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 SAD

4. I get into an argument with another student. The principal
   tells me I must write out what happened so he can deal with
   me fairly. I feel

HAPPY 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 SAD

5. I am asked to write a free essay about anything I want.
   I feel

HAPPY 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 SAD
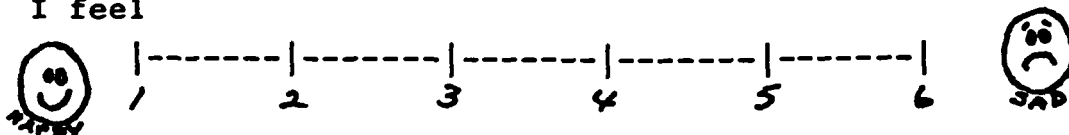
6. I am asked to write an essay about a very specific topic.
   I feel

HAPPY 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 SAD
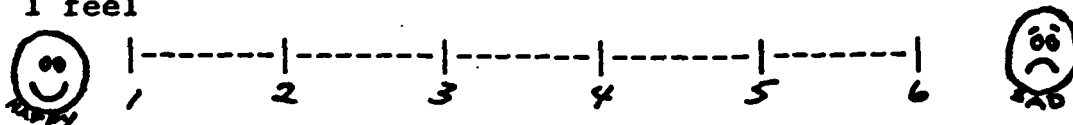
7. I have been asked to enter a writing contest. I feel

HAPPY 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 SAD
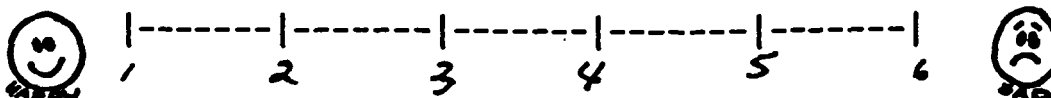
8. If my parents insisted that I write in my journal or
   diary every night for 15 minutes, I would feel

HAPPY 1 ---- 2 ---- 3 ---- 4 ---- 5 ---- 6 SAD
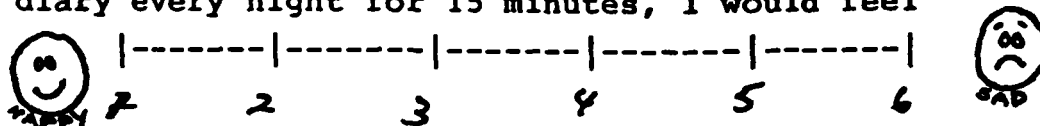
Appendix 3

Instruction In Word Processing

The word processing program used in this study was Magic Slate. This was a fairly easy to learn and straightforward system which the author has used successfully with both average-achieving adolescents and adolescents with learning disabilities. Magic Slate was available at the school where the study was planned in sufficient copies as to make group instruction viable. Further, the program was accompanied by a tutorial program in booklet form which makes instruction on the WP easier and more uniform. A series of five one-hour lessons was given.

In Lesson 1, students were introduced to the hardware of the WP system: the Apple II computer, the disk drives, monitor and printer, and to the Magic Slate WP Disk and the students' personal data disk. Before work on WP began, students reviewed some safety concerns, including the careful moving of the computers, and care of the disks. Students then bagan to work through the Magic Slate Handbook (an example page appears in Appendix 3) filling out review notes as they proceeded through the lesson, and practicing the operations taught. Lesson 1 of the Handbook reviewed the Main Menu, (which included commands such as EDIT, LOAD, PRINT, NEW, SAVE, DELETE, MAKE and QUIT). Files and file names, the Typeover mode and prompts, cursor movement and saving were also introduced. Students worked through the tutorial exercise in Chapter 1.

Lesson 2 covered the functions of DELETE and GET for characters, words and sentences, and introduced inverse type as a way of identifying text to be deleted. Students had the opportunity to practice these operations using the tutorial.

Lesson 3 introduced the INSERT mode (and cursor) to the students and provided practice using this mode and changing to the typeover mode.

Lesson 4 dealt with paragraphing, including the use of the return key, and indenting. Not included in the handbook, but mentioned to students, was the mechanism for scrolling text. In the experience of the researcher, students not familiar with WP occassionally became anxious about the disappearance of text from their view. A quick explanation and retrieval of their text was effective in relieving their concern. Also included in this session was a section on printing, which was generally done with the aid of the teacher.

The last lesson dealt with the "replace" function, and the term "global". Block commands were also introduced, and the marking, unmarking, copying, moving and deleting of blocks of text were practiced.

Two short quizes were given at the beginning of Lesson 3 and 5. Students were asked throughout the sessions to demonstrate their grasp of the lessons covered as they worked through the tutorials. Students having difficulty with the WP system were given extra instruction as required, but no student needed more than the class

time. In addition, students were moniterred throughout the writing sessions to ensure that they were able to write, edit and save effectively. This was especially important as the study extended over the Christmas break. However, students showed no lessening of understanding throughout the course of the study.

Appendix 4

Quizes used to Test Word Processing Knowledge.

MAGIC SLATE - QUIZ 1

I. MATCHING

_____ Main Menu	a) start the program by loading the Magic Slate disk and turning on the computer
_____ data disk	b) initial picture showing 8 different things you can do, like SAVE or NEW
_____ FILE NAME	c) removing a letter or word
_____ cursor	d) disk on which you save your writing
_____ TYPEOVER mode	e) used to store your work on your data disk
_____ save	f) short messages at the bottom to help you
_____ prompts	g) uses the ☐ cursor and types over your letters without moving them
_____ boot	h) should be short and cannot contain spaces
_____ inverse	i) "highlighting" a letter or word
_____ delete	j) computer device used to mark your place

II. Three things you must be careful about when you work with computers are:

MAGIC SLATE - QUIZ 2

1. FILL IN THE COMMAND FOR EACH ACTION.

To delete a word, hold down control while you type D.   Then hold down Control and type ____   .

To delete a sentence, hold down control while you type D, then
_____

To GET back what you last deleted, hold down control and type ____ .

2. MATCHING

_____ uses the cursor ___, and puts in extra words or letters	a) get
_____ highlighting a letter or word	b) INSERT MODE
_____ uses the ☐ cursor and types over your letters without moving them	c) inverse
_____ lists all the files on your disk and lets you select one to work on	d) LOAD
_____ tells you when you have pushed "return" to start a new paragraph	e) indent
_____ leave a space, like at the beginning of a paragraph	f) TYPEOVER mode
_____ returns to you what you last deleted	g) ↵

Appendix 5

Examples of Revision Types

The following examples are the transcriptions of two subjects' first and second copies of the essay Accident. Both subjects wrote using a word processor; one subject was learning disabled and the other was average-achieving. These two cases were randomly selected from the data pool of subjects using the word processor. Errors are indicated by underlining, and changes are indicated by a letter and number on the second copy of the essay.

SUBJECT 19 - LD word processor

I was walking down the rode to go pick up some milk and bread

when on my way I saw a big truck come around the corner

and I guess he didn't know that the rode was very slipery and icy

there was a car coming around the other corner

the other car lost control to and slid into a street lamp

the other car was going straight at the car that hit the lamp

it hit the back of the other car and went fliing into the air

the and it luchly laned on its wheels

and it never stoped .

The other driver was very badly hurt

so I said call an ambulance.

Acc 2 - 19

I was walking down the road to go pick up some milk and bread __

when on my way I saw a big truck come around the corner __

and I guess he didn't know that the road was very slippery and icy __
                                        A1   A1
there was a car coming around the other corner __

the other car lost control too, and slid into a street lamp __
                              A1 A3
the other car was going straight at the car that hit the lamp __

'it hit the back of the other car and went flying into the air __
                                                        A3
the and it luckily landed on its wheels __
                    A1   A1
and it never stopped.
            A1
The other driver was very badly hurt so I said call a Ambulance. __
                                            A1 A1
Just as the ambulance was taking the person too the hospital another car

came around the corner and hit the ambulance right in the back __

the impacked killed the driver and the hurt person .

There was head rolling down the road .
              ^
I went to the police car and got his shot gun and shot the car that was

trying to get away __

the car blue up

and pieces of the guys body came flying out of the car.........

SUBJECT 15 - Average-achieving word processor

Acc 1 - 15

I was sitting on the mailbox on the side of the road.

I can hear the police coming and the fire thucks.

They pull up

the fire man look at the cars

and calls some man over to put the flames out.

The police officer calls out to the people if there was any witness.

I say yes, I'm a witness

I saw the whole thing

the police officer takes out his book of paper and ask for my name

Randy Bolkowy I say,

where do you live he says,

41595 Cottonwood rd I say,

tell me what happened kid

well I was walking down the street to the store

before I went in the store I sat out side to find my money

when I heared some cars motor make a

Acc 2 - 15

I was sitting on the mailbox on the side of the road.

I can hear the police coming and the fire trucks.

A1

They pull up

the fire man look at the cars and calls some man over to put the flames

out.

The police officer calls out to the people if there was any witness.

I say yes , I'm a witness

I saw the whole thing

the police officer takes out his book of paper and ask for my name

Randy Bolkowy I say,

where do y_ou live he says,

41595 Cottonwood rd I say,

tell me what happened kid

well I was walking down the street to the store

SAME AS #1   before I went in the store I sat out side to find my money

when I heared some cars rmmotor go in to a higher gear.

I sat there on the mailbox looking out on to the road_

the car that was come up the road was going about 60km.

The car was blue 1985 Z28 _

as it was come up to the store a yellow pick up truck was pulling out

and the Z28 was just about to hit the pick up truck_

but it swerved around it and hit the red honda parked on the road.

The driver must have hit his head on the windshield

because it took a long time for him to start the car__

he s█████ed it and took off__

__did you get the license plate number kid the police officer said __

. yes I did

it said ROAD HOG on the license plate

Appendix 6

Student Comments in Support of the Use of Word Processing to Improve Composition

Most students were enthusiastic about being selected to participate in the study, and most who were chosen to work on the computers were pleased. Parents were also interested and enthused, and several parents attempted to ensure that their children were selected to work on the word processors. When informed about the random nature of the selection, and the provision that all students would learn word processing at the end of the study, they withdrew their requests.

Throughout the course of the study, both the researcher and the teachers noted significant remarks made by students. During that time, no WP students requested to write out their work, but numerous PP students requested to use the WP. Pen and paper subjects (both average and LD) waited anxiously for "their turn", which came at the end of the study. Typical remarks from students included the following:

> "When's my turn?" (to work on a WP)
> "Can I come in after school and do it?" (WP from a APP subject)
> "Can't I do computers in Learning Assistance and write in English? (from a LDPP subject)

Students were amazed at the print-outs of their work, and watched, line by line, as the essays emerged from the printer. One LD student was particularily impressed..."Hey, I can read this stuff!"

Students did, however, view the computer as an independent writer, and errors in the text were often attributed to the computer for the first two essays. This no longer occurred after the third essay. Another interesting phenomena was the students' inability to read the screen and the print-outs from a reader's point of view. Typical of the responses to peer or teacher questioning is the following:

> "No, no... it doesn't say that...(pause to reread) Well, it's not suppose to say that..."

Some students had a little difficulty reading the moniters. But as the study progressed, students began to revise their work looking at the moniters continually, instead of the hard copy of their first and second drafts. Although Kane (1983) found her students too involved in their work to speak to others, it became clear that in this study, the "publicness" of the moniters, and the possibility of eliciting peer help and interest made a difference to most students.

This study did not conduct any long-term measures of attitude of writing progress, after its completion in January. However, several significant things happened with the groups of students. After the completion of the study, one class (mainly average -achievers) embarked on an extensive school newspaper project, using the computers to draft, extensively revise and publish a long newspaper. The second class (mainly LD students) lobbied effectively to have a computer moved from the upper floor of the school to their classroom on the lower floor. They used it primarily for individual reading comprehension and math programs, although some team composition was also done.

In the Learning Assistance Center, where most LD students were placed for about three blocks a week, the computer became the most desired "free" activity, after regular reading instruction and assignments were completed. Spelling and typing programs of a "game" format were most popular, but when these programs were in use, students would compose stories on their own, type up notes from other classes, or work on assignments from other classes.

Appendix 7

Pearson correlation coefficients for types of changes made between first and second, and second and third copies of essays

	AE13	AE24	BE13	BE24	CE13	CE24	DE13	DE24
AE13		0.1912 P=.170	0.879 P=.000	0.3209 P=.051	0.7011 P=.000	0.3236 P=.050	0.0901 P=.328	0.0244 P=.452
AE24	0.1912 P=.17		0.2141 P=.142	0.099 P=.308	0.3099 P=.058	0.0973 P=.331	0.1494 P=.229	-0.099 P=.307
BE13	0.879 P=.000	0.2141 P=.142		0.5437 P=.002	0.7528 P=.000	0.4779 P=.006	0.3303 P=.046	0.1174 P=.280
BE24	0.3209 P=.051	0.099 P=.308	0.5437 P=.002		0.4845 P=.005	0.8434 P=.000	0.5826 P=.001	0.3958 P=.019
CE13	0.7011 P=.000	0.3099 P=.058	0.7528 P=.000	0.4845 P=.005		0.481 P=.006	0.4619 P=.008	0.1979 P=.161
CE24	0.3236 P=.050	0.0973 P=.311	0.4779 P=.006	0.8434 P=.000	0.481 P=.006		0.4525 P=.009	0.5704 P=.001
DE13	0.0901 P=.328	0.1494 P=.229	0.3303 -=.046	0.5826 P=.001	0.4619 P=.008	0.4525 P=.009		0.1949 P=.165
DE24	0.0244 P=.452	-0.0997 P=.307	0.1174 P=.280	0.3958 P=.019	0.1979 P=.161	0.5704 P=.001	0.1949 P=.165	

AE13 refers to A type changes (formal meaning changes) made between copy 1 and copy 2 of two essays

AE24 refers to A type changes (formal meaning changes) made between copy 2 and copy 3 of two essays

BE13 refers to B type changes (meaning-preserving changes) made between copy 1 and copy 2 of two essays

BE24 refers to B type changes (meaning-preserving changes) made between copy 2 and copy 3 of two essays

CE13 refers to C type changes (microstructure meaning changes) made between copy 1 and copy 2 of two essays

CE24 refers to C type changes (microstructure meaning changes) made between copy 2 and copy 3 of two essays

DE13 refers to D type changes (macrostructure meaning changes) made between copy 1 and copy 2 of two essays

DE24 refers to D type changes (macrostructure meaning changes) made between copy 2 and copy 3 of two essays

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