The Impact of a Word Processor as a Tool in the Remediation of Learning Disabled Elementary School Children

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Word Processing and Learning Disabled Children

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Abstract

The study was undertaken to assess the effects of a word processing program with learning disabled elementary school children. For six months, twelve students used the Bank Street Writer twice a week to compose their stories. To assess if there were changes in their written language, two variables were studied: fluency, defined as the number of words generated per composition; and the number of editing procedures. Protocols of the students' writing behavior were kept containing a complete record of their editing. In addition, data on the number of words per composition were tabulated.

The results of the study suggest that a number of significant changes took place in the learning disabled students' writing. The students demonstrated highly significant increases in both fluency and the number of editing procedures when they used the word processor for their compositions. In pretest and posttest, paper-and-pencil compositions the learning disabled students demonstrated a significant increase in their production of words per composition. The results suggest that positive changes facilitated by computer-assisted writing may generalize to the more traditional paper-and-pencil environment.

Résumé

Cette étude a été entreprise pour évaluer les effets d'un programme de traitement de textes sur la capacité d'apprendre des enfants ayant des troubles d'apprentissage d'école primaire. Pendant six mois, douze étudiants se sont servis du "Bank Street Writer" deux fois par semaine pour composer leurs histoires. Dans le but d'établir si leur langage écrit avait changé, deux variables ont été étudiées: la facilité de langage, définie par le nombre de mots produits dans une composition, et le nombre de mises à jour de la composition. Un dossier complet contenant les différentes mises à jour de la composition a été monté pour chaque étudiant. De plus, les données concernant le nombre de mots d'une composition ont été compilées.

Les résultats de l'étude demontrent certains changements significatifs dans le langage écrit des étudiants ayant des troubles d'apprentissage. Par l'emploi du traitement de textes pour leurs compositions, les élèves ont pu accroître leur facilité de langage et le nombre de procédures de mises à jour. Dans les compositions écrites précédant et suivant l'emploi de système de traitement de textes, les élèves ont démontré une augmentation certaine dans leur production de mots par composition. Les résultats positifs de cette étude prouvent que l'emploi du traitement de textes peut être généralisé au monde de l'écriture traditionnelle.

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Chapter I

INTRODUCTION

The microcomputer is often hailed as a powerful new tool in the remediation of special education students (Schiffman, Tobin & Buchanan, 1982). Papert (1982) specifically singled out learning disabled students as needing primary access to classroom computers in order to demonstrate their strength and importance in education. A major area of learning where the computer is considered able to produce dramatic improvements is in written language. The use of word processors is thought by some educators as having the potential of not only changing the way students learn to write but also of increasing student literacy (Bardige, 1982). English teachers praise it as "the most powerful tool... yet encountered in the teaching of composition" (Gula, 1982). If word processors can change students' writing ability for the better, then this would have important implications in the education systemince one of the major skills that children are supposed to acquire in school is that of written language. Its importance cannot be overestimated because it is primarily through written communication that students' knowledge is assessed and evaluated (Graham, 1982).

The purpose of this study is to attempt to ascertain if there are some changes in the written language of a special group of elementary students - the children with severe learning disabilities - when they use a word processor. Generally there have been mainly anecdotal comments about children's improvement in their writing skills when they use microcomputers,

and there has been very little systematic observation of children while they use word processors. The few research studies that have been reported, generally have as subjects children who are already fairly proficient at writing, extremely proficient adult writers, or adult transcribers such as secretaries. The question then is what happens when the word processor is used with a population which is known for its deficiency in written language?

Writing, in itself, is an extremely complex task that embodies a vast array of skills in both language and cognition. This is how Lerner (1982) describes some of the requirements for writing:

> -a child must have the ability to keep one idea in mind; -to formulate that idea in words and appropriate syntactic patterns; -to plan the correct graphic form for each letter and word; -to correctly manipulate the writing instrument to produce these letter shapes; - to integrate complex eye-hand relationships; - and to have sufficient visual and motor memory.

All these are required for the basic act of writing before the qualitative aspects of that written product are even considered.

In this study, only those issues in written language theory that might pertain to using the word processor will be discussed. The importance of other issues is recognized but it is necessary to limit the discussion to try to understand what type of effect this technology will have for this special population.

One objective of this study is to assess if the computer might alleviate some of the problems that affect learning disabled children. In the paper-and-pencil mode, the motoric aspect of writing demands spatial skills as does the formation of the letters, and spacing between words, so that readers can tell when one word stops and the next begins. These can all be frustrating tasks for those children who have difficulties in spatial direction

and sequencing. When they approach a writing task, this one act of literally forming the words becomes the dominant and absorbing activity to the detriment of other necessary tasks.

Working on the computer, on the other hand, may be less arduous and frustrating, since a number of performance problems are either minimized or eliminated. For example, the demands of legible handwriting demands are eliminated since computer copy is always neat and presentable, and multiple copies from the printer are readily available. The computer, also, begins automatically at the top of the screen and works down in a left to right sequence minimizing the spatial judgment demands on the children.

Most important is the ease of editing with a computer. If these special students were provided with some simple text editing commands on a computer, would they stop worrying about how their work looks and whether each word is spelled correctly? Would they then concentrate on ideas and communication, if it were easy to go back and check their work? Erasing and changing words with a computer does not affect the rest of the text, and does not leave messy blotches. Simple text editing procedures can be thought of as intrinsically interesting tasks in themselves - might this entice the children to become more willing to re-read and edit their errors?

The present study will examine two basic and concrete variables in written language. The first is fluency - the total number of words that a student writes during the composition time. Fluency is of major interest to educators of learning disabled students because research has shown that these students consistently write fewer words per composition than their regular peers (Graham, 1982). The second variable to be studied is the number of edits that the student initiates per composition time. Learning disabled

students generally do not re-read or edit their work as often as their other classmates (Polloway, Patten & Cohen, 1981). Any significant increase in the amount of editing would suggest that students were becoming more aware of their mistakes, and were more willing to try to correct them.

The population of learning disabled students presents a number of difficulties when trying to assess their written language in order to determine whether or not there has been any improvement. Learning disabled children do not fall into convenient categories and so their learning is highly individualistic. They also take a longer time than the average student to show improvement in most areas of academic learning. Again, since learning disabled children have generally had such negative experiences with their written language, their reluctance to write can become extremely deep-seated, sometimes to the point of producing emotional problems.

Some concern that has been voiced over praise of the word processor as beneficial to children is that what is being observed is just the Hawthorne effect - the initial motivation of using a new toy. It must be remembered, though, that this effect is one of the strongest and most reliable ones in education. All good teachers are cognisant of the benefits of this effect and use it each time they try new and interesting approaches. What teachers understand is that during the time the Hawthorne effect is in operation real learning is also taking place, and they take advantage of this as much as possible in order to hold the child's interest.

This skepticism about using a word processor is counterbalanced by the fact that at the beginning, when excitement and motivation are at their peak, the children's performances are hampered because of unfamiliarity with the keyboard and with the word processing program.

Summary of the Chapter

This study, then, will try to assess if there are specific changes in the writing skills of young learning disabled students when they use a word processing program. In an educational situation, writing skills are of utmost importance because it is through written tasks that the majority of learning is judged. The two variables that will be examined are fluency and number of edits per composition. It is thought that using the microcomputer may alleviate a number of writing and performance problems that are prevalent in learning disabled students.

Chapter II

REVIEW OF THE LITERATURE

Written Language

The research pertaining to written language is extensive and embodies many complex issues. The discussion will be limited, therefore, to the literature related to writing development, and that which is relevant to a computer task.

Complex Task

Although there are a number of different frames of reference for the study of written language, most theorists agree that it is an extremely complex task which demands the mastery of many interrelated component skills. "Writing", according to Flower and Hayes (1981), "is the most complex of human mental activities." Gundlach (1981), in his discussion of written language, noted that oral language develops without explicit instruction, while the same could not be said of writing. Myklebust (1965) viewed written language as the last skill achieved in a hierarchical scale. He considered that receptive and expressive language were first developed as a response to a need to symbolize an experience. Reading as a visually receptive skill would therefore be acquired before written language which in his terms was basically a visually expressive skill.

Chomsky (1971), on the other hand, noted that many children write even before they read and very often cannot even read what they have

written. This activity may be explained by the observation that young children learn best through physically "doing", and writing is a more concrete activity than reading. It does, though, allow the children to practice some similar tasks such as sound-symbol correspondence.

Read (1975), like Chomsky, observed children who were using their own invented spelling to write before they could read. The spelling was not totally idiosyncratic though, and often had a logic and a phonologically developmental sequence to it. Read (1981, p. 105) describes a stage "in which children have two distinct systems, one for reading standard spelling and one for writing in their own invented orthography." Bryant and Bradley (1979), agreeing with some of the views of Chomsky and Read, believe that children use different strategies for reading and writing. They may spell on the basis of sound-symbol correspondence, but read by recognizing longer units or whole words.

The question as to whether writing is the final and most difficult stage in children's language development, or whether it is a separate one with some similarities, has not been resolved by the experts. What is agreed is that there are many skills which are needed to be successful at this task.

Developmental Approach

Whether or not researchers accept the theory that on a hierarchical scale written language is the final skill to be learned, most theorists do talk about developmental stages in written language. Graves (1983), who has extensively studied the writing of young children, describes five stages each in which children concentrate on different skills while writing. Children's initial concerns are on the spelling of each individual word, they then

concentrate on motoric, aesthetic factors such as the formation of the letters and the neatness of their handwriting. Punctuation and capitalization are the next areas of concentration. According to Graves, these first three categories come to have little importance because these skills soon become automatic. When children are comfortable with these demands, they are then able to concern themselves with the last two categories, which are topic information and finally revision. Revision is generally the last area of which children become aware. The reason for this, according to Graves, is that children only see the finished product of other authors and are not cognisant of the revising and re-editing that may have taken place before the product was finished.

In the last twenty years, the emphasis in studies of written language has shifted from analysis of the finished product to a close examination of the process of composing (Barritt & Kroll 1977). The objective has been to examine how a composing skill develops in terms of its underlying cognitive structures. This in turn, may help explain the observable actions. Many of the issues such as differences in oral and written language, types of error, and audience awareness, all have a developmental component to them as there are distinct differences between young writers and more experienced ones in these aspects. For example, young children's oral language is more complex than their writing, while the opposite is true of more mature writers (O'Donnell et al., 1967). As mentioned previously with Graves' work, and also discussed by Petty (1978), the concerns of older experienced writers were more on content aspects rather than on the mechanics which occupied the emphasis of the younger writers. Young children, also, are egocentric writers and have great difficulty taking the perspective of the reader and

being cognisant of the reader's needs. They, therefore are unaware of whether the message that they are trying to send is really being received (Litowitz, 1981).

Emig (1978), who is also a process theorist, discussed the role of the hand, eye, and brain in the process of writing. In seven and eight-year-olds the role of the hand is crucial since the area of concern is the act of literally forming the letters. The eye's usefulness is in the three basic composing stages of prewriting, writing, and revision. Lastly, Emig discusses the role of the brain in written language development. She states that in order to learn to write, children must reach a certain level of symbolic maturity in order to realize that not only can things be 'drawn' but also that speech can be symbolically represented.

According to some researchers, the three stages model (prewriting, writing, and revision) that was discussed by Emig and also by Hayes and Flower (1980), does not coincide with what young children actually do, however. As Scardamalia (1981) noted, beginning writers do not plan (prewrite) or review, since they find the writing task itself already difficult enough. Bereiter (1980) is of similar opinion when he states that the young writer does not have highly automated skills so that lower-order schemes such as the literal act of writing, i.e., handwriting, take precedent until these schemes are automatized.

Characteristics of Young Writers

Young writers, then, can be characterized as having a number of traits. Their generation of ideas far exceed their ability to express them. The end result of this is a loss of meaning in their work since their concentration is

on production rather than expression (Barritt & Kroll, 1978). The writing ends up lacking connectedness, with very few details, and those details that they do have are generally inadequate or incomplete. Ferreiro (1978) in her study of children's perceptions of what is needed in a written sentence, found definite developmental stages which she felt coincided with a Piagetian cognitive process framework. These stages commence with the children considering it necessary to have only the noun written, to a concept that the entire sentence is written down though not necessarily each individual word, to all words except articles, and then finally to the whole sentence. What is interesting is that children are not bothered by some of the contradictions in their stages of thinking. Neither does the children's concept of what is a word, correspond to the adults' perception.

Children have great difficulty taking the perspective of the reader whose needs they cannot recognize or understand (Vigotsky, 1962). When children are asked to be cognisant of this aspect, other qualities in their writing often suffer as a result. Children may be capable of manipulating many aspects of a written language task, but not always at the same time.

> Textual editing, which requires simultaneously monitoring for ideas, mechanical errors, as well as information missing for a reader is an impossible and incomprehensible task for most beginning writers (Litowitz, 1981, p. 86).

They adopt a strategy, then, of concentrating on only a few factors at a time in order to reduce the demands of the writing task (Hayes & Flower, 1980).

Another characteristic of children's writing is that they generally write in a linear, sequential way, and expect to have a perfect, finished product. They are not aware of the revising and re-editing that was demanded in the

polished product of a mature writer (Graves, 1983). Revision, in general, seems to be the factor that is the last to be developed. The next section will examine some of the research in that area.

Revision

Nold (1981) carefully reviewed the 1977 National Assessment of Educational Progress study of writing revision which demonstrated a distinct developmental change in the number of revisions that children made. Even at the age of nine, 40% of those children were not revising at all. At thirteen years of age, there were still 22% of the students who did not revise.

Although conscious attention to the purpose of revision may be taught, children do not seem to assimilate the knowledge of the importance of revision. Nold (1981) admits though, that even adult beginning writers do not naturally review their writing. In her suggestions for teaching, Nold stresses that revising should be "encouraged as a normal part of the writing process and not as a punishment for incompetence" (p. 20). What generally happens in schools is that multiple drafts are usually not required of the children, so that the suggestions and marking that the teacher puts on the papers are for consideration the next time the children write.

Most of the research on revision is with subjects who are at the late high school or college level. In those studies which report the numbers and types of revisions it is demonstrated that this task is a difficult one for students and it is late to develop.

Bridwell (1980), studied the differences between patterns of revision of more successful and less successful twelfth grade students. The most

frequent types of revision were surface revisions (spelling and mechanics) and word changes. Of those papers which were revised the least, over half were not only below the mean of the group in terms of their quality, but were also shorter. Extensive revising, though, did not necessarily correlate with quality writing but it did correlate with length of composition. While some good writers revised extensively as they were competent assessors of their own writing, others did not need to revise as much since their linguistic abilities enabled them to write an acceptable first draft. The competent writers were much more willing to change or eliminate what had been written on the first draft as compared to the writers of the poor essays. According to Bridwell, those students whose papers were of poor quality did not spend much time rereading their essays between drafts.

> Inspection of these papers demonstrated that these students were so concerned with surface and lexical level problems that they could do little more than begin again their laborious processes when asked to revise (p. 216).

Bridwell suggests that there are definite developmental differences in the ability to successfully revise. It is not clear from this paper what these developmental stages are. While a low rate of revising is usually associated with poor quality writing, a high rate of revising does not correlate with high quality. Her results suggest that, as Graves and Scardamalia have pointed out, poorer writers remain at a lower level of the writing process. Once students have become expert writers, individual styles seems to account for most of the differences.

Stallard's (1974) study of the writing behavior of twelfth graders found a different pattern. The more successful writers not only made a greater number of revisions, but also they were more likely to re-read their work

during the process of writing. The good writers made many more single and multiple word changes as they reread their composition. Liner (cited in Bridwell, 1980), in his study of students in grades 9 to 12, reported an increase in the frequency of revisions across grade levels.

These studies are all of high school level students as very little research has been done on the revision practices of elementary school students. In general, the younger students are thought to revise mainly in terms of spelling and mechanical corrections with very little concern with making their communication clearer to the intended reader by finding precise words.

The weakness in using revision as a factor in the study of written language has been discussed by Nold (1981). She had some criticisms of it as a measure as she did not think that it gave any information as to the overall success of the final product.

Evaluation

Nold's criticism of revision is generally the main criticism extended to all quantifiable measures of written language. On the other hand, many qualitative measures have been found to be too subjective, and have low inter-rater reliability (Meckel, 1967).

A major difficulty with written language research is in this area of evaluation. While the latest research is concentrating on process, most evaluation is on the product of writing (Litowitz, 1981). Some of the the measures include total number of words, number of words per sentence or clause, different types of ratios, and indices of syntactic maturity (O'Donnell, 1976). One of the most widely used indices is the one developed by Hunt

(1965) which he calls the T-unit. This syntactic unit is defined as one complete thought contained in a main clause plus any subordinate clauses that might be attached to it. According to Hunt (1965), the length of T-units increase with age. All of the syntactic indices are based on the observation that as children get older, their writing become longer and more complex. There has been some verification of Hunt's T-unit as a measure of syntactic maturity (O'Donnell, 1976), but the T-unit length was only found to show differences in children's writing when the assessment was spaced apart at Grades 4, 8, and 12 (Hunt, 1965). This seems to be a very crude measure as it would not seem to be sensitive to changes within less than a year. Very few studies, though, have indicated differences within a two-year span (O'Donnell et al., 1967). It has also been reported that the T-unit measure is least effective with students eleven years and under (Richardson et al., 1975). In general, although the T-unit measure may be the proper tool in certain studies, it would appear less useful for subjects under eleven years of age, or in studies which hope to measure change within a one year period. Under these circumstances, other objective ratings may be more pertinent.

Another quantitative rating that has sometimes been used is grammatical usage. Although a number of tests do use some criterion of proper use of grammar in the evaluation of written language ability, there has been found only a very low correlation between knowledge of grammar and the ability to write (West, 1967).

Fluency counts have often been used as a measure in the search to find an objective rating tool (Armstrong, 1965). This fluency, or composition length, which has been considered one of the best predictors of quality

(Stewart & Leaman, 1983), has been found to correlate with IQ (Percival, 1966). It also appears to differentiate between high and low ability students (Rosen, 1969). Some studies which have employed strategies to increase fluency have also found that there have been other positive effects along with the longer compositions (Van Houten et al., 1974). The researchers found that using explicit timing of a composition period, immediate feedback on the number of words written, and the posting of this score, resulted in not only a significant increase in production but also in an increase in story quality.

Although it is a standard measure in many studies (Brigham et al., 1972; Van Houten et al., 1974; Richardson et al., 1975; Moran, 1981; Rummel & Dykstra, 1983), the use of fluency as a measure of writing improvement has some weaknesses. For example, in the Richardson (1975) study, the individual passage length in this research of 521 eleven-year-olds ranged from less than 50 words to over 600 words ($\underline{M}$=204.9, $\underline{SD}$=106.7). This points up one of the difficulties with using fluency as a rating tool. The variability between subjects was very great. Other researchers have pointed out that not only is the variability between subjects large, but there is also a great discrepancy within subjects (Anderson, 1960). As Wilkinson et al., (1983) have noted, there is such variability within individual student's writing, having one sample of their writing is of little use in studying their competency. This weakness can be overcome in two ways, either by having a large sample of subjects, or by having a large number of writing samples from each subject so that this variability can be averaged.

Myklebust (1973) has written extensively on the developmental changes in children's written language and has charts to demonstrate a number of

quantitative indices, one of which is fluency. He has found that "There were significant increments in story length for both sexes up to the age of thirteen (p. 17)."

For children aged seven the mean number of words was 27.6 (SD= 17.1); at age nine, the mean was 89.8 (SD=51.7); at eleven years of age it was 116.0 (SD=56.0); and at thirteen it was 149.1 (SD=70.1). While there are significant increases, it is also obvious by looking at the standard deviations that there were substantial variation in the amount of writing that occurred for each age group. Myklebust also compared the total amount of words with other variables and came to the conclusion that:

> Language fluency (as indicated by total words) abstract ideas and meaning were interrelated. ...This implies that word fluency is related to imagination, use of abstract thought and expression of meaning (p. 22).

Because of the inter-subject subject variability which is prevalent in written language, there is serious difficulty in evaluating significant change in students' writing ability. Consequently most researchers compare children over a much wider range of time than is done for other educational tasks.

In Beaven's (1977) discussion of evaluation, a basic premise is that growth in writing is very individualistic, and that it "occurs slowly" (p. 136) which is her explanation as to why many research treatments fail to show significant improvement.

> ...improvement may occur over a much longer period of time than the six-, ten-, or even fifteen-week periods which teachers and researcher usually allow (p. 136).

The slow growth in writing improvement is paralleled in other areas of language development. Cazdan (1972) showed that it took children between eight and twenty months to master the use of plural nouns.

Hunt's (1977) studies of syntactic structures only look for changes at two and four year intervals. In a book describing tests of written language which use quantitative measures (Fagan, Cooper, & Jensen, 1975), there are a number of tests based on Hunt's work. They, too, look for significant changes only at two or more year intervals. For example, in the Indices of Syntactic Maturity (Dixon-Hunt-Christensen, 1970) test, the normative values are for Grades 4, 8, 12, and 16.

In another test, the Transformational Analysis of Compositions (Dupuis, 1972), the means are given for Grades 9 and 11; and for the Syntactic Maturity Test (O'Donnell & Hunt, 1970), mean normative data is given for Grades 4, 6, 8, 10, 12 and "skilled" adults.

Myklebust also looks for changes in no less than two-year intervals from age nine to age fifteen for some measures, and ages seven to seventeen for others.

Most research studies independent of their methods of measuring students' growth do not use less than a two-year interval for their comparison groups and many feel it necessary to use even longer intervals. For example, Finn (1977) describes a study by Knapp which compares total words at grades 4, 8, and 11.

In summary, many researchers in the area of written language do not usually expect to see significant differences in writing variables in less than a year.

The next section will discuss learning disabilities, its definition and some research issues. The written language of learning disabled children will then be presented in some detail.

Learning Disabled Children

Children with learning disabilities have many of the same characteristices of young immature writers. Where they differ is in the longer length of time that they remain at one stage of development, and the difficulty they experience with the preliminary tasks of reading and writing. In order to try to understand the problems that learning disabled children have, it is necessary to provide a definition and some description of this population.

One of the most widely accepted definitions is from the U.S. Public Law 94-142:

> 'Specific learning disability' means a disorder in one or more of the basic psychological processes involved in understanding or in using language spoken or written, which may manifest itself in an imperfect ability to listen, think, speak, read, write, spell, or to do mathematical calculations. The term includes such conditions as perceptual handicaps, brain injury, minimal brain disfunction, dyslexia, developmental aphasia. The term does not include children who have learning problems which are primarily the result of visual, hearing, or motor handicaps, of mental retardation, of emotional disturbance, or of environmental, cultural, or economic disadvantage (Lerner, 1981, p. 6).

The accepted definition of learning disabilities is not very satisfactory. It is based on descriptions of learning difficulties after all other possibilities for these problems have been ruled out. A way to view it is in the same terms as the concept of intelligence. There is a range of variables that is embodied in this concept, and there is a range of ability attached to each variable. Children are called learning disabled when they display an arbitrarily set degree of difficulty in certain skills which are needed in order to learn to read, write and do mathematics. Generally, this limit is defined as a skill level being two years or more below chronological age. As a group, though, children with learning disabilities are very heterogeneous since

each child may display a separate pattern and degree of disability. According to Dobbins and Bickel (1981),

> The spectrum of abilities of children in special education is very wide. Indeed, the range of individual differences in ability in these children exceeds that which exists in any other sector of education (p. 25).

Because of this heterogeneity, many difficulties are encountered when researchers try to obtain a comparable control group. For example, according to reported studies (Valtin, 1978-1979) of good versus poor readers, the poor readers' mean IQ is generally 95, while the good readers' mean is between 110 and 115. If this is controlled for, the two groups are then really not representative of the general population. Controlling for IQ could still result in the two groups differing in their specific abilities since the distinguishing feature of learning disabled students is their extreme variability in their subtest scores (Harber, 1981).

Harber's (1981) assessment of 229 research studies on learning disabilities found that the majority were quasi-experimental in nature. She stresses, however, that this is usually due to ethical and remedial considerations, and under these circumstances, the designs used are "an appropriate substitute" (p. 374). Harber also suggests that in the future, researchers try for more homogeneous subgroups in their studies and in particular, to concentrate on studying the severe learning disabled subpopulation.

Even given the heterogeneity of the learning disabled group, there are some commonalities. One of the most obvious is that if children have disabilities with listening, speaking, or reading, then they will have

difficulties with the writing task both developmentally and structurally (Litowitz, 1981). The reasons for this are explained briefly.

An intact, receptive language capacity is necessary for proper listening. Problems in that area relate to auditory memory (both immediate and delayed), auditory discrimination, auditory attention span, and sequencing ability. Children with auditory difficulties often do not "hear" unstressed syllables, word endings and even words. Since they are not cognisant of them, they do not write them.

When such children have good receptive language, their difficulties may lie in the expressive or speaking capacity. They may have problems with name labelling or retelling a story in an organized and coherent fashion. They may also be immature in their use of complex syntax. According to Menyuk and Flood (1980), almost all children who have a reading problem have a language problem. A written language processing problem is also likely to occur if children have an oral language processing problem whether it is in sentence memory, language development, or syntactic processing. Children who have speech perception problems have trouble decoding a word, while those who are slow to learn word meanings have trouble comprehending the word after they have decoded it.

Lanyon (1974) has looked at the relationship between faulty pronunciation and misspelling and has found that investigations supported a 'general verbal factor' in the spelling task. Proper spelling though, also demands both visual spatial and motor skills plus an efficient sequential memory.

There is a smaller group of learning disabled children whose language abilities are intact, but who have deficits in visual processing skills (Lerner,

1981). These may be with visual discrimination, visual sequencing, and/or visual memory. Such children have great difficulty with what a word looks like, or what letter shape goes with a specific sound.

Ferreiro's (1978) study of children's developmental concepts of a written sentence demonstrated that young children have great difficulty with the concept of spaces between the single words since these spaces do not have any relationship to the spoken sentence. Children with learning disabilities demonstrate this difficulty in their written work time and time again. For example one student wrote that a certain idea "is above and beyond me". How he spelled it was "is a bouvin beon me". Another child wrote about his "next door neighbor" as his "lescdoornaber". Neither of them 'knew' what these words should look like and were just writing the words as they pronounced them.

Written Language of Learning Disabled Students

In terms of writing, Menyuk and Flood (1980) state:

> Writing is a recursive idiosyncratic process in which writers must control the linguistic, rhetorical and substantive content of their message (p. 10).

These researchers did not compare learning disabled and normal students, but looked at average versus able readers. They found differences between these groups as the average readers made twice as many errors as the able in all types of errors. They hypothesized that the more able possessed more sophisticated skill in the mechanizations of language.

There is very little research which describes the difference between the writing process and the performance of learning disabled students and their normal peers (Poplin et al., 1980). After Myklebust had studied the

development of normal children's written language on a number of factors, he then compared these same means with those of reading disabled children. Myklebust's (1975) work reports lower scores for learning disabled students in those areas of total number of words and words per sentences, plus such categories as ideation and syntax.

In his chart which compares normal and reading disabled children in terms of their total words per story, Myklebust reports that at age nine the mean for the normal group was 90.4 words, compared to the reading-disabled children's 28.7 words. At age eleven, the means were 116.0 to 49.0 words for normals and learning disabled repectively. By the age of thirteen, the mean for the normal children was 149.7 words, while the mean for the learning disabled group was 58.2. At the age of fifteen, interestingly, the data shows a decrease for both groups with the normal group having 138.0 mean words and the students with learning disabilities only writing an average of 35.0 words. This may be a function of either the small sample size for this age group or the nature of the task being different for this age group. In general, Myklebust found that learning disabled children write approximately one-third the amount of words of the average group. He stated that:

> the reading-disability children were markedly deficient in output of written language, suggesting a lack of fluency, a laboriousness, in the use of the written word (p. 72).

Poteet (1978) found a difference between learning disabled and average students with the learning disabled children having significantly more errors in categories of punctuation and word omissions. The finding was similar for the total number of words and sentences, with the learning disabled students writing only half as many as their non-disabled peers.

Poplin and her fellow researchers (1980) used the Test of Written Languge (TOWL) developed by Hammill and Larsen (1978) with both learning disabled students and average students in grades 3-4, 5-6, and 7-8. They wanted to ascertain if the students with learning disabilities differed from their non-disabled peers in their writing ability as measured by a number of the TOWL subtests. Their conclusion was that children with learning disabilities can perform as well as their regular peers in such areas as theme and even vocabulary, but that they perform significantly worse on the mechanical and stylistic aspects of written language. For some reason, the researchers did not report a comparison of the writing fluency or production of words of the different groups. No reason for this is given, except to state that this was the first of a series of studies.

The researchers' suggestion to those working in remediation is to reinforce and emphasize those aspects such as ideation and meaning and concentrate less on the mechanical aspects. This, they felt would build up the students self-esteem and would result in a more positive attitude towards writing tasks.

A study by Moran (1981) reported somewhat different results on a written language task with learning disabled children. The population chosen, though, was older secondary school students who were compared with low achieving students instead of with an average peer group. Twenty-six learning disabled students were compared with the same number of low achieving students in grades 7 through 10 to see if there was a significant difference between low achieving and learning disabled students' written performance. The only significant difference was found to be in spelling performance in which low achievers made significantly fewer errors than the

learning disabled group. Moran reported the range as well as the median for the two groups on a number of written language measures. Although she did not comment on it, what was interesting was that on a number of measures the range for the learning disabled group was much larger than for the low achieving group although the median differences were not significant. For example, in a comparison of median percentages correct for conventions (which were defined as "features governed by language rules" (p. 274) such as subject-predicate number agreement, or noun-plural agreement), the medians were 93.50 and 100.00 for the learning disabled and low achieving groups respectively. The marks, on the other hand, ranged from 36% to 100% for the learning disabled students as compared to the low achieving group, whose marks only ranged from 76% to 100%. Again, for the measure of mechanics, which included punctuation and capitalization, the marks for the learning disabled group were between 14% to 100%, while the marks for the low achieving group only ranged between 44% to 100%. The medians, which were not significantly different, were 81% and 78%. These wide ranges seems to support the finding of the great variability within the group characterized as learning disabled, and also seem to indicate that important information can be lost when this variability is not taken into account and only medians are compared.

Moran did not find any significant difference in productivity between the two groups. This could have been affected by the instructions as the students were told to write "at least six sentences". It is questioned whether this would not have an effect on the amount that they would produce, as many students would consider the task to be completed after the six sentences were written. A number of studies have already shown that

the instructions do have an effect on the amount that a student will write (Van Houten, Morrison, Jarvis, & McDonald, 1974; Alvarez, 1983).

Generally, though, the research suggests that children with learning disabilities write significantly fewer words per composition than their normal peers, who, for example, in Poteet's (1978) study wrote 42% more than the learning disabled students. This is a very important finding as it is often argued by educators that remedial help cannot be given in written language if the students are writing minimal amounts. Children must begin to write longer compositions before they can begin to receive remediation (Kraetsch, 1981). Myklebust (1973), also states that "Fluency, as represented by story length, must be enhanced (p. 132)." Since some studies which have employed strategies to increase fluency have also found that there have been other positive effects along with the longer compositions such as story quality (Van Houten et al., 1974), this might also be true for learning disabled children.

Another study which reported increase in quality in conjunction with an increase in quantity is the one by Brigham, Graubard, and Stans (1972). Using "operant learning principle" techniques (p. 422), they attempted to manipulate three objective aspects of composition with thirteen remedial students. These students were described as having academic failure and behavior problems. The Grade 5 students were randomly placed into three groups, and twice a week they were instructed to write on a set topic but were given no time limit. At the beginning, a baseline was established, and they were then instructed that they would receive points for their number of words. Extra points were added for number of different words and then number of new words. These conditions were varied as to the order initiated for the three groups.

The results indicated that all groups increased in the number of words written. The "different-words" and "new-words" contingency produced little overall effect and may have been a distracting element. The increase in number of words also correlated with an increase in quality assessed on five dimensions by independent judges. The highest correlation, though, was in the "new-words" effect. The researchers also noted a change in the students' attitude towards the writing task with a lessening of resistance to writing and fewer negative comments, and an increase in the amount of time spent.

In summary, Lerner (1981) best describes students who have difficulty with written language stating that they:

> soon learn to beat the game by limiting their writing vocabulary to words they know how to spell, by keeping their sentences simple, by avoiding complex and creative ideas, and by keeping their sentences short (p. 344).

In order for learning disabled students to develop maximally their writing ability they must stop concentrating on mechanics such as spelling and concern themselves with their ideas (Johnson & Myklebust, 1967).

Revision of Learning Disabled Students

Besides writing shorter compositions and having difficulty with the mechanics of writing, children with learning disabilities do not revise or proofread as much as regular students. Polloway et al., (1981) speculate that the reasons for this may be that they are concentrating on completion of the task, or that they associate revision with a failure syndrome since their previous assignments may have been "over-corrected". Another reason for the failure of learning disabled children to proofread may be a visual difficulty which makes it hard for them to successfully scan their work.

There is a qualitative and quantitative difference between the way skilled writers revise as compared to unskilled or even randomly selected peers. Stallard (1974) found significantly more revisions, an average of 184 in the work of skilled Grade 12 students as opposed to an average of 64 revisions for a randomly selected group. Stallard also found a difference between the groups in the time spent on the writing task: 40.6 minutes for the skilled writers versus 22.6 minutes for the random sample.

The qualitative differences in revision that have been observed between skilled and unskilled adult writers is described by Sommers (1978). The skilled took a global approach to the revision task first, and then worked on specifics. The unskilled writers, on the other hand, concentrated only on revising at the word level.

Motoric Problem

If children have difficulties in spatial direction and sequencing, the motoric aspect of writing (starting at the top left-hand side of the paper and going horizontally across, and then down and back to the left-hand side again) can be a frustrating task (Silverman et al., 1981). It demands spatial skills as does the formation of letters, and the spacing between words. The legibility or non-legibility of the written work can have serious implications. There are some studies that indicate that the efficient monitoring of written work can only be accomplished if there is a certain degree of legibility (Polloway et al., 1981). In other words, not only may the quality of their writing be lowered because they may be concentrating on the physical act of writing, but, if it is messy and poorly formed they will have difficulty simultaneously rereading and writing their work.

Spelling

In Moseley's (1974) study of the correlates of spelling ability, he was not comparing learning disabled students per se, but poor spellers versus competent ones. His conclusions, though, were somewhat similar to Poplin and her colleagues (Poplin et al., 1980), and he found that where the weak spellers differed were in lower vocabulary and punctuation scores. In the more complex task of comprehension, though, there was no difference between the groups.

Teaching Methods

Silverman et al., (1981) have expressed grave concern over the lack of attention that is given to teaching methods to improve the written language of learning disabled students considering its importance in education. In one study they reported on, the students spent less than five minutes a day on written language tasks if they were beginning readers, and even when they could read at a second, third, or fourth-grade level, they only spent 7.5 minutes in creative writing.

The majority of the research evidence, though, strongly supports the concept that children learn best what they spend the most time doing (Fillmer, 1968; Blake, 1971; Graves, 1978). It is important then, in order for children to learn to be better writers that they must spend more time writing. Silverman et al., (1981) support the importance of providing the learning disabled students with more written language instruction and they also emphasize that the students main concern should be with generating ideas and not with the mechanics of spelling, punctuation, and the like.

The Computer and Word Processing

There are three basic types of articles in the literature concerning computers and writing. First, there are general articles illustrating the advantages and disadvantages of using a computer with reference to its word processing capacity. Some of these articles are directed at professionals working with learning disabled children (Bennett, 1982; Papert, 1982; Shiffman, Tobin & Buchanan, 1982; Wall & Taylor, 1982; Hofmeister, 1982; Kearsley & Hunter, 1983; Torgesen & Young, 1983; Hagen, 1984). For example, Hofmeister discusses the use of the computer as a vocational tool for exceptional children and states that:

> Business education classes in high school that do not involve the computer for word processing and bookkeeping will clearly be limiting the practical skill development of their students. (p. 118).

Other authors point out the uniqueness of learning disabled students and present suggestions as to how to utilize the computer most effectively. For instance, Shiffman, Tobin and Buchanan (1982) state:

> Learning disabled children need to be recognized as being very unique in their social and emotional behaviors and learning style, and it is probably a poor procedure to have two or more children working on a computer at the same time (p. 558).

Some authors are very strong in their endorsement of word processing. Comparing paper-and-pencil writing, Hagen (1984) writes:

> The alternative provided by a microcomputer and word processing programs for learning disabled children is equal to the reinvention of written language designed specifically for their needs (p. 38).

The computer's capacity to allow students to revise is the main factor that is stressed in these articles. According to Fisher (1983):

> Any tool that encourages students to properly revise and edit their written work is a welcome addition to the classroom (p. 88).

While there is some research on the effects of word processing on adults and older students' writing (Schwartz & Bridwell, 1984), there is still little research on the effects of word processing on younger students' writing, but some reports of teachers' preliminary findings indicate that students write more and edit more often and more carefully (Fisher, 1983). No specific studies or researchers are cited, however. Bradley (1982), does give examples of some of the research being undertaken to improve students' writing through computer use, and also reports on two other categories of research, the use of electronic mail as a writing motivator, and text analysis as a teachers' aid.

The second type of article is the anecdotal and descriptive one presenting the students' writing experiences on the computer (c.f. Schwartz, M., 1982; Watt, 1982; Schwartz, L., 1983; Arms, 1984). Some of these articles specifically describe dyslexic or learning disabled students. The recurring theme in these papers is that the word processor has the potential to change the students' thinking about revision. Editing need no longer be perceived as a negative and insurmountable action, but as a challenge that will allow the students' writing to be relevant and meaningful (Schwartz, 1983; Arms, 1984).

Papert, Watt, diSessa, and Weir (1979) described a learning disabled child who did not want to use the "turtle", but preferred to write stories on the computer instead. Since 'Tina' (as they called her) and her computer experience was one of the first published examples of a learning disabled student using a word processor, the description of her sessions will be discussed in terms of how they are indicative of learning disabled students and what one can derive from a close examination of her experience.

In terms of attitude towards the computer, Tina not only personalized the machine, but also fussed and acted babyish when someone else used her particular computer. This, while not attractive behavior, was a very successful technique since no one touched 'Peter' ('her' computer) again.

According to the report, as Tina successfully interacted more with the other children this behavior subsided and she became more accepted by the group. Such inappropriate social behavior is sometimes characteristic of children with learning disabilities. Another common characteristic which Tina displayed was the long amount of time it took her to settle down and start to work. This is also not an uncommon trait as many learning disabled students have difficulty changing set or activities.

Since Tina was not interested in turtle geometry (the usual method by which children learn LOGO programming), a simple text-editing program was developed for her. The researchers then described some of Tina's writing behaviors while she was working on the computer that they considered detrimental to her success as a writer. She had a habit of clearing the text screen which interfered with her learning as it eliminated the possibility of her responding to error messages and maintaining continuity in her composition.

There are two important issues here. In order for Tina to stop clearing the text screen, she first had to grasp the significance and importance of rereading her work. She may not have been at that stage in her writing development. Her actions may also have been her (extreme) way of coping with too much text on the screen at one time.

At the McGill-Montreal Children's Hospital Learning Centre (site of this study), a number of learning disabled children have been observed who felt

the need to space their lines for easier rereading. Perseveration is also a factor with some learning disabled children who feel compelled to repeat an action over and over again. An example of perseveration in one subject's writing is shown below.

> ther is ten players on the ice if ther is mor then ten players on the ice ef ther is mor then ten haw mene onthe will go in the peldebos 5 players frum ick tem on the ice
>
> (There is ten players on the ice. If there is more than ten players on the ice ... If there is more than ten ... how many on the (ice) will go in the penalty box. 5 players from each team on the ice ..)

For this child, writing is such a difficult task that he loses his train of thought and starts to repeat himself.

This previous example also typifies a number of other observations about Tina that the Brookline researchers described. Not only did Tina never proofread, edit, or add, but when she was asked to reread her stories, she consistently read words that weren't there.

Another of Tina's traits which the researchers described as causing her grief with her written work was that she had a strong desire for completion and correctness in all her work. One of the most difficult situations arises when a learning disabled child is also a perfectionist and a writing task becomes a perfect setup for failure and defeat.

The coping strategy devised by Tina was one where she developed a set pattern of computer activities which she would and wouldn't do, and she kept

to these firm boundaries. While this strategy prevented her from learning as much as she might have been able to, it did allow Tina a feeling of comfort and security within which she could work.

The explanation that the teachers used as to why Tina did not work in turtle geometry was that by "writing stories", she wasn't competing with what the others were doing and therefore there could be no comparison of her work with the other children's. While this was a reasonable explanation, one wonders if there weren't other reasons involved. Since writing is so difficult for learning disabled children, comparison with regular students is very obvious even if the normal students' compositions were not in front of her.

A more logical explanation may be that Tina's main learning disability may have been in the spatial areas. This is hinted at in the comments that when Tina first tried Logo, she did not seem to see a connection between her commands and the drawing. Tina's need to have a clear screen and her constant demands for help with a rectangle she was trying to draw, also lend credence to this assessment.

The Brookline Report's extensive description of Tina's progress is important as it provides some clues as to why learning disabled children may be successful in writing on the computer when they are not in class. These factors are the same that have been suggested in the articles on the benefits of the word processor and with Tina, they have been found to be true. Although she was a fanatic about errors, Tina could easily rub them out and so an immense source of tension and frustration was eliminated. There was a professional and 'finished' quality about her computer printouts and she could make many copies, therefore she received even more positive feedback

from her endeavours.

In conclusion, one important aspect of teaching methodology was noted in this report. As Tina was sensitive about corrections, the teacher never pointed out any of her spelling mistakes, but only answered the questions that Tina posed to her. According to the authors, Tina therefore assumed that the rest of the composition was correct and she was proud of her work. This specific teacher strategy may have been important. That raises the issues of what would have happened if the teacher had pointed out spelling and grammatical errors or, as very often happens, if her family had? Another issue that is raised by this report is that Tina felt unique because no one else wrote stories, but what if others had written stories? Would she have achieved the same level of success? In other words, how generalizable is her experience?

Aside from the general articles on computer uses in education, and the descriptive accounts, the third type are those few research reports of studies on the use of the computer with students.

Researchers who are working in the area of children's writing with computers admit that this research is just in the preliminary stages and that there are still many unanswered questions to be resolved (Rubin, 1983).

Levin, Boruta and Vasconcellos (1983) have a 'writing environment' program called Writer's Assistant, and they have undertaken an exploratory analysis of the writing processes on computer. Levin is particularly interested in the comparison between the novice and expert writer in order to understand how best to assist the novice using computer-based environments for writing. The approach that Levin considers central to his work is one he calls "dynamic support" based on the work of Feuerstein

(1979). Dynamic support is that which is given to a novice in order to have the task successfully completed. As expertise is acquired in the subtasks, this support is progressively withdrawn. Levin considers that the keystroke data, and the observations that have been collected on children as they composed with the computer, as being "powerful" information with which to "look at the progression to expertise in writing (p. 221)".

Levin et al., describe a preliminary study in which two groups of students were given pre- and post-test writing tasks using a paper and pencil. The experimental group used the computer to write their compositions for four months. The results were analysed with respect to total number of words per sample, and general quality using a holistic approach. They found that there was an increase of 64% in the number of words in the computer-use group, from an average of 45.1 words to 74.1 words per sample. The control group, on the other hand displayed no increase in fluency as their average pre-test length was 44.6 and the post-test was 46.4. There was also an increase in the quality rating for the experimental group while there was no change for the control students.

In a similar study by one of Levin's colleagues, Quinsaat (1983), the results demonstrated the same pattern. In the computer group, the fluency pre-test was 85.8 words while the post-test increased to 165.4 words on a paper-and-pencil task. The control group did not show any gain as their scores were 77.1 and 77.8 words respectively. These studies are of particular importance since they seem to be demonstrating that a computer writing environment generalizes to the traditional paper-and-pencil environment. Students who practice their writing skills on a word processor ultimately seem to write better even on paper.

In another preliminary study at Bank Street College by Kane (1983), it was reported that students using a word processor spent more time composing a paper, often using 5 or 6 sessions to complete their composition, as compared to a reported 30-45 minutes on a paper-and-pencil task.

Therefore, one of the most consistent results that has come out of the sparse studies on composing with the computer is that average children will write more and spend more time using a text editor as compared to paper-and-pencil tasks (Daiute & Taylor, 1981; Kane, 1983).

Other researchers are developing and assessing programs that not only have word processing capacities, but also tutorials to aid the writing process. Rubin and her collegues are working on a writing curriculum called QUILL in which one of the goals is to provide a writing and communication environment for students that will facilitate good writing behaviour (Rubin & Bruce, 1984). This environment includes a simple text editor (the Writer's Assistant developed by J. Levin) with easy formatting aids, planning aids, publication aids, an information exchange system, and a message system which would demonstrate to students the concept of writing as a means of retrieving and disseminating information. Rubin hopes that the students would then become more aware of the importance of the purpose of writing, and the need to develop the ability to communicate to a specific audience.

Rubin cautions however, that the developing programs for writing tasks must be carefully assessed as to their effect on students.

> Because learning to write is critically dependent on initiative, computer based writing activities need to be especially cautious about undermining student's sense of control over their task. (Rubin, 1983, p. 213).

Some preliminary studies by Woodward, Bereiter, and Scardamalia

(1981-82) seem to indicate that this cautionary note is not unjustified. These researchers undertook two studies to assess the results of using an interactive composing program. The first study, in which the subjects were twelve Grade 6 students, utilized a computer program that had a word processor plus "help" procedures to aid the students in writing an opinion essay. This program was to facilitate the cognitive tasks needed for composing and thus lessen the burden on the students. It offered spelling assistance, sentence openers, contentless prompts, and an abstract elements list such as "give a reason" or "an opinion". After the students were instructed on the use of the program, they were given two similar opinion topics, one of which was written by paper-and-pencil method, and the other using the computer aided composing program. The students' essays which were written with the aid program were then compared to the paper-and-pencil one in terms of number of words produced and on a holistic quality rating. The authors reported no significant effect for either fluency production or quality. The students did spend significantly more time on the computer task, though, and their reported impressions were very interesting. The majority of the students preferred writing with the computer, and they felt that while this program could help them write better, they did not feel that their computer composition was of better quality than their written task. The authors hypothesized that the computer assistance was at too low a level in the writing process and might even be interfering with higher cognitive processes.

In their second study, Woodward, Bereiter, and Scardamalia introduced a compulsory intervention format which interacted with the students at the end of each sentence. The written product was compared with not only a

similar paper-and-pencil task, but also with an essay written using just the word processing capacity of the computer. The results were similar to the first study: no significant differences in number of words were produced under the three conditions. In terms of the quality rating, though, the word processing program produced the highest results. The authors suggest that the intrusive nature of the interactive program interferred with the quality of the writing probably because the students were trying to adopt new strategies offered by the computer.

One of the main weaknesses in these studies was the few sessions that the students were given on the computer. It was noted at the McGill-Montreal Children's Hospital Learning Centre that not only students but also teachers needed many sessions on the computer before they were comfortable enough to successfully use the tools of a simple word processor. As the researchers have pointed out, it seems quite clear that a one-time experience of students on the computer will not effect change in their writing processes, and a longer time frame is needed before any conclusions as to the effectiveness of specific composing aid programs is drawn.

Since the researchers concluded that the first program was drawing upon only lower level strategies of the writing task, it would be interesting to study the effect of this program on students who have difficulty at these levels to see if, over time, their writing qualitatively improves.

The researchers' conclusion, though, seems justified and worth noting. They write that:

> Typically, children write very little. Anything that can encourage them to become involved in the development of their composing skills is valuable. Whether it is the magic of the computer or the assisstance provided by procedural facilitation is only of theoretical importance. From the practitioner's point of view, computer assisted composition is making composing more enjoyable and therefore should increase the student's willingness to compose (Woodward, Bereiter & Scardamalia, 1981-82, p. 147).

Summary of the Chapter

This chapter presented a discussion of the development of written language, the characteristics of young writers, and their revision behaviour. A general description of learning disabled students was also presented along with a discussion of the research into their written language. The final section dealt with the literature pertaining to computers and word processing.

Chapter III

RESEARCH DESIGN

Hypotheses

Children with learning disabilities can be thought of as having either of two broadly defined areas of weakness: language, or visual spatial difficulties. Both types or combinations of difficulty may result in impaired written language skills. In most of these cases, the computer may be helpful. For children with visual spatial difficulties the computer can alleviate a number of problems. As has been pointed out, children do not have to be cognisant of the many motoric acts involved in handwriting. The physical act of forming the letters and words, which may often be the dominant and absorbing activity, is virtually eliminated with the computer. Working on the computer, therefore, may be a less arduous and frustrating task for these children. Thus, if the children were provided with some simple text editing commands on a computer, they would not need to concentrate totally on how their work looked or whether each word was spelled correctly, and they could work more on ideas and communication, knowing that they could always return to edit their work later. The following hypotheses were developed to study the effects of a word processor on learning disabled childrens' writing:

Hypothesis 1

Learning disabled children will show an increase in fluency when they use the computer for written language.

Hypothesis 2

Learning disabled children will show an increase in the number of editing procedures when they use the computer for written language.

Hypothesis 3

Children with learning disabilities will show an increase in fluency on written language paper-pencil tasks after they have used the word-processing capacity of the computer.

Subjects

The learning disabled students who were included in this study had all been classified as learning disabled by the staff of the Learning Centre after extensive evaluation. All fell within one standard deviation on the WISC-R full-scale intelligence quotient and were 'underachieving' by at least two years on a number of reading or achievement tests such as the Stanford Diagnostic Reading Test, the Spache Diagnostic Reading Scales, the Wide Range Achievement Test, and the Peabody Picture Vocabulary Test - Revised.

In addition, a committee comprising a number of psychologists and remedial teachers chose the subjects for the research project. The children had to have already been accepted by the Learning Centre for remediation, and they had to have had known difficulty with written language aside from their specific learning difficulties. In other words, the children must have had great trouble coping with the written work in the school setting. Generally, the children who were included in this group were those for whom a regular written language remedial program had not been successful. Since the children who come for remediation to the Centre are those who need special, one-to-one remediation which regular schools can not provide, they tend to be the most severely learning disabled.

The students also showed no evidence of any other disability of a physical, mental, or social nature. All the students were of elementary school age with the range being between eight and twelve years of age. Out of the twelve subjects, four were female, this being a higher proportion of female to male than is usually found in the learning disabled population (Lerner, 1981).

Research Design

After careful examination of the literature due to both learning disabled children and written language development, it was decided that a control group for this particular study would not contribute substantially more information pertinent to the questions under study. The reasons for this are as follows. The review of the literature in Chapter II included a discussion of the weaknesses in most studies pertaining to the difficulty of obtaining a valid control group for learning disabled students (Dobbins & Bickel, 1981). Some studies questioned the usefulness of using IQ scores as a criterion for making comparable groups when a major characteristic of learning disabled students was their variability on the subscores of the IQ tests (Harber, 1981). Children whose profile scores range from 9 to 11 on the WISC-R subtests are probably very different students than those whose scores range from 3 to 18, even if their full scale scores are identical. Controlling for age, then, ten-year-old learning disabled students whose reading age may be seven years, are being compared with children whose chronological age and reading age are the same (Valtin, 1978). Conversely, if the reading age is kept constant, ten-year-old learning disabled children are then compared with seven-year-olds who have very different

characteristics. The main difficulty with attempting to obtain a comparable learning disabled control group was, again, the variability and uniqueness of each child and the type and severity of his or her disability. According to Harber (1981) the:

> findings of research based on a homogeneous population of severely learning disabled individuals might differ substantially from findings based on a more heterogeneous, less severely disabled population, even though the same variables were measured (p. 379).

Thus, because the size of the severely disabled group being studied is small, a valid control group would be difficult to obtain, and difficult even to determine its parameters.

The literature on written language demonstrates that there is great variability among students who are the same age (Richardson, 1975). Given that fact, it was decided to use a 'subject as his own control' design, and use the students' own baseline behavior to compare whether any change takes place.

Although given the logic of the design choice, the weaknesses inherent in a one-group, pretest-posttest design must be acknowledged. Cook and Campbell (1979) discuss how in this design, other factors might account for the rejection of the null hypothesis. According to them, the researcher must demonstrate the implausibility of these factors being the major contributing ones and may call upon common sense, theory, or experience to help build the case for using this design.

In the study of written language development, one of the outstanding features is that very few studies have even tried to measure change occuring under less than two years (Beaven, 1977). Most researchers acknowledge that while there may be yearly growth in written language development, this growth would be difficult to measure in such a short space of time due to variability both between and within subjects (Wilkinson et al., 1983). Since the present study is to be

undertaken over a six-month period, it is assumed that if any change is noted, it would be less likely to be attributed to maturation in written language than to skill improvement.

Apparatus

The computer used in this study was an APPLE IIe microcomputer, equipped with a dual disk drive, colour monitor, and an Epson printer. After extensive assessment, the word processor that was chosen was the Bank Street Writer developed by Intentional Educations, Inc., Franklin E. Smith, and Bank Street College of Education, and published by Scholastic Inc.

Procedure

Time spent on the computer was part of the students' remedial program, and they were aware that the main emphasis was to be on written language practice. Both the teaching and the observations were done by the researcher. Because these were performed in a clinical setting, certain elements were situationally dependent. There was a set departure time, but the time students began depended on their other therapist and the work being done with them. Generally, the time spent on the computer was a half an hour.

Teaching Method

The directions given to the subjects were very similar to those described by Silverman et al., (1981) and Levin, Boruta and Vasconcellos (1983). In the writing assignments the children were instructed to concentrate on generating ideas and not to concentrate on mechanics, spelling, or punctuation until after they had completed their work. Since one of the objectives was to promote more positive

attitudes to the writing task, teacher instruction was limited to suggestions to reread the work and decide if there were any changes they would like to make, and/or spelling they would like to check.

When each child was satisfied with his or her composition, it was saved on his or her own diskette. During each session, children had the choice of continuing their previous story, or starting a new one. If the children had difficulty thinking of a topic, the Creative Story Starters (D.L.M.) was offered to them to help generate ideas.

All of the students' final compositions were printed out and made into a book for them to keep.

Collection of the Data

The students' compositions were printed out on the printer and the fluency assessed. This productivity of the students was determined by the total words generated per composition where 'words' were defined as any group of letters intended to represent a spoken word whether it was spelled correctly or not (Kraetsch, 1981).

A detailed log was kept by the researcher for each session. The observations in it provided information on the number of edits that each subject performed during the writing of the compositions. All of the childrens' editing was carefully noted, and those that arose from accidental typing errors were not included in the assessment of number of edits per composition.

Pretests and posttests were collected from the students which consisted of paper-and-pencil composition tasks given under the same conditions as the computer composition tasks. In addition, examples of the children's school writings were collected the month before the children started remediation at the Centre

and a month after they had finished.

Summary of the Chapter

This chapter contained a description of the hypotheses to be studied and, the way in which the subjects were selected. The rationale for the research design was presented as well as the teaching method and the data collection method.

Chapter IV

RESULTS

The students in this study were observed for a period of six months. These subjects acted as their own controls as they worked twice a week producing their compositions on the computer. The mean number of writing sessions for these students was 24 with the number of sessions ranging between 21 and 30. Although few of the children before the remedial computer sessions had spent more than one session working on a composition, after becoming familiar with the word processing program a number of the students spent some weeks working on individual compositions and seemed to derive great satisfaction from the length and complexity of their work. Consequently, each child produced a different number of compositions. The students did not confine themselves to one composition per session and the data showed the mean number of compositions was 18 with the number of tasks ranging between 8 and 24.

It appeared from an examination of the composition protocols that each session, defined as a specific time limit of thirty minutes, did not frame any significant aspect of the task. While there were no discernible session boundaries, there were clear composition or task endings. It was decided, then, that the analysis of the data should be by composition rather than by session. Given the variability of the number of compositions produced, the problem was how to analyze the data in this repeated measures design. This problem of varying numbers of tasks was dealt with by collating the stories in the order in which they were written, and then dividing them into four

equal groups. The mean was then found for the number of words per composition in each of the four groups. This same procedure was followed with the data on the number of edits per composition in each quarter. This resulted in four mean scores for both fluency and editing based on a six-month time frame. These data are presented in Table 1.

TABLE 1

Fluency and Edits Scores per Composition

Subject no. 1

QUARTER	MEAN FLUENCY	MEAN EDITS
1	52.0	7.5
2	52.5	7.2
3	41.2	7.0
4	101.2	15.2

Subject no. 2

QUARTER	MEAN FLUENCY	MEAN EDITS
1	51.2	13.0
2	63.4	14.6
3	86.6	21.2
4	132.0	24.2

TABLE 1 (cont'd)

Subject no. 3

QUARTER	MEAN FLUENCY	MEAN EDITS
1	61.7	5.5
2	92.2	13.2
3	49.0	7.2
4	159.5	28.7

Subject no. 4

QUARTER	MEAN FLUENCY	MEAN EDITS
1	35.5	4.5
2	55.3	7.8
3	56.0	9.5
4	75.0	15.8

Subject no. 5

QUARTER	MEAN FLUENCY	MEAN EDITS
1	48.7	4.2
2	69.5	7.2
3	75.0	8.5
4	93.0	22.0

TABLE 1 (cont'd)

Subject no. 6

QUARTER	MEAN FLUENCY	MEAN EDITS
1	27.6	10.0
2	60.8	13.8
3	52.3	13.1
4	59.4	9.6

Subject no. 7

QUARTER	MEAN FLUENCY	MEAN EDITS
1	47.5	5.0
2	305.0	87.5
3	117.5	24.0
4	154.0	31.0

Subject no. 8

QUARTER	MEAN FLUENCY	MEAN EDITS
1	44.0	9.6
2	63.2	17.2
3	84.4	20.8
4	103.4	20.4

TABLE 1 (cont'd)

Subject no. 9

QUARTER	MEAN FLUENCY	MEAN EDITS
1	43.8	8.4
2	45.0	8.6
3	53.6	14.6
4	93.0	13.8

Subject no. 10

QUARTER	MEAN FLUENCY	MEAN EDITS
1	76.6	13.0
2	70.8	8.6
3	123.6	21.2
4	92.3	13.3

Subject no. 11

QUARTER	MEAN FLUENCY	MEAN EDITS
1	77.6	8.3
2	52.0	6.0
3	46.6	6.0
4	420.3	51.0

TABLE 1 (cont'd)

Subject no. 12

QUARTER	MEAN FLUENCY	MEAN EDITS
1	60.0	16.0
2	59.0	11.8
3	90.6	29.6
4	153.8	28.8

The data were analysed using a multivariate analysis of variance for a one-sample design with repeated measures over time. A between-subjects trend analysis was undertaken in order to examine whether there were changes over time in either fluency and/or edits. Repeated measures permits a test of the treatments main effects. "The advantages of repeated measures are most obvious when the treatment is expected to increase over time" (p. 356, Cook & Campbell, 1978). The multivariate analysis also provided test statistics in order to ascertain whether the trend had a linear, quadratic or cubic pattern. Evidence of a quadratic trend would have indicated that there had been decreasing acceleration in the growth curve, while a cubic combination of the means tested would have indicated that there were irregularities in the growth.

The results obtained from these analyses are as follows. For the test on fluency or word production over time, a significant difference ($p < .01$) was found on the F-statistic for the multivariate test of equality of mean vectors (F (3,9) = 11.10). The highly significant p indicates that there were changes over time in word production. An examination of univariate F's

indicated that only a linear trend was present, (F (1,11) = 10.89; $p < .01$).

The outcome of the multivariate analysis on the number of edits was also significant (F (3,9) = 14.85; $p < .001$) suggesting that there were significant changes in the number of edits per composition. In the analysis of the univariate F 's, testing as to the type of trend, it was found to be linear (F (1,11) = 17.26; $p < .01$). This indicates that the number of edits per composition for the subjects increased during the time of the study.

The fluency scores from the paper-and-pencil pretest and posttest written language tasks were analysed in a repeated measures analysis using the three factors of time, location, and subject in an A * B * S design. Location, which compared the written work done at the Learning Centre with that done at school, was not found to be a significant factor, nor was there a significant interaction between location and time. The means are presented in Table 2. Time, comparing the pretest and posttest written tasks was found to be highly significant (F (1,11) = 11.98; $p < .01$). This indicates that there were highly significant differences between the pretests and posttests. The compositions of the children for the posttest were found to be significantly longer.

The observed combined means are presented in Table 2.

TABLE 2

Paper-and-Pencil Compositions
Pretest and Posttest Fluency Means

Learning Centre		School	
Pre	Post	Pre	Post
60.58	129.27	55.83	87.08

Summary of the Chapter

This chapter presented the results of the analyses on the data and reported that there were significant changes over time in the word production of the students. The number of edits had also significantly increased as had the fluency scores from the paper-and-pencil tasks. A discussion of these results is to be found in Chapter V.

Chapter V

DISCUSSION

This study attempted to ascertain if there were significant changes in the written language of learning disabled students as a result of using a word processor.

Many educators and researchers have discussed the importance of adequate writing skills not only in the educational environment, but more broadly in the cultural environment (Lerner, 1981). There are both physical and psychological factors, though, that constrain the writing process (Daiute, 1983). The slow and tedious act of physically writing and revising places a burden on young writers which often discourages them from exploring their ideas in print. During this writing act, students may be constrained by the limited capacity of their short-term memory to monitor all of the steps in the writing process. Young writers generate ideas much faster than they can put them down in writing and this often leads to frustrating experiences during composing.

The computer has been found to be successful in helping writers in their composing since it alleviates a number of their burdens. Because of the ease of revising, young writers can allow their imagination to flow without the pressure of worrying about letter formation, mechanics of punctuation, and spelling. During revision, students can focus on one task at a time thus relieving the pressure on their short-term memory and concentrating on communicating their ideas. It has been shown that students then begin to write more, and also willingly edit more when they use the

computer. It also appears that their compositions improve in terms of quality. As Daiute has commented: "Writers can use computers to do drudge work.... As writers let computers do such work, they free themselves for thinking (p. 144)."

The question raised in this study was, "do children who are severely learning disabled, demonstrate a similar pattern of increased word production and revision when using a word processor as do normal students?"

Hypothesis 1 stated that learning disabled students would show an increase in fluency when they used the computer for written language. Since a number of studies discussed in Chapter II have shown an increase in quality as the students increased their word production the importance of a tool that increases students' productivity cannot be underestimated. Productivity in learning disabled students is of special concern since their meager amount of output hinders their development in written language and adversely affects their educational standing. Educators stress that it is imperative to get the students writing longer compositions as one of their primary goals (Myklebust, 1973; Kraetsch, 1981).

The results of this study support Hypothesis 1 indicating a highly significant increase in fluency when the children used the word processor ($p < .01$). This increase was effected in less than a six-month time period whereas most studies do not look for an increase in less than a two year period (Myklebust, 1973; Poteet, 1978). Because of this short time period, an increase of this magnitude probably could not have been acomplished without the use of the word processing program. Although their comments were mainly anecdotal, the special education teachers claimed that the students who took part in this study were generally very reluctant to commit

themselves to paper and that many had developed complex manipulative strategies to get out of writing tasks. While by the end of the remediation period these students were not all avid and skilled writers, many teachers had noticed a decrease in their negative attitudes and often these children demonstrated considerable pride in their finished compositions. As the students received more positive feedback from their peers, school teachers and family members, they were encouraged to continue writing more, and also they became more aware of their audience and their needs. This sense of audience, according to Graves (1984) is a crucial element in the development of good writing skills:

> ...publishing will really help the kid reach a larger audience. It's true we can publish without a computer, but the capacity for making multiple copies and the clean-looking print will make it more seductive for the student to keep going, to keep writing and publishing (p. 21).

Hypothesis 2 stated that learning disabled children will show an increase in editing procedures when they use the computer. Revision is considered a task that few beginning writers actually do since, with paper-and-pencil, the result looks messy. There is a time factor involved also, as students would have to totally rewrite their work if they make some changes. The computer not only facilitates revision, it encourages it as editing procedures are often considered by the children to be an interesting and motivating task (Bean, 1983). In the special education field, many educators emphasize the importance of teaching revision as learning disabled students are generally very poor at this task. As discussed in Chapter II, this ability to revise is considered to be a higher-level writing skill since the amount of revision has been found to correlate with other writing skills (Stallard, 1974; Bridwell, 1980; Pollowav et al., 1981).

For example, in the Bridwell study (1980), of the papers which were revised the least, over half were below the mean in the quality ratings, and were also shorter. Stallard (1974) had also found that the more successful writers made a greater number of revisions and reread their work more than average students.

According to Graves (1984), it is a major breakthrough in young writers' writing processes when they can view their writing, not as a finished and static product, but as part of the drafting process in which their printed words are not inviolate and to which information can be added and deleted. The physical ease of revision on the word processor encourages dynamic experimentation.

In this study, the increase in the number of edits made by the learning disabled students was found to be highly significant ($p<.001$). The students in this study, then, began to demonstrate the same type of writing behaviour as successful writers. They started to reread and edit their work more willingly, and made significantly more changes to their compositions than they had at the start of the remediation period. Each individual student, it was noted, had their own threshhold of editing "errors" with which they could cope. It appeared that over time, as the students became familiar with the features of the word processor, their ability to accept the idea of revision increased. Revision no longer seemed like a 'production failure' but rather more like a further step in the natural writing process. It appeared that it was with relief that some students relinquished the necessity of concentrating on the proper spelling of every individual word and allowed their ideas to flow and develop. In general, there is an agreement among most educators that the most powerful benefit of using a word processor in the teaching of

writing is in its editing capacity (Bradley, 1982; Gula, 1982; Schwartz, 1983). For learning disabled students, with their many difficulties with the writing process, the ability to edit often means that for the first time they may be able to write an acceptable and readable paper (Watt, 1982). This seems to provide enough incentive for the students to continue to experiment with written language.

The third hypothesis in this study looked at the question of whether learning disabled children would show an increase in fluency on paper-and-pencil written language tasks after they have used a word processor. In order to assess this, pretest and posttest written language tasks were gathered from the Learning Centre and the children's schools. The reason for this was that one of the criticisms of using a computer was that even if these children do improve on the computer, they would not be able to use the computer for most of their school subjects.

The results of this study indicated that there was a significant increase in fluency between the pretest and posttest paper-and-pencil tasks ($p < .01$). This suggests that some generalization to paper-and-pencil tasks may have taken place. The children improved in fluency not only at the Learning Centre but also at school. It is suggested that giving these students positive experiences in written language may have made them less negative towards the task and therefore more willing to write (Poplin et al., 1980; Kane, 1983). Written language, too, can only improve with more practice - lectures and excercises in grammar are simply not enough (Graves, 1983).

Implications for Further Research

While children do seem to write more and edit more, the question still remains, "Is their completed work any better?" More study needs to be undertaken, to assess the qualitative differences that might appear after using a word processor. What is known is that there is a high correlation between fluency and quality, especially for the elementary school children (Brigham et al., 1972; Van Houten et al., 1974; Stewart & Leaman, 1983), although as writers become more expert, this correlation drops. Since one of the main difficulties for learning disabled students is the small amount of production, this variable was studied first. The quality of the writing, though, is also an important topic which must be studied in future research. The issues involved in evaluating the quality of written language are large and complex and many studies will be needed to properly assess this variable. Appendix 1 contains short descriptions of a number of the students involved in this study along with examples of their compositions presented in chronological order. This section was included in order to present concrete examples of some the great difficulties that these students face. Besides that, it is possible to see some qualitative changes in their written compositions.

Further research on using word processors will make use of developing new tools. In particular, the collection of key stroke data from the students as they write over long periods of time will have important implications for researchers and theorists in the field of written language development. For the first time, it is possible to collect hard data on the revision process as it changes over the students' developing years. The information may determine not only how much revising is done at certain developmental

stages, but also the types of revisions that occur and the circumstances under which the most effective writing may take place.

Limitations

The present study was based on a small sample, with the subjects serving as their own control. The reasons for this were discussed in Chapter III. Further studies may wish to draw upon the larger school system looking at a greater number of learning disabled children. One difficulty in using a larger sample from the school population is that the children may not have been assessed as thoroughly as the ones in the present study, and so may be mislabelled. Such a sample would certainly have a wider range of types and degrees of disabilities. Because of these difficulties, a number of researchers have advocated the need for more research in the area of severe learning disabilities (Harber, 1981). It is important to know if the severely disabled children might improve under certain treatment conditions as this subgroup often gets lost in a group analysis when larger more heterogeneous learning disabled groups are studied. What was studied here were learning disabled students with the most severe written language problems. Since these children demonstrated significant improvement in fluency and editing, there is a high probability that other children who are not as seriously disabled will also demonstrate the same positive pattern of change.

In this study, the experimenter was also the main observer and teacher. A stricter control would be if there was a separate observer. It must be stressed, though, that the observations were of objective data and not subjective data. The teaching method that was used, was one that was in accordance with the Learning Centre's educational philosophy, and practiced

by most of the remedial therapists.

Since 90% of school work in the later grades involve written expression, the mastery of writing must be a prime objective for learning disabled students (Weiss & Weiss, 1982). Two primary areas where these students demonstrate deficits are in production and editing. These are the areas, then, that need to be addressed.

The research studies tend to consistently show that average children do improve in certain aspects of written language when they use a word processor. These aspects are fluency and time spent on the written language task (Kane, 1983; Levin, Boruta & Vasconcellos, 1983; Quinsaat, 1983). This study demonstrates that there is considerable promise in the use of the word processor for the children who have severe written language difficulties. The students in this study not only supported the findings of past research with their significant increase in word production and editing, but also they demonstrated some carry-over onto paper-and-pencil tasks. Whether these children were motivated by the novelty or the ease of editing their work is something that needs further study. The most common comment from their remedial teachers was that it was apparent that the children were more enthusiastic about writing. The somewhat magical quality of making phrases appear and disappear, and fixing many spelling errors seemed to take the drudgery out of a difficult task.

Conclusion

This study demonstrated that learning disabled students can improve signifcantly and quickly on a number of factors when they use a word processor. It also showed that this improvement may generalize to

paper-and-pencil and may not just be computer-specific.

Just as the computer is proving to be an important aid if not a necessity for the physically handicapped, it may well be that the word processor will become an invaluable tool for children with written language disabilities.

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APPENDIX

Although it is important to be able to measure quantitative changes in students writing, of equal importance are the qualitative changes and the childrens' attitudes towards their writing tasks. The following pages give a short description of a few of the children with some examples of their individual work. Looking at their compositions, it is easier to understand where their difficulties lie, and in what areas teaching needs to be emphasized. Even though children with learning disabilities usually show improvement only after many years of remediation, there are qualitative differences that can be seen even during this project's short space of time. Most of the credit for this belongs to the children and their enthusiasm for using this writing tool.

CASE HISTORIES

BRIAN

Brian is an eleven year-old boy with superior intelligence but severe reading and spelling difficulties. With excellent vocabulary and verbal reasoning Brian has many strengths but his auditory memory and auditory sequencing skills are areas of weakness.

Brian has had great difficulty with sound symbol relationships, and with remembering and visualizing words. He is also a perfectionist and fears making mistakes. He is often reluctant to commit himself unless he is sure of the answer.

When Brian was first working on the computer, he would agonize over the spelling of every word to the detriment of his story ideas. It was helpful to have him refer to a spelling reference book. This seemed to free him from the burden of concentrating on the spelling and allowed him to develop his own ideas. However he is most comfortable with a format that he knows well and he composes stories about the same character, Mr. Funnyone, during most of his story writing sessions. Brian's writing fluency increased from 44 words per story in September to 103 words in the Spring. The number of edits doubled during the same period.

Examples of Brian's Compositions

Space

Space is a unknown frnter. Space fasenacs people fome all concus .Nasune sentests perfexte one of wolds best lifesport simse.They use it alote of times in space. Space is the oney pcae were people cane not live.

THE COMPUTER THEEF

One day a man went to a computer store and pulled out a shotgun and demanded all there money and the blueprints for the new computers . After they gave him the money and blueprints he began to run out of the store . Than police car raced towords him and he panick and drop his loot and began to shoot at the car . He hit their engine . It burst into flames and went screeming towords him POOF. it was all over . Anther closed chapter in computer thefts .

THE EVIL GENEY

One day a rich man found a lamp and rubed it and a little man jumped up and said for freeing me from my eternal sleep you will pay and he turned him into a pig . Soon it became supper time and a fat mead came to see why the millionaire was lite for supper wan the geney sar her she reminded him of a cow. Then the geney desided to turn her into a ugly fat cow . Then he desided to leave on his magic broom to find some action and was never seen a geen .

MISTER FUNNYONE

One day Mister Funnyone was on his way home. He saw a Valentines card. He picked it up and took it home and he raed it.It was for him . It said—

TO MY LOVE

FROM YOUER SWET HART ?

So he decide to go see his Mis HaHa who is his swet hart that livs next door. When he got there he said would you marry me she said NO .Mister Funnyone was so mad he never spok to her again. And he lives miserablely every after.

One day Mister Funnyone was on his way to town THEN smack a ray suck him . When Mister Funnyone recovered from the ray he found himself in a space ship . A Fionian zapped him with a freeze ray and giggled and ran off . But then king FIONIAN rold in to the room and said what kind of creature is this ? because I think we alrready have one of them in our zoo so we will have to beem him back to earth so smack bang Mister Funnyone was beemed backed to earth . When Mister Funnyone recovered from the beem he ran off to buy a raygun so he would be raty to zapp any Fionian that trys to catch him and put him in a zoo . Off he went home to start a battle station .

MISTER FUNNYONE

One day Mister Funnyone was going for a walk then he saw a lamp so he picked it up and he blew on it POP a little green man pop out and said I

grant you 3 wishes master os he said I wont a red car , so the little man waved his hand crach a little red car . Mister Funnyone was so angry he said I wont a big car pop a gint car appeared in front of him. Then the little man said I know what you want now but it was to late Mister Funnyone was angrver then befor so he said go away pop the man was gone so Mister Funnyone continued his walk Then swoosh a giant trasheater swooped down and snatched the cars and flew away while Mister Funnyone was walking home.

GERRY

Gerry is a twelve year-old boy who was assessed as having learning disabilities when he was six. He has had tutoring since then and has progressed well enough to be placed in a regular class with some modifications to the curriculum and extra remedial help.

At the beginning of the school year, Gerry's writing had little coherence and continuity of thought. Although he was able to stick to one main topic, Gerry did not break it into subtopics, but jumped around as a thought came to him. In general, at the beginning of the remediation period, his writing was similar to that of younger children's. The sentences started the same way each time (simple subject/ verb construction), and his production was very low.

During the writing sessions Gerry was an enthusiastic and conscientious worker although on a few occasions Gerry worked equally hard at trying to get out of writing. Since he was a charming boy, this was probably a successful strategy. (Gerry even admits that he is a "good conniever".)

Gerry has made excellent progress in a number of areas. He now has more understanding of the ideas of paragraphs, sequence, and logic. During his last sessions he chose to write a mystery story which was a very difficult topic as he had to pay attention to how the story was evolving. This meant that he had to retain an organized plan that became increasingly complex. Although it was a difficult task for Gerry, he persevered and successfully completed the topic, even including details that demonstrated his awareness of the reader and his needs.

Gerry's basic spelling skills seemed to be quite good and he placed

great emphasis on the need to have all the words spelled correctly. For example, on his last paper and pencil composition, he got very upset because he forgot how to spell 'night'. He felt that "a twelve year-old SHOULD remember that".

In assessing the content of Gerry's work, he is still writing only about concrete events pertaining to the plot and including very little description in his writing. For example, in his last composition, when some deaths occurred, there was no mention of an emotional response or how these deaths might affect the characters. Gerry just reported the actions and none of the feelings.

Examples of Gerry's Compositions

Learning To Play Baseball

The objeck of the game is to hit the ball with a baseball bat as hard as you can. You try to run around the bases as fast as you can but you got to watch out because the other team tries to get you out. If the player hits the ball over the ball fence it is an automatic home run. If the pitcher hits the batter will walk.

If I Had Three Wishes

If I had three wishes I would wish for a farm because I like animals. My secend wish would be to be a lawyer because you get a lot of money. My third wish would be to be an actor because it is fun.

THE MYSTERY OF THE MISSING COBRA

Mike and Jim were in the jungle in africa trying to catch the cobra. Mike and Jim wanted to catch the cobra because they did not want the cobra to kill everybody. They cought it by shooting the cobra but the snake did not die. Then it was brought to L.A.

They put the cobra into a cardboard box for the plane trip. The plane took off and the cobra got loose and started to attack people. One of the people died, but Mike and Jim saved the rest of the people by grabbing the cobra's neck and putting it into a steel box. Everyone was frightened. When the plane landed in L.A. the police and ambulance were there to greet them. When everybody looked in the steel box the cobra was not there. HE WAS

MISSING.

Mike and Jim found out the steel box had a hole in it. The cobra slithered under one of the plane seats till the plane landed. When the plane landed the cobra snuck out into the police car. Suddenly the police left in his car, but the cobra was hiding under the seat. The cobra came out of his hiding spot and bit the police man. The police man had no control of his car and smashed into a pole. The police man got rushed to the hospital luckly the police man was all right, but the cobra was still on the loose.

Mike and Jim were looking all over for the cobra. They saw the cobra under the police car. Mike and Jim were scared to grab it because the cobra was biting people. They found a stick and pushed the cobra into a garbage bag. They used a garbage bag because there nothing else around. The cobra tore right threw the bag.

Everybody saw the cobra sneak into a field where there was only long grass. They couldn't see the snake because tall grass was in Mike and Jim's way. Mike stepped on the cobra and ran for his life. The cobra was chasing him and bit Mike. Mike got rushed to the hospital. A week later Mike died.

Jim is all alone trying to capture the snake. Jim had a stick on him. He saw the cobra and picked the snake up with the stick and carried it to a glass tank. He took it to a zoo and everyone was looking at the cobra.

A week later a strange guy came in the zoo and smashed the tank with a hammer. The snake came out of the tank. Jim was called to find the cobra. Jim was mad because he has to go look for the cobra again. He looked all over the zoo and he could not find the snake.

The reason Jim could not find the cobra is because the male cobra went to look for the other cobras. It found them in the snake house and it mated

with a female cobra. A month later the female cobra laid an egg. A while later the egg hatched and a baby cobra came out. Now there was a baby cobra, mother cobra and a father cobra. So they lived happily ever after in the snake house, but Jim is still looking for the cobra.

THE END

The Mystery Of The Silver skull

The story starts with Bob and jeff. They are detectives and they live in the Bahama's and they are trying to solve a mystery about who killed Jack. Jack is a son of a famous singer. It all happend when a killer killed Jack with a gun while he was walking down the street. Nobody saw Jack and so there's where Bob and Jeff come in. A week later everybody was getting suspitious they did not know where he was. They hired Bob and Jeff because they did not know anybody else that would look for him. So Bob and Jeff went searching for Jack.

They did not find Jack because the killer took Jack's body and and shoved it into the car and drove off to his appartment. The killer put the body in a box and brought it to his room. He went to buy a can of spray paint. He put newspaper all around the room so he wouldn't get paint on the floor and then he painted the body silver. After he painted it he threw the newspaper into the garbage chute. The killer made a statue out of Jack.

Bob and Jeff found a clue there was blood on the sidewalk. Bob and Jeff asked people if there was anything strange going on in the bar at that cornar They replied yes they say every night they saw a man come in the

bar with a knife. The man was wearing leather black pantes, a lot of jewellry, and a black jacket. He came in the first night with red blood on him. On the second night he came in with silver paint on him. So Bob and Jeff found more and more clues and then sooner or later they will find the killer. Bob and Jeff followed the blood tracks to his appartment. When they finally reached the building they went imeditly to the appartment and the number was 202. Bob and Jeff asked the killer where's Jack. The killer said I don't know where he is. Bob and Jeff knew he was lieing so they threatend the killer to tell them where Jack is. The killer said he was in the garbage shute. Bob and Jeff went to the garbage shute and found news paper with silver paint on it. They were putting it together and then after they finished putting together the outline formed into a person. They did not know who the guy was, but they thought it was Jack. After they remembered they saw a silver statue in the appartment. They went to the killer's appartment and Bob and Jeff took the killer to the police station and the killer went to jail.

JULIE

Julie is a ten year-old girl with average intelligence. Her mother who is an artist and sculptor, reports that she was first assessed by a school guidance consultant while she was repeating Grade one.

Julie was a delight to work with on the computer. She did not have any difficulty generating ideas for her stories. At the beginning she had poor fine motor control and displayed awkward finger movements as she searched for the right keys. She always took advantage of the computer's easy editing facilities, constantly changing the spelling of words as she searched for the proper spelling. Besides working on her spelling, she often added or deleted words in order to improve her paragraph. It was most interesting to observe this editing process since she did not concentrate exclusively on her written language difficulties but enjoyed adding descriptive phrases and words.

Examples of Julie's Compositions

My Mother the Scechise

Do you know how my mother makes Scechise? no so I will tell you all how to do it. My mother takes clay she frist takes tools for her Scechise then she takes her patlle and she bes the clay until it gets the right shape then she does the face with tools then she does the bote. Then she bakes the Scechise then she takes the scechise out of the new cile then she puts them on the tabble pase the Scechise then she goes to bed .

One family said to the other family lese make a hot air baloon. Father said yes but the mother said no becouse she had two babys. So one family made a hot air baloon and went up in the air. After 20 min they came down but they didn't pass the wall. If they stade a little more loger they would of got pass the wall but they didn't. So they had to find there car and drive home . When they got home they went to sleep and next morning they made another hot air baloon and a biger one fare all the familys. The family that didn't what to go said that they want to go know . They finsh the hot air baloon. They went up in the air and stade in the air fare 30 min and they pass the wall . The end

MY VALENTINE DAY

At valentine we send cards to people and they send cards to us.we eat Tarke or beef.I think that we are having beef. my mother makes good beef . my

mothers birthday is soon it's nare valentine day. My mother said I can help her and I said yes to her . my mother is inviting Sandy,Jim and Jenny. I made a valentines heart for my mother. I put a pies of paper on the valentine heart. I drew a picture on it . my mother said to me It looket nice and I said thank you.my big brother made a valentine heart too . he put a snow house with two people.I can't wait until valentine day.

The End

The gaost in the house

Joe and Jimmy said let's look for a gaost so they looked for a gaost they looked in a old house and looked and looked then they herd a noese and Joe said it's a gaost and Jimmy said let's go home they looked if the gaost was not there. When they were going out of the house then some water came down the steps they said let's go see what is all the water coming down the steps.So they went up the steps and in the bathroom and so a seal in the bathtub and they laughet.

THE END

MAX

Max is a twelve-year-old boy with a history of prenatal and postnatal problems. The family has moved frequently because of father's job and Max has attended at least 6 different schools. Max is outgoing and personable, with high average intelligence. He has an excellent memory for material that he hears, however, he has great difficulty linking up letters with sounds. Max often acts in a manipulative way in order to avoid academic tasks which he anticipates will be difficult for him.

Although Max seemed to enjoy the computer sessions, he was very easily distracted by things around him and acted quite impulsively. In the beginning, during his writing sessions, Max made many jerky movements with his body and used odd contortions with his hands which were not efficient. For example, he would place his fingers on the computer above the keyboard and just use his thumb to type. Max's difficulty with spelling interfered with the content of his stories. He stopped after every word or two to check his spelling and looked constantly for assurance. He was quite embarassed about his poor spelling.

Despite all of these difficulties Max began to write longer stories and stayed on task for longer periods of time. He became very interested in writing a murder story and from then on, enthusiastically wrote a new part each session. He seemed quite determined that he was going to end up writing a novel if the school year was long enough. After the murder story was finished he had some difficulty thinking up another topic, so that his average scores for fluency went down in the next quarter time. In general, though, his production of written work on the computer far exceeded what

he was doing at school according to his teacher. Max did not want to show his school teacher the amount of written work that he was producing on the computer as he did not want to have to work at that level at school. (His exact words were: "Are you crazy? I'm not going to show my teacher this - she"ll make me do it at school, too.").

Examples of Max's Compositions

Hallowe'en

I would like to be a clown for Hallowe'en . I have to take my little brother to go trik-or-treating. I DO NOT WONT TO TAKE MY LITTLE BROTHER BECAUCE HE HAS TO BE HOME AT 8:00 o'clock YOU GOT IT . I would like to get lots of candy.

MY TERRIBLE DAY

I Wonted A Terrible Day And I GOT ONE.... I did not wont to kam to day to the lerning senter.... Me and my friend had solled the same amont of chocolat bars..my and friend had to drow a pes of paper to win the silver doller because Im not there my friend would win the silver doller..

Devils Creek

It was the most horably murder in the world. It swaped people off there feet.The murder took place at DEVILS CREEK.The people involved were three young boys in the smith family. They had stoldin a boat and started to row for devils creek. They wanted to see what was in the big and spocky castle but that was not all they saw.

There was two people in the castle they were dressed in red. One of the people was the care taker that had died two years ago but the man with him no one knew who he was. When the caretaker saw the boys the men vanished in thin air.The three boys jumped and went for the boat raced

home. When the boys got home there mom and dad were waiting for them. They tolled them to go to bed we will see you in the morning. It was a fast nigth in the morning there was a screem they all woke up it had came from the bigest brethers room when they got there it was terible the bigest brother was in 100 pieces in the room his guts were all caming out of his mouth. the mom called the amblis for her and the garbe track for the piace of body and the cleaner to clean the blood steans off the flor.

The murder weapon was in the wall it was the bigest ax the police had ever seen in two years the caretaker of devils creek had one of the bigest ax in the town but he is dead . the police want to the castle and found the grave of the caretaker when they opened the coffin it jumped out. YEAHHHH skremed the police a big BIG spider had jumped in the closest police man's face and poked his feet in his eyes. In the grave the bones were gone so the police want back to the town and brot the policeman to the hospital.

The town had a meeting the police told the mayor that the bones of the caretaker were not there. One man said, "he is a ghost" and the mayor said," do not be silly," The black smith said," he was graved snatched," "It could be" said the mayor." What if he is not died." said the storekeeper "We mast deside on what to do" said the mayor. "We don't wont any more murders to take place." The town had a vote to burn the castle. It will take a lot of men if caretaker is in the castle. The next day the people from the town meeting want to the castle in big boats and lots of equipment.On the island the capten said to pot the torches on the arrows and he did just that. They set fire to the castle.They saw two black bodies burning. The people said the caretaker and his friend are dead for good.

The night after the Smith family's home was burned to the ground.

THE

END

THE VALENTINE SPOCK

Ones apon a time there was a boy named Mark he had no friends. Valentine's Day was two days away and Mark's mother had bought a lot of Valentine cards But he did not have any friends to send them to. So what can he do with a pile of cards for Valentine's. He thinks and he got and idea I will put bad things on them.And he want on tham he want to house to house with the valentines. The boys and girls were talk about the cards that they got from the valentine spock one of the boys was suspic so he want to the teacher and asked her if she could give him permission to look in one of Mark's book as he thought it was the same as the writing on the cards.He said for Mark to come to the front of the desk and he told what he did after he was finished all the boys and girls were Mark's friend and they were friend.

Feb 5,1983 my friend and me went to the airport to pick up my dad. When my friend and me got to the airport the plane that my dad was on was late we had to sit and wate for him. We saw a man with a gun in his hand at the clerck.We went to a phone and called the police.In five minites the police came and the thief run out the door and the police caught him and took him to the police station.The next day he went to the judge you must go to jail for ten years..he exsap from jail my friend saw the thief in his back yard. he calles me and talles me what he saw I said to thing ware he

can be and call me in the moring.The next day we go to the airport and saw the man with a lady.We go to the phone and tham we here a skream from the ather side of the room . We call the police but the thieves see us and run after us. A lady pick up the phone and talles the police to come to main the police come and one of the police called out stop in the name of the low.The thief trned and shote at the police the police shote back at the thief and killed him the lady was shote but not killed. The girl was santis to ten years.

THE

END

DONNIE

Donnie is a chubby, freckle-faced ten-year-old boy. Although quite tall for his age, he often gave the impression of a much younger child. Generally, he was cheerful and worked well, but there were occasions when he would try to avoid working. Donnie's attention span for language activities is quite short, and work had to be structured in small chunks to maintain his interest. He prefers to be actively engaged in "doing" type tasks. However, he displayed good attention and exceptionally good skill in problem-solving computer games.

Donnie has made great gains in his written language skills. His word fluency (number of words per story) doubled and the average number of edits also increased during the year from 5 to 16. Initially Donnie had great difficulty generating a story, and had no notion that it would be helpful to reread his story. By the end of the year he was, with encouragement, correcting many of his errors.

Examples of Donnie's Compositions

wy dusint a cicnc wer duprs

dy cus hes pecr is on hes fes

THE MONSTER

He is a monster he is mine monster he kills peple he lis in the forst anebute that come they wont stay aliv bkus he snes into pepls hous and kills them and he will hrs erebute nowun can live his forist alive he will get you befor you go he will

kill you he has fans and his fias is gren wen he gos to kill sunbut he gos eehaha

In a spooky house wer witchs live and gosts live toger thay mack spooky nosis the gost go ooooow the witchs go EEEEEE and thay thot that wus funn peple wer skerd to deth and Frankenstein livd in a cofin that sed Frankenstein and ther wer bats thay had a fite Frankenstein bet up the witchs but Frankenstein chont bet up the gost but Frankenstein fist went rit trow the gost.

My dad wim he was 16 he was ast into the bostin brosins but he sed no he was the best on the tem he skod the most gos he played difes he got a pas and he slapt in the nete and he stopt them fo skoring on them he past to hes tsm mas and thay past back and he tock a shot and skod but on wum cod stop he he gust cept on skoring

I went to a hoted house and the door opind up and I went in. I had a pockt and I hade a jac nift. I thock it out of my pockt and I opnt it in case sumone popt out fo nowere then drackulu pot out and he trid to kill me but he dint I got him. I shot my nife at him to kill him. I mest I will get him nest time he ran up the sters and trid to set a trap on me. But I nosted it and I put some grlick on the sters and then drackulu came done sters to see wut was hapning and then I spot him with the light and I shot my nife at him and I got him and I left.

DIANE

At the beginning of the year Diane was very shy and did not voluntarily start a conversation, only answering any questions with a simple yes or no. She has blossomed into a warm, and friendly girl with much to discuss and write about.

Once a topic was presented to Diane she was never at a loss for something to write. Her stories were almost always about events that were happening in her life or ones that she was looking forward to, such as Christmas, birthdays or trips. Seldom did any of her very sad family life permeate her compositions.

Diane had very little trouble remembering the procedures and commands on the computer, and she seemed to enjoy using it as a writing tool. She was always willing to reread and edit her work during her sessions. Her print-outs do show a number of her difficulties with language and sound-symbol correspondence, but it is also easy to see her progress throughout the stories. For example, many of Diane's stories are about her country place which starts off being written as "kunteeplas", then "contre plas", "contre plays", progresses again to "countre place", and then finally "country place".

Diane's stories have become much longer, and include greater detail and description. While the majority of her editing has been to correct spelling errors, on a few occasions the editing has involved content areas and she has added descriptive phrases or explanitory sentences. At the beginning of the year the main emphasis was on fluency, having her become comfortable with typing in ideas on the computer, and familiarizing her with the keyboard and

the editing capabilities. Now she is ready to begin working on style and content within her compositions.

Examples of her stories follow in chronological order.

Examples of Diane's Compositions

school

for school you hafe to were a yunaform. some kids dont and some kids do. at school you hafe a lots of school buses and some cares that baen you home. some schools are strik a lot. in hischool it is esy but when it comes to homework it is hard.

some kids hafe to yuos there cacolater for math . elamentry schools dont get that much homework only if you are in grade six.

On Nov.28 my class is going to a hocke tournament . my class is the onle one going in the school mabe. But I dont wont to go because we dident have a nufe pratis. And if my friend Renee duse ent go then I wont go and if we dont go then we are not going to school then. And I no we are gonae lows.

THE LITTLE RACCOON.

It was a sunny day in a little country. There was a long line up for the bank to open. A little raccoon from NewYork was pasing a little countrv. The little raccoon was walking he saw a line up. The raccoon said hey what is going on. But no one ansurd but a little girl. Hy we are all the people here for our money. Money what is money? you dont no what money is? What is it? It is a pese of paper with numbers on it. What kind of numbers. Like 1,2,5,10,20,50,and 100. Oh wow well by.By. Bang. Bang. Help help we were just robbed and little raccor was standing right beside the big man that stole all of the money. The police chased the man the man shot the money at the little raccoon. Hey you. who me? Yes you. You are under arest for

robbing the bank. But but I didn't. Just come with me. But. No but just come. One hour later. Get in here. Can I phone my mom later. Two hours later. Hey you. Who me? Yes you you can go. I can go? Yes we just found the big man that took the money. Can you tell me the way to canada.Just fallow the road. Thank you. By. by hy you little raccoon.I live all by myself will you live with me? Is there a teleaphone? Yes.Well o.k.and they lived happy ever after.

It was a nice day . Norman came over to see me. We went to the store and then we went to the park for a while.We went to the big M for supper. Then we met all of are friends at the bus stop.We all went to the park for a while and then we went for a long walk to the Aquaduct . On Saturday Tammy and my two friends and I went to see a movie it was cald Footloose.There was a lote of dances in it .And it was about teenagers that are not aloud to do anything. They were not aloud to lisson to music. And are not aloud to have partys at school or at home.But thay went against the older people.Then thay finly had a party at the last day of school.

On march the 26 was my birthday and I am 13 years old and I am very happy now.I fell a lot different.MY dad brot me and my sister out for my new clothes.Later on we went to the Big M for supper.Now being a teenager is a iot beter but now I have my own responsabillity and now when I get older my responsabillity will get bigger.I will save some of my money untill I have a nice small house for my self.I will have to watch out for my self.