THE DEVELOPMENT OF A RESOURCE GUIDE SUPPORTING THE EFFECTIVE INTEGRATION OF MICROCOMPUTER INSTRUCTION INTO THE WRITING PROCESS WITH LEARNING DISABLED WRITERS

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PAULINE MARY JANICE PINEAU

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BY

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ABSTRACT

Microcomputers are an integral part of the instructional tools used in our classroom settings. When used appropriately, microcomputers can be of great value to teachers and students. Moreover, microcomputers can provide instructional material appropriate to students' individual needs. Currently, a growing body of research reveals that through the use of microcomputers, learning-disabled students with writing problems can receive effective instruction in the classroom setting.

Now that microcomputers are becoming widely used in Canadian schools, educators will be expected to develop the competence required to utilize the technology for classroom instruction. Furthermore, the current prevailing ideology of educational integration will require teachers to adapt instruction and curriculum to match individual learner needs. It is the author's belief that using microtechnology effectively will help facilitate the match between the curriculum demands in the classroom and the individual needs of learning-disabled students experiencing writing difficulties.

The author conducted a review of the educational literature on the promised benefits of microcomputer instruction in the teaching students with learning

disabilities in writing, and incorporated relevant theory and research into the design of a resource guide, appropriate for teachers at the elementary school level. The author consulted with the thesis supervisor who provided feedback during the development process. Consultation led to adaptations and modifications so that the resource guide would better meet the specified objectives. A summative evaluation tool was distributed to educational specialists to evaluate how well the resource guide met the objectives set out by the author. Analysis of the evaluation data collected by the author indicated that the participants felt the objectives stated for the resource guide were achieved.

Enriching the Learner: A Resource Guide on Effective Microcomputer Instruction with Learning-disabled Writers, was prepared as a guide to assist educators with effective integration of microcomputer instruction into the writing process, specific to children with learning disabilities in writing. It is a practical tool designed to support the classroom use of microcomputers among learning-disabled writers. A significant component of the resource guide is a theoretical overview of the myriad of writing problems experienced by many learning-disabled children. The resource guide is unique in its attempt to present a link between effective instructional principles in education and the integration of microcomputers into writing instruction. The

resource guide is an outgrowth of the author's extensive research and clinical experience in the field of special education. The resource guide can be located in Appendix C of the thesis.

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TABLE OF CONTENTS

TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

CHAPTER I

BACKGROUND

Introduction

Microcomputers are powerful tools that are rapidly entering our homes, businesses and educational environments. Bitter and Camuse (1988) state, "Simply put, a computer is a machine that processes information electronically. It accepts input, manipulates data, and produces output in some form for display" (p. 1).

Microcomputers are currently being utilized in all aspects of life because of the speed and efficiency with which they carry out various tasks. Sales of home and business computers continue to increase as computers become smaller, more affordable, and more powerful.

The rapid growth of computers is perhaps no more evident than in the field of education. The emergence of computers in many facets of our society has placed a great deal of responsibility on schools to prepare children of today for life in a technologically-progressive environment.

The microcomputer as a tool to enhance learning has become one of the most widely publicized developments in the last decade (Torgenson, 1986). Instructional applications of computer technology are among the most frequent topics discussed in educational journals, instructional magazines and among professionals in the field of education (White, 1988).

Classroom computers are becoming a common tool in Canadian schools. Given the rapid proliferation of microcomputers in education, school districts across Canada are presently involved in policy planning to guide the use of microtechnology in educational settings. Within Canada, provincial and national conferences on educational computing are being held continuously.

The potential benefits of microcomputers on the teaching and learning process has been recognized at various levels. A number of government agencies have acknowledged the considerable benefits of integrating computers into the education system throughout Canada. (Alberta Department of Education, 1983; Manitoba Department of Education, 1983; Newfoundland Department of Education, 1992; Prince Edward Island Department of Education, 1983; White, 1988). The major thrust to computerize our educational environments has created a pressing need for teacher inservice and training in the feasibility and potential efficacy of computer implementation.

Microcomputer Applications in Special Education

Microcomputers have emerged as an innovative tool in the area of special education. The increasing refinement of both hardware and software is effecting the way exceptional children are being educated. The widespread use of microcomputers holds many possibilities for enhancing the educational opportunities provided to exceptional students in both regular and special class settings. Sitko (1986) suggests "With respect to special education, a review of the state of the art of computer applications suggests the computer has a unique promise in the assessment and instructional programming of students with special learning needs" (p. 407).

Currently in the province of Newfoundland and Labrador, computer applications with exceptional children are supported by the Provincial Department of Education. In a paper presented by Dr. Edna Turpin Downey to the Provincial Committee on the use of microcomputers in special education (Newfoundland and Labrador Department of Education, 1985), the microcomputer applications considered for use with exceptional children are: 1) Classroom instruction; 2) Computerized educational management; and 3) A tool for communication. These areas are briefly addressed in the following discussion as they pertain to microcomputer use in special education.

The Microcomputer as an Instructional Tool

There has been considerable support for the use of microcomputers in the education of exceptional children. For the purpose of this thesis, the term "exceptional" refers to all students with special learning needs. The current definition of exceptional children adopted by the Department of Education for Newfoundland and Labrador (1992) is as follows: "a student whose behaviourial, communicative, intellectual, physical, or multiple exceptionalities are such that she/he is considered by the program planning team of a school to need a special education program. The term exceptional refers to both disabled and gifted students" (p. VII).

Microcomputer technology can provide a whole spectrum of possibilities for teaching exceptional children. The suggested efficacy of computer technology was addressed throughout the research and literature of the past decade (i.e., Kolich, 1985; Schiffman, Tobin, & Buchanan, 1982; Torgenson & Young, 1983), and new applications for a variety of exceptional learners continue to be addressed throughout the literature.

There are a number of computer applications useful in the instruction of exceptional students as seen from a review of the research and literature. In fact, current research and literature reviews exploring the benefits of computer use with

exceptional children, have reported optimistic findings. Recent studies have indicated some of the most prolific applications of computers in education have been in the form of Computer Assisted Instruction (CAI). According to Reid (1988), "Computer Assisted Instruction or CAI refers to software packages that teach academic skills or review existing skills" (p. 419). Computer assisted instruction (CAI) is particularly beneficial for students who need to review and/or practice concepts previously introduced in the classroom setting (Sitko, 1986). Torgenson and Young (1983) support Sitko by suggesting that microcomputers can be used as a tool to provide the additional drill and practice that mildly handicapped students require in order to achieve automaticity in math and reading. They point out that many children with mild handicaps often experience difficulties in basic reading and math skills which effects their ability to perform with efficiency in these areas (Torgenson, 1984).

The advantages of using computer assisted instruction with learning-disabled children was supported by a longitudinal study conducted at the Trillium School in Milton, Ontario (Lindsay & Marini, 1983). The investigators implemented CAI with learning-disabled students in the area of math. The Milliken Math Sequences program used in this project is designed to enhance an elementary through junior high math program. In 1983, Lindsay and Marini revealed that

in a number of cases, students demonstrated an improvement of two grade levels during the first year. These results are extremely promising. There is a need for further research to see if the skills attained by students using this program can be maintained over time and generalized to paper and pencil tasks. Day and Sweitzer (1990) suggest "For students who have weaknesses in remaining on task and responding in written form, modifications may be necessary in order to assess their level of performance more accurately" (p. 435).

Tutorial programs are becoming increasingly useful as a tool for the instruction of special needs learners. A tutorial program presents information in an instructional sequence to guide students through programmed lessons. Kolich (1985) maintains that the "Tutorial,...provides a fixed instructional sequence that literally takes students through the various stages of learning: It presents a concept to be learned, prompts for answers to questions it provides, and offers feedback on responses" (p. 428). For example, to accompany a demonstration on adding mononomials in algebra, a tutorial program can be used to illustrate the mathematical process in small, sequential steps which incorporates student practice. Instruction that is broken down into manageable steps with repeated practice has the potential to provide the structured repetition necessary to achieve automatically in specific skill areas.

Although microcomputers can be effective tools in providing practice to ensure comprehension of subject matter, teachers need to monitor student interaction with the computer, record individual progress, and provide consistent feedback (Bear, 1984; Day & Sweitzer, 1990). Sitko (1986) states, "Teachers in particular must see their role not only as implementors of the new technology but also as researchers and evaluators who can carefully and systematically assess the impact of the new technology on their students' knowledge, skills, and attitudes" (p. 468).

A recent body of research on word processing suggests that microcomputers are promising writing tools, particularly for learning-disabled children who have experience difficulty with written expression (Lindsay & Marini, 1983; Outhred, 1989; Rosegrant, 1985). As more educators have a greater access to word-processing software, students who have been previously impaired in their written language skills may demonstrate an increased involvement in the school curriculum.

Computerized Educational Management

In addition to the individualized nature of the computer for the exceptional child, it can also be used as an effective tool in administrative and classroom management. As an increasing number of exceptional children move into mainstreamed schools and regular classrooms, there is a great need to seek effective systems to manage administrative data and information (Freeze, 1988). Moreover, educators will require easy access to individual case histories in order to plan effective instruction for the exceptional children in the school environment.

A major, time-consuming task for educators is the development of the Individualized Educational Plan (IEP). The IEP is a written report describing a child's strengths and areas of need designed to assist teachers in providing the appropriate educational program for a child. An efficient computerized record management system has the potential to eliminate the time consuming handwritten IEP document replacing it with a more efficient method of individualized educational plan formulation. Kolich (1985) states "The legendary difficulty of writing the IEP itself can be lessened through the use of software designed to tailor descriptions of problems and solutions to the needs of individual students" (p. 429).

It is obvious that computerized educational management

programs have the potential to provide increased efficiency in the area of information management. Microcomputer programs are now capable of managing vast amounts of documentation associated with special education programs with relative simplicity and speed. Bennett (1982) suggests:

> Capable of running on relatively inexpensive and compact microcomputers, these systems generally perform such functions as storing individual student records; periodically listing names of children due for preplacement evaluation, re-evaluation, and IEP annual review; generating child count reports; and automatically printing and addressing letters of notification and consent documents to parents (p. 107).

Consequently, such efficiency allows special educators and administrators additional time for program development and relieves some of the paperwork involved in special education services. These current developments in microtechnology are having a substantial impact on the delivery of special education programs at the classroom, administration, district, and department levels throughout Canada.

The Computer as a Communication Aid

The use of the microcomputer for instructional purposes has the potential to benefit students of varying abilities. For example, some students with physical disabilities have been unable to communicate effectively because of the difficulties they experience with body movement and control. Current developments in computer technology add a new dimension to educating students who experience difficulties communicating as a result of their disability.

Male (1988) describes a number of unique hardware features that have made input easier and more accessible for students with physical impairments. Switches have been designed to allow the user to operate a computer without a keyboard. The recent development of voice input and output systems allow the speech-impaired child to communicate. Male states "For visually impaired, physically or learning-disabled students, voice entry reduces the need for keyboard input and increases their productivity" (p. 15). Consequently, students who are unable to type due to problems with motor and/or voice control can still take advantage of computer power and technology. Regardless of the means by which the microcomputers capabilities are realized, the use of computers as a tool to enhance the educational opportunities for students with physical and communication impairments holds great promise.

Educators are only beginning to realize the potential of microcomputers in enhancing the educational opportunities for exceptional children. Cain and Taber (1986) suggest that future technologies can become "normalization agents" for exceptional learners in the home, school and community. Moreover, if properly developed and carefully planned, these new technologies will help to circumvent many of the physical, communicative, and intellectual barriers that frequently prevent exceptional learners from achieving their intellectual potential and reaching their educational goals.

Statement of the Problem

A review of research and literature on microtechnology and education reveals that children with learning disabilities in writing which impedes the ability to write, have special learning needs with regard to the curriculum and consequently with respect to learning materials (Kolich, 1985; Schiffman et al., 1982; Torgenson, 1984). A growing body of research reveals that through the use of microcomputers, learning-disabled students with writing problems can receive effective instruction, demonstrate knowledge and understanding, and become active participants in the classroom setting (Graham & MacArthur, 1988; Kerchner & Kistinger, 1984; Outhred, 1989).

As educators continue to introduce microcomputers into their classrooms, the new technology can assist teachers in making appropriate curriculum modifications for students with diverse learning needs (Day & Sweitzer, 1990). However, using microcomputers in this way will require educators to become proficient at effectively integrating curriculum support courseware to match the educational needs of learning-disabled students (Foreman, 1983; Kolich, 1985; Sitko, 1986). It is the purpose of this thesis to review the literature on the effective integration of microcomputer instruction into the writing process, specific to children with learning disabilities in writing, and to incorporate relevant theory and research into the design of a resource guide, appropriate

for teachers of learning-disabled writers at the elementary school level. The resource guide is designed to support the classroom use of computers among learning-disabled writers.

Rationale for Development of a Resource Guide

Microcomputers are currently an integral part of the technology utilized in educational classroom settings. When used appropriately, microcomputers can prove to be an invaluable tool for improving the instructional decision making for learning-disabled writers (Morocco & Neuman, 1988).

Now that microcomputers are becoming widely used in many Newfoundland schools, regular and special classroom teachers must be prepared to teach using the current technologies. The results of data gathered by Collins (1991) on the educational use of computers revealed that 100% of the respondents would make more use of CAI if software and a curriculum guide were available.

Locally, the Newfoundland and Labrador Provincial Department of Education has yet to produce a policy on the integration of computer technology with special needs students. However, The Newfoundland and Labrador Provincial Department of Education's Distance Education/Learning Resource Section has formed a working group comprised of specialists throughout the educational system in an effort to meet the computer resource needs in this province. Within the context of education, the working group will, "Identify appropriate computer and related technologies to meet the curriculum and resource needs of students, including special needs students" (Newfoundland and Labrador Department of Education, 1992).

As with any new educational intervention or teaching method, the effective integration of microtechnology into curriculum areas depends on proper teacher training and teacher resource support. This resource guide represents an attempt to meet this need by providing educators with a guide in the effective integration of microcomputers into the writing process specific to children with learning disabilities in writing.

Significance

Technological advancements, particularly the establishment of microcomputers in the classroom setting, have enormous potential for expanding the instructional possibilities for learning-disabled children. We can expect a continuous growth in classroom applications of microcomputers as we move into the 1990's and beyond.

Today's educators will be encouraged to recognize and develop individualized educational programs for students with special needs. Concepts such as "mainstreaming", "least restrictive environment" and "regular education initiative" represent a movement away from segregated classes for students with unique learning needs. Winzer (1989) contends "In Canada today, educational integration is the prevailing educational ideology. Growing numbers of exceptional students are entering the public school system and classroom populations are being described more broadly" (p. 7).

This movement is particularly promising for learning-disabled students who are often in need of curriculum modifications in the regular classroom rather than segregated learning environments. Simmons, Fuchs and Fuchs (1990) suggest "The successful integration of students with learning disabilities into mainstream reading classrooms may require teachers to adapt instruction and curricula in major ways" (p. 354). It is the author's belief that using microtechnology

effectively will facilitate the match between the curriculum demands in the classroom and the individual needs of learning-disabled students experiencing writing difficulties.

Definition of Terms

The following are terms used throughout this thesis. They are presented in the following way: a) a general working definition, and b) a theory based definition derived from the relevant research literature pertaining to that specific term.

Auditory Perception

a) This is defined as the process of discriminating, sequencing, and organizing information received through the auditory channel.

b) "The ability to interpret or organize the sensory data received through the ear" (Lerner, 1981, p. 514).

Cognition

a) This is defined as all forms of knowing, for example, perception, memory, reasoning are all forms of cognition.

b) "The act or process of knowing; the various thinking skills and processes are considered cognitive skills" (Lerner, 1981, p. 515).

Curriculum Modifications

a) This is defined as the process of modifying or adapting curriculum materials to match the individual needs of the learner.

b) "It is the adapting or interpreting of a school's formal curriculum by teachers into learning objectives and units

of learning activities judged most reasonable for an individual learner or particular group of learners" (Comfort, 1990, p. 397).

Dyspedagogia

a) A shift in focus from something disabled within the child to an inadequate instructional program.

b) "The issue of a curriculum deficiency or 'dyspedagogia' has been suggested as a critical factor in the failure to acquire basic skills" (Roit & McKenzie, 1985, p. 258).

Dysgraphia

a) This is defined as impairment in spontaneous writing.

b) "Extremely poor handwriting or the inability to perform the motor movements required for handwriting. The condition is often associated with neurological dysfunction" (Lerner, 1981, p. 515).

Etiology

a) The theory or cause of a particular condition.

b) "The cause of origin of a condition" (Lerner, 1981, p. 515).

Expressive Language

a) This is defined as language that children produce,

specifically, speaking and writing.

b) "Skills required to produce language for communication with other individuals. Speaking and writing are expressive language skills" (Lerner, 1981, p. 516).

Impulsivity

a) This is defined as an individual's initiation of certain behaviours without sufficient forethought as to consequences.

b) "The behavioral characteristic of acting upon impulse without consideration of the consequences of an action" (Lerner, 1981, p. 516).

Inefficiency

a) This is defined as not performing a function efficiently.

b) "This term refers to either low accuracy or low speed in learning or performing a given task" (Learning Disabilities Association of Canada, 1991, p. 8).

Learning Disability

Children who experience learning problems and school failure are often referred to as "learning-disabled". Although there exists a variety of prevailing opinions in the educational community regarding the categorization of

exceptional children, for the purpose of this thesis the following terminology will be used:

a) The term "learning disabilities" applies to those children who fall significantly below expectations for them in the school setting despite the fact that many learning-disabled children display average intellectual ability. The term learning-disabled is appropriate, for these children are indeed disabled in some aspects of learning.

The official definition adopted by the Canadian Association for Children and Adults with Learning Disabilities on October 18, 1981 states:

b) Learning Disabilities is a generic term that refers to a group of disorders due to identifiable or inferred central nervous system dysfunction. Such disorders may be manifested by delays in early development and/or difficulties in any of the following areas: attention, memory, reasoning, coordination, communicating, reading, writing, spelling, calculation, social competence, and emotional maturation (Learning Disabilities Association of Canada, 1991, p. 2).

"Learning disabilities are not due primarily to visual, hearing, or motor handicaps; to mental retardation, emotional disturbance, or environmental disadvantage; although they may occur concurrently with any of these" (Learning Disabilities Association of Canada, 1991, p. 2).

Mainstreaming

a) This is defined as an educational process for exceptional children based on the view that each child should be integrated in the least restrictive educational environment in which individual needs can be addressed.

b) "It is the physical, intellectual, social, and emotional integration of exceptional students into the regular educational milieu. Mainstreaming demands individual programming, co-operative planning, and a range of educational options and support services" (Winzer, 1989, p. 20).

Metacognition

a) This is defined as the ability and awareness needed to perform a cognitive task effectively.

b) "Metacognition refers to our ability to know what we know and what we don't know" (Costa, 1984, p. 57).

Modality

a) This is defined as the visual, auditory, or haptic style of learning used most efficiently by a child.

b) The pathways through which an individual receives information and thereby learns. The 'modality concept' postulates that some individuals learn better through one modality than through another. For example, a child may receive data better through the visual modality than the auditory modality (Lerner, 1981, p. 517).

Psycholinguistics

a) This is defined as the study of mental processes that underly the acquisition and use of language.

b) "The field of study that blends aspects of two disciplines - psychology and linguistics - to examine the total picture of the language process" (Lerner, 1981, p. 517).

Receptive language

a) This is defined as language that children receive through their environment, specifically listening and reading.

b) "Language that is spoken or written by others and received by the individual. The receptive language skills are listening and reading" (Lerner, 1981, p. 517).

Special Education

a) This is defined as an educational support system designed to provide appropriate services to meet the needs of exceptional children.

b) Special Education may be viewed as planned intervention designed to reduce, eliminate, or preclude deficits in learning or behaviour. It is especially designed to meet the particular needs of exceptional children: to prevent or ameliorate conditions that hamper the intellectual, communicative, social, emotional, or psychological functioning of pupils (Winzer, 1989, p. 9).

Visual Perception

a) This is defined as the process of discriminating, sequencing, and organizing information received from the visual channel.

b) "The identification, organization, and interpretation of sensory data received by the individual through the eye" (Lerner, 1981, p. 518).

Whole Language Philosophy

a) The whole language philosophy stresses that the language processes of reading, writing, listening, and speaking are interrelated and assist children in making sense of the world around them.

b) A Whole Language Philosophy...advocates that language learning is child-centred, not teacher-dominated; that language is integrated, not fragmented; that children learn by being actively involved in authentic language activities - that is - they learn by talking and doing rather than through passive listening; as well, they learn to read and write as they engage in experiences with literature and writing instead of isolated drill and workbook exercises; and that children learn best in co-operative interactive, problem-solving situations (Newfoundland and Labrador Provincial Department of Education, 1991, p. 14).

Scope and Limitations

The nature of learning disabilities, with its myriad of forms, has been extensively investigated throughout the research literature (Lerner, 1981; Myklebust, 1973; Newcomer & Barenbaum, 1990). Current research suggests that learning disabilities may be manifested by difficulties in any of the following areas: memory, attention, reasoning, coordination, communication, reading, writing, math, social behaviour, and maturation. Given the heterogeneity of the population, the author found it necessary to limit the research to one specific subtype of learning disabilities. Therefore, for the purpose of this thesis, the author is interested in learning disabled children who display cognitive problems in written expression. Feagens, Short, and Meltzer (1991) suggest subdividing children by using various classification procedures may have important theoretical and practical implications. The move represented by subtyping children with specific disabilities creates the possibility that the learning disability can be validated and identified more specifically (Hagen, Kamberelis, and Segal, 1991). Meltzer (1991) states "subtype research has provided some systemization of our knowledge base and has enhanced our understanding of the heterogeneity and multiplicity of symptoms which characterize this population" (p. 183).

Microcomputers have come to be used in a variety of ways

in our educational services during the past decade. Specifically, within the context of education, microcomputers have been used in three major ways: (a) as an object of instruction, that is, learning about the programming functions of the computer; (b) as a medium of instruction, that is, the use of a computer to complement and/or supplement curriculum content; and (c) as a catalyst of instruction, that is, the use of the computer to increase and enhance learning (Newfoundland and Labrador Department of Education, 1985). The scope of microcomputer applications in education is broad. Therefore, the author has limited the review of the research and contents of the resource guide to microcomputer use as a medium of instruction and as a catalyst of instruction specific to children with learning disabilities in writing.

The resource guide is non-technical in nature, designed to support the effective classroom use of microcomputers with learning-disabled writers.

Although the resource guide is directed towards teachers of learning-disabled children, many of the instructional strategies and methods that are effective with learning-disabled students are helpful to students with other special learning needs. Teachers will discover that the information presented in the resource guide may assist them in helping students with other exceptionalities.

As gleaned from the research literature, there exists a

limited supply of microcomputer courseware specifically designed for learning-disabled children with writing problems. Nevertheless, an extensive search was carried out for courseware that can be adapted to the unique learning needs of learning-disabled children experiencing writing problems.

Because of the rapid production of courseware, it is impossible to peruse all resources recommending courseware for special education populations. A large number of catalogues and resources were sampled. Similarly, it is impossible to preview all courseware packages deemed adaptable or specifically recommended for learning-disabled children with writing difficulties. In consultation with the thesis supervisor, a substantial number of courseware packages were sampled throughout the research process. Four pieces of educational courseware were then selected as models for the instructional plans in the resource guide.

The recommended courseware and instructional plans presented in the resource guide are only guidelines and suggestions that do not ensure improved written language abilities among learning-disabled children with writing difficulties.

Although the resource guide lists a number of courseware packages deemed adaptable or specifically recommended for learning-disabled children, the sample resources are not described or evaluated. It is the author's belief that it is

up to each individual teacher to choose and evaluate curriculum support courseware according to the demands of the entire teaching-learning environment.

Thesis Format

The contents of Chapter II will constitute a review of the relevant research and literature pertaining to learning-disabled writers in general, with concentration on the instructional uses of microcomputers and the writing process, specific to children with learning disabilities.

In Chapter III of this thesis, the specifics of the design of the resource guide are described which include the analyses of users and a statement of resource guide purposes.

Chapter IV includes a description of the formative evaluation process used in the development of the resource guide.

Chapter V includes a number of recommendations based on the results of the summative evaluation tool, a review of the research and literature on learning-disabled writers, and the development of the resource guide.

References: All references used throughout this thesis are included in this section.

Appendix A contains the summative evaluation tool developed by the author.

Appendix B contains the written correspondence distributed by the author during the development process.

Appendix C contains the microcomputer resource guide.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

There exists throughout the educational literature, a growing body of research on the promised benefits of microcomputer instruction for children with learning disabilities specific to writing. This review of the literature examines six specific areas of research literature which are relevant to the thesis. They are listed as follows:

(1) Early Writing Development;
(2) Learning Disabilities: Theoretical Perspectives;
(3) Learning-disabled Writers;
(4) Current Instructional Approaches to Writing;
(5) Microcomputers: Access to the Writing Process;
(6) Effective Microcomputer Integration.

Early Writing Development

Recent History

Writing is a complicated cognitive process with which people communicate to themselves and others. Outhred (1989) contends "Writing is a complex process linking language, thought, and motor skills" (p. 262). Psychologists and linguists have debated for years about how children acquire written language skills. Although there exists a number of theories pertaining to written language development, there is still much unknown about the processes involved in the acquisition of written language.

Research on writing, particularly knowledge about early writing processes in children, is a recent development in educational and social science research. In contrast, research in the area of reading development and behaviour is approximately 50-100 years ahead of writing research (Whiteman, 1980). However, over the past two decades, psychologists, sociologists, anthropologists, and educators have become increasingly interested in the writing development of young children.

Traditionally, the understanding of reading and writing development by educators was guided by a concept of "readiness". Strickland and Morrow (1989) explain "Readiness for school and readiness for reading and writing implied that

there was some point in development when it was time to begin to learn to read" (p. V). However, since the 1960's, challenges to the existing readiness paradigm appeared throughout the educational literature as researchers began to investigate early language development from birth forward. Teale and Sulzby (1986) state "The roots of this challenge can be traced to two broader trends: a) cognitive approaches to issues of learning and development and their increasing influence on educational related research and classroom practice and, b) renewed interest in the first few years of life as a period of critical significance in development" (p. XIV). The influences of these trends have challenged researchers and practitioners to direct attention to the early writing processes of children. As a result of the heightened interest in children's writing development, a number of important ideas and perspectives have emerged from the research.

Early Patterns in Children's Writing Development

While the period from birth to school entry has been of interest to researchers and practitioners concerned with language development, it is only recently that pre-schoolers' engagement in written language has been observed in an attempt to understand the processes involved in early writing development. To gain an understanding of how writing development is viewed today, it is important to look at the major research trends and perspectives which have shaped our current thinking about how writing develops.

Myklebust (1965) viewed written expression as the last symbol system acquired in a hierarchial scale achieved only when the prior skills of language are automatized. Similarly, Kellogg (1971), in his discussion of language development proposed a hierarchial model of language acquisition. According to his model, it is essential that prior to acquiring the processes and skills necessary for written expression, children must have knowledge and experience in the areas of listening, speaking, and reading. Cicci (1979) states, "Written language or the expression of ideas through writing, is the last of the language arts skills acquired by children in school" (p. 240). In contrast, Chomsky (1971) maintained that many children write before they read and are often unable to read what they have written. Other

researchers Read (1970), and Deford (1980), have also observed the early writing behaviour of children before formal instruction and competence in reading occurs.

Vygotsky (1962) found that young children without formal training attempt to express themselves using visual signs such as marks or scribbles. Dyson (1983) supports Vygotsky's (1978) theoretical position that children's initial scribbles indicate symbols which directly denote certain concepts or objects. Thus, early attempts with symbolism appear to represent children's intention to convey meaning in his or her linguistic environment.

An important pioneering study in early writing research was Read's (1970) investigation of preschooler's perceptions of speech sounds as indicated by invented spellings. Read found that after learning the letters of the alphabet, young children without formal instruction began to spell words using blocks and letters, eventually progressing to written messages of various kinds. These attempts have been observed in children as young as three years old.

Read's research inspired Chomsky (1971) to propose that "Children ought to learn how to read by creating their own spellings for familiar words as a beginning" (p. 296). The seminal works of Read (1970) and Chomsky (1971) into the early phases of children's writing development have inspired subsequent investigations into young children's writing

development from birth forward.

More recently, there exists a well-documented body of research knowledge on children's early writing development by (Clay, 1975, Graves, 1973, 1979) and others. A very detailed description of children's early attempts to write is provided by Marie Clay (1975). Her observations indicate that children's writing appears to show patterns of growth revealing developmental stages. Evidence obtained from Clay's examination of a child's first attempts to write provides unique insights into early literacy development. Clay identified six developmental writing patterns as showing principles about writing development: (1) the recurring principle; (2) the directional principle; (3) the generating principle; (4) the inventory principle; (5) the contrastic principle; and (6) the abbreviation principle. These stages are an attempt to describe a child's interaction with pen and paper activities in developing early writing processes.

Writing researcher Donald Graves also investigated writing development in children. His early contributions include an investigation of the composing processes of seven-year old children (1973), and a longitudinal study of writing development in the primary grades (1979). Graves strongly suggests that the complexity of the writing processes has been underrated by parents, educators, and researchers. Graves (1981) argues "Children want to write. For years we have

underestimated their urge to make marks on paper. We have underestimated that urge because of a lack of understanding of the writing process ..." (p. 5).

Graves' interest in writing instruction appears to have evolved from his early research investigations into the area of children's writing development. Graves' (1973) research into the writing processes of seven year old children provides a body of knowledge about writing development and classroom instruction. This study was preceded by only two other research projects which used the case study approach as a means to observe children during the writing process (Emig, 1969; Holstein, 1970). Graves' findings led him to hypothesize that differences among students in writing development are influenced by factors such as sex, learning environment, and individual developmental factors. This unique study achieved significant recognition for its contribution to writing research.

Graves (1978) and his two associates, Lucy McCormick Calkins and Susan Sowers, conducted a two-year longitudinal study set out to document the writing development of children in the first four primary grades. Data was collected in an effort to gain valuable knowledge about how children's writing changed from one level to another over a two year time period. Children in five different classes were chosen because of their individual differences along pre-selected criteria of

language, composition, spelling, and motor performance. Results indicated that children cycle through a series of operations during the writing process beginning with initial idea generation to a finished product. Graves (1978) and his colleagues, maintain "Children show us what is involved in the writing process through the many sub-processes that contribute to a finished product. Significant sub-processes include topic selection, rehearsing, information access, spelling, handwriting, reading, organizing, editing, and revising" (p. 4-5). The hallmark research conducted by Donald Graves has helped to bring about a gradual change in the views of writing development, by moving the emphasis from an analysis of the finished product of children's writing to a close examination of the process used by children during writing activities. This expanded view has provided educators with new insights on the way writing develops.

Deford's (1980) investigation of the writing processes of two through seven year olds developed a framework which focuses on understanding children's writing development. Deford contends "While the...stages are not sequential, there is a suggestion of growing sophistication as more of the child's strategies and concepts become refined, reflecting conventions of writing language" (p. 162). Her study revealed that knowledge about print production appears to develop before any formal instruction in the classroom environment.

Kane (1982) has suggested that early writing develops from a form of scribbling, to graphic expression, to written symbols. It may be that the concepts and knowledge children develop before formal schooling occurs, i.e., scribbles and graphic expression are essential to acquiring more abstract concepts of written discourse (Kane, 1982). Both Kane (1982) and Deford (1980) concurred that knowledge about print production develops before formal schooling begins.

Dyson's (1983) observational study of oral language in written language in the beginning writing processes of children revealed that growth in writing follows developmental patterns or processes. She maintains that writing, like other elements of human growth and development is governed by the orthogenetic principle. Dyson explains "mental activity is initially an undifferentiated fusion of concepts, processes, and events. With development, differentiation occurs - distinct and identifiable concepts and processes emerge. Gradually integration takes place as new learnings both become distinct and fit together with other learnings" (p. 17). Dyson's study tentatively identified three stages beginning writers experience. The three stages include: 1) message formulation; 2) message encoding; and 3) mechanical formulation. Dyson (1983) explains, "The child has a message, the child uses the message, and the child actually forms the letters" (p. 16). Dyson's research contributes to the notion

that children progress through rather well defined developmental patterns in writing prior to formal instruction.

Over the past two decades, the importance of elucidating what happens during early writing development has been realized. As a result, contemporary researchers have explored new paradigms in seeking to understand young children's reading and writing development from birth forward. Although researchers and practitioners do not yet have a complete picture of the writing systems used by children, research findings have provided insight into the way we view children's literacy development.

Emerging Literacy Overview

In many ways, current theories about writing development provide valuable insight into children's literacy development. Results from a number of hallmark studies contribute to a significant shift in our perspective on children's language development (Clay, 1975; Deford, 1980; Dyson, 1982; Goodman, 1986; Graves, 1973, 1979; Hildreth, 1936; Read, 1970).

A descriptor in the recent shift in perspective on early reading and writing development has come to be known as "emergent literacy". The term emergent literacy, a concept originally coined by Marie Clay in her (1966) doctoral dissertation, has come to view literacy development as a process that develops from birth forward. Teale & Sulzby (1986) explain, "In the first few years of life we can see that even though development precedes in fits and starts, with periods of vigorous growth and periods during which the child seems to be consolidating knowledge, children are continuously learning to write and read, moving toward the time they will do so conventionally" (p. XX). Teale and Sulzby suggest there has been a gradual discrediting of the traditional concept of "readiness" resulting from the current research knowledge on literacy development. They summarized several valuable insights that are currently emanating from the research on early literacy development:

1. Literacy development begins long before

children start formal instruction. Children use legitimate reading and writing behaviours in the informal settings of home and community. The search for skills which predict subsequent achievement has been misguided because the onset of literacy has been misconceived.

2. Literacy development is the appropriate way to describe what was called reading readiness: The child develops as a writer/reader. The notion of reading preceding writing, or vice versa, is a misconception. Listening, speaking, reading, and writing abilities (as aspects of language - both oral and written) develop concurrently and interrelatedly, rather than sequentially.

3. Literacy develops in real-life settings for real-life activities in order to "get things done". Therefore, the functions of literacy are as integral a part of learning about writing and reading during early childhood as are the forms of literacy.

4. Children are doing critical cognitive work in literacy development during the years from birth to six.

5. Children learn written language through active engagement with their world. They interact socially with adults in writing and reading situations; they explore print on their own, and they profit from modelling of literacy by significant adults, particularly their parents.

6. Although children's learning about literacy can be described in terms of generalized stages, children can pass through these stages in a variety of ways and at different ages. Any attempts to "scope and sequence" instruction should take this developmental variation into account (p. XVIII).

The debate among researchers as to whether children's language development is hierarchial has not been entirely resolved. What is agreed upon is that writing is a complex process which appears to progress developmentally, from scribbling, to pictorial and graphic expression, then to

written symbols (Dyson, 1983; Teale & Sulzby, 1985).

As writing research and practice have come to be recognized as an extremely important activity in the educational field, researchers and practitioners have begun to investigate the writing phenomenon with exceptional student populations, such as among learning-disabled children. The following section includes a review of the research of individuals who generated theories and concepts that have advanced the thinking in the field of learning disabilities.

Learning Disabilities

Introduction

One of the most rapidly burgeoning areas of knowledge in educational research is the study of "learning disabilities". Originally coined by Dr. Samuel Kirk, the term was used to describe those children who experience disorders in language, speech, reading, and communication skills. In a discussion of learning disabilities, Kirk (1962) explains:

> A learning disability refers to a retardation, disorder, or delayed development in one or more of the processes of speech, language, reading, writing, arithmetic, or other school subjects resulting from a psychological handicap caused by a possible cerebral dysfunction and/or emotional or behaviourial disturbances. It is not the result of mental retardation, sensory deprivation, or cultural and instructional factors (p. 263).

Since the term learning disabilities came to be recognized in the 1960's, the field has grown up. Research in the area is ongoing. The term learning disabilities has been used by practitioners and researchers to describe a heterogeneous group of children who may possess any of a

number of learning problems. Educational services are available for learning-disabled children and adults, and conferences on learning disabilities now include sessions on educational integration and transition, university training programs, and employment opportunities.

Wiederholt (1974) divides the historical roots of learning disabilities into three clear phases: (1) the foundation phase (1800-1830), was one of scientific research on the brain and its functions; (2) the transition phase (1930-1960), a period marked by scientific studies of brain function disorders; (3) the integration phase (1960-1980), during which the concept of learning disabilities became distinctly recognized in education. During this time, teacher training in learning disabilities was emphasized, school services and special programs for the learning-disabled were created, and an eclectic approach to addressing the important interactive aspects of learning disabilities emerged. Lerner (1981) added a fourth phase to the history of learning disabilities, the contemporary phase. This phase, from 1980 forward, represents contemporary issues, such as the recognition of learning disabilities across various age spans, an examination of the definition and categorization of learning disabilities, and the concept of mainstreaming in education.

The diversity of the theories pertaining to the nature of

learning disabilities is a result of the contributions among various disciplines, including education, neurology, sociology, psychiatry, and pediatrics. A knowledge of the theories concerning the nature of learning disabilities is critical for a more complete understanding of the academic difficulties and educational needs of the learning-disabled. The following section serves to provide the reader with an overview of the major theoretical perspectives on which the concept of learning disabilities has been built.

Theoretical Perspectives

Perceptual - Motor Model

Early emphasis in the field of learning disabilities was concerned with perceptual disturbances in children experiencing brain injury. Initial interest in perceptual - motor dysfunction was initiated by Strauss and Lehtinen (1947) in their work with brain injured children. Cruickshank (1972) maintained "This work, first aimed at the exogenous mentally retarded child was not translated into research dealing with intellectually normal, neurologically handicapped children until approximately 1948, and the results of this work did not find their way into publication until approximately 1952" (p. 381). During this time, professionals believed that perceptual disturbances were a product of neurological dysfunction.

A number of perceptual-motor theories have been echoed by Barsch (1966), Frosting and Maslow (1973), Kepart (1964), and others. This widely accepted view was strongly supported by Cruickshank (1972) when he clearly argued "learning disabilities are essentially and almost always the result of perceptual problems based on the neurological system" (p. 383). The research conducted by these theorists has had significant influence on the field of learning disabilities and educational practice. Proponents of this model viewed

learning as sequential and hierarchal.

Although many perceptual-motor diagnostic instruments continue to be used in some educational settings, the perceptual - motor theoretical model as a way of understanding learning disabilities has been strongly criticized throughout the research literature. Vellutino, Steger, Moyer, Harding & Niles (1977) contend "One argument against this view is that the relationship between perceptual and conceptual functioning is probably reciprocal rather than sequential" (p. 55). Wallace and McLoughlin (1988) argue "The definitions of the concepts are vague, both formal and informal tests lack appropriate technical quality to justify their use, and the remediation emanating from these assessments has not resulted in improvements in either the perceptual skills or the primary academic disabilities" (p. 28). Current research into the visual and auditory systems tend to emphasize cognitive rather than perceptual concepts of learning disabilities (Wallace & McLoughlin, 1988).

Maturational Theory of Learning Disabilities

A number of learning-disabled children are often characterized as immature or behaviorally younger than their chronological ages in certain aspects of neurological development (i.e., motor, verbal, social, and other areas of human development). Proponents of the maturational theory of learning disabilities believe that each individual has his/her own rate of maturation and development, including intelligence. The basic tenet of the maturational perspective is based on normal progressive development of the neurological system. Researchers and theorists of the maturational model suggest individual children who experience deficits in certain areas of human growth do not necessarily display a dysfunction of the central nervous system, rather, the disorder is manifested by a maturational lag or developmental delay in one or more aspects of the neurological system (Lerner, 1981).

Koppitz (1972) contributed to an understanding of the maturational perspective through a five year follow up study determining the maturational rate of special class students with learning disabilities. She concluded "In general, it was found that children with learning disabilities were more immature and more poorly integrated than most other youngsters and they needed more time than most to learn and to grow up" (p. 136). Koppitz suggested children with learning

disabilities do not learn at an average rate.

The maturational lag perspective has generally been helpful in understanding the profile of strengths and weaknesses of the learning-disabled. Parents and teachers have learned to modify their expectations in some areas of social and academic development. However, a major criticism of this perspective has been the mistaken belief that these children will outgrow the learning difficulties. In fact, research indicates that learning disabilities are found at all chronological ages and persist into adulthood (Wallace & McLoughlin, 1988).

Currently, evidence suggests a delay in providing appropriate instructional assistance may lead to secondary problems such as a low self-esteem (Wallace & McLoughlin, 1988). Identifying and programming for children with learning problems should begin at an early age so subsequent problems can be prevented (Wallace & McLoughlin, 1988).

Psychological Processing Theory

Prior to the 1960's, terms such as minimal brain dysfunction, perceptually handicapped, and dyslexia, were used to describe a variety of disorders later known as learning disabilities. During the 1960's, a number of theoretical models of psychological processing were proposed in an attempt to describe and interpret the nature of learning disabilities (Chalfant & Scheffelin, 1969; Johnson & Myklebust, 1967; Kirk & Kirk, 1971). Lerner (1981) explains "The concepts fundamental to the psychological processing theory are that children differ in their underlying mental abilities to process and use information and that these differences effect the child's learning" (p. 170).

Proponents of this theory believed that some children fail to learn in the classroom because of dysfunctions directly related to the brain (Lerner, 1981; Poplin, 1984). It was believed the source of children's learning problems in reading, writing and math resulted from disorders in one or more of the psychological processing systems (i.e., poor visual or auditory processing and discrimination, slow understanding and interpretation of visual or auditory information, poor organizing and generalizing ability, expressing oral or written concepts, memory dysfunction, motor deficit, and others) Kirk and Kirk, 1971. As a result of this

theoretical orientation, research efforts were directed at identifying specific disorders by assessing the psychological processes of children with learning difficulties.

Among the several models of psychological processing theories proposed to explain the nature of learning disabilities, Kirk and Kirk's (1971) psycholinguistic process model is one the best known (Lerner, 1981; Wong, 1985). It purports some children have difficulty with classroom learning because of a psychological processing dysfunction, often referred to as an ability deficit (Kirk & Kirk, 1971; Lerner, 1981). According to this theory, these children require special instructional methods to learn effectively in the classroom setting.

Proponents of this theory have designed three different instructional plans to teach children in this area. The first involves specific training in the area of dysfunction. The second centers on teaching through a child's modality of strength. The third instructional approach is a combination of the first two previous methods (Wong, 1985).

The psychological process model has been criticized throughout the research literature (Myers & Hammill, 1982; Torgenson, 1984). Wong (1985) strongly criticizes the ability - deficits theory and states "By focusing exclusively on the child's ability deficits, the proponents of this theory failed to grasp the complexity of the total learning situation, in

which, multiple and interactive factors determine the learner's learning outcome" (p. 145). Although the psychological processing perspective has been criticized throughout the research literature, educators and practitioners have found the theory helpful in the diagnosis and remediation of children with learning disabilities (Lerner, 1981).

Academic Skills Mastery

During the 1970's, behaviourists became prominent in special education. Theorists and practitioners began to examine the field of learning disabilities from a behavioral perspective (Poplin, 1984). Central to a behaviouristic explanation of learning disabilities is the academic skills mastery approach to diagnosis and instruction. A number of terms are used interchangeably throughout the research literature to describe this theory: task analysis, specific skills training, directed teaching, sequential skills training, and mastery learning (Lerner, 1981).

Specifically, the basic tenet of the academic skills approach is the analysis of a particular task into its component parts or behaviours (Lerner, 1981; Poplin, 1984). Lerner (1981) explains "The underlying assumption is that academic success or failure is due to the connections between the subskills that are characteristic of a particular academic task" (p. 174). Proponents of this perspective believe that the child has a lack of experience and practice with the task itself rather than an intrinsic developmental or ability deficit. The academic skills mastery theory focuses on an analysis of the component parts of a task rather than an analysis of the child (Lerner, 1981).

A number of prominent theorists have criticized the

notion of a hierarchy of sequential skills in learning. Johnson and Pearson (1975) argue:

> The whole notion of a sequence or hierarchy of skills is, at best, a pedagogical convenience. While the idea may appeal to our sense of logic just as we think of driving a car or riding a bicycle as a complex sequence of subskills, there is precious little evidence to support the existence of separate skills let alone separate skills which can be placed into a sequence of hierarchy (p. 760).

Cruickshank (1977) says it is deluding to ignore concepts of psychological processing dysfunction in the explanation of learning disabilities, given we are dealing with complicated developmental deficits, not just a problem with sequential instructional techniques.

Although a number of researchers and practitioners have raised some fundamental concerns regarding the academic skills mastery perspective, it has had considerable impact in the field of learning disabilities and educational practice.

Cognitive Developmental Approach

The decade of research between 1970 and 1980 set the stage for the emergence of a new theoretical model to provide a more complete understanding of learning disabilities (Poplin, 1984; Reid, 1988). Debate and criticisms over the psychological and behavioral models to demonstrate maintenance and generalization of skills over time provided impetus for further research investigation. A growing body of research emerged suggesting the strategic repertoire and the way a learner approaches a task is as significant as the accuracy of acquired academic behaviours (Poplin, 1984).

Proponents of the cognitive developmental approach began to view children as active participants in the learning process, contrasting the behaviourists view of learners as passive recipients responding to environmental conditions (Reid, 1988). Reid explains, "This new approach to learning is both cognitive, and developmental in that it is primarily concerned with the process of learning that goes on inside the learners head, and developmental, in that its focus is on how children change over time" (p. 12). Gradually, researchers from a wide variety of fields became interested in how children acquire knowledge.

Jenkins' (1979) adapted tetrahedral model represents and outlines this cognitive - developmental approach to learning

and instruction. The model identifies four basic factors of influence in a learning situation: (1) the characteristics of the learners; (2) the criterial task; (3) the learning activities; and (4) the nature of the materials (Reid, 1988). The model demonstrates that all four factors indicated in the tetrahedral model are important determinants in the learning process. Reid explains that the tetrahedral model attempts to understand the processes involved in learning rather than fully concentrating on the product oriented outcomes of learning.

Wallace and McLoughlin (1988) suggest that learning-disabled students encounter deficits with various concepts of cognition (i.e., impulsivity, inefficient usage of strategies, memory deficits, problem solving, metacognitive deficiencies and others). Torgenson (1977) maintains that many learning-disabled children can be characterized as strategy deficient, inactive learners.

The cognitive - strategies model of identifying and training emphasizes the need for learning-disabled students to actively develop and apply functional learning strategies to learning tasks. Cognitive - instructional strategy programs resulting from the theoretical framework discussed here deserve serious consideration for use with the learning-disabled population. However, extensive research is needed to ascertain the strategies and knowledge used by subtypes of

learning-disabled children, and then to relate this information to instructional and training techniques. A number of cognitive - instructional programs are currently being developed and utilized by researchers and practitioners (Graham & Harris, 1987; Harris & Pressley, 1991).

Summary

A knowledge of theory and its relationships provide a foundation for one seeking to understand the diverse learning problems of learning disabled children. Although many theorists and practitioners are seeking to explain the concept of learning disabilities, it is a slow process with a number of fundamental problems prevailing. Current research must continue to investigate the field of learning disabilities in an effort to gain a more thorough and eclectic understanding of the nature of learning disabilities.

Learning-Disabled Writers

Historical Influences

Initially, the concept of writing disabilities referred exclusively to severe and persistent problems in spelling and handwriting. In 1937, Orton defined writing disabilities as "developmental agraphia" which refers to either slow or illegible handwriting performance. The notion that learning-disabled writers have difficulty meeting classroom writing demands because of problems related to the mastery of handwriting and spelling has persisted, although a more comprehensive understanding of writing disabilities has emerged from the research literature.

The earlier understanding of learning-disabled writers has broadened to include the written composing ability of students with learning disabilities (MacArthur & Graham, 1988; Nodine, Barenbaum, & Newcomer, 1985; Scardamalia & Bereiter, 1986). Houck and Billingsley (1989) state "Interest among researchers in the field of learning disabilities is partly due to the importance attached to writing skills, concerns about students' writing proficiency, and the view that the study of interrelated language systems (speaking, reading, and writing) enhances our understanding of cognitive processes" (p. 561).

During the past decade, researchers have been examining

the written language of students with learning disabilities to try and provide insight about specific areas of writing dysfunction. Deficits in the area of written language among children with learning disabilities are well documented throughout the research literature and researchers have argued that these writing difficulties are persistent into adulthood (Graham & Harris, 1987). Although the body of research literature describing the writing performance among children with learning disabilities is current, diverse, and far from comprehensive, it provides valuable insight into the kinds of writing difficulties that many learning-disabled children encounter.

Review of the Research Literature

Quite often, children who experience learning disabilities specific to writing have repeatedly encountered failure in attempting to express themselves in written form. As demands for writing increase through the upper grade levels, students experiencing difficulty in written expression may become increasingly reluctant and anxious during writing activities. Outhred (1989) suggests "These children commonly develop strategies to cope with writing - for example, limiting their vocabulary to known words, avoiding complex ideas, and making any written work as short as possible" (p. 262). Additionally, with increasing awareness of their writing limitations as they move into the higher grade levels, children with learning disabilities specific to writing may experience motivational deficits that further interfere with their academic performance. Consideration must be given to effective instructional strategies that will enable learning-disabled writers to participate more actively and confidently in the curriculum (Graham & Harris, 1992).

In the last two decades we have witnessed an increased interest in writing research and instruction in education. In fact, a number of prominent investigators have examined the written language of individuals displaying specific learning disabilities in an attempt to identify areas of written

language deficiencies. An examination of the research reveals that writing difficulties among learning-disabled students are manifested in (1) spelling, punctuation, and grammar (Wong et al., 1991), (2) handwriting skills (Cicci, 1989; Graham & MacArthur, 1988; Graves, 1985; Majsterek, 1990), and (3) a lack of efficient planning, composing, editing/revising, and awareness of audience (Graham & Harris, 1992; Scarmdamalia & Bereiter, 1986). Findings from many of the studies describe the differences between normal and learning-disabled students' writing processes and their writing performance.

A number of early studies conducted in the 1970's and 1980's focused primarily on the mechanical and syntactic processes in writers with learning disabilities. Myklebust (1973) examined the syntactic maturity in writers with learning disabilities. His findings clearly demonstrated significant deficiencies in both the mechanical and syntactic processes of writers with learning disabilities. Myklebust reports that learning-disabled children received lower scores in syntax, ideation, and total number of words per sentence than their non disabled peers. Similarly, Poteet (1978) using Myklebust's (1965) Picture Story Language Test examined the written language of learning-disabled students. Poteet found that learning-disabled students produced fewer words and sentences than their normally achieving peers, made more punctuation errors, and produced shorter sentences. A little

later, Anderson (1982) investigated the syntax in the written expression of five learning-disabled and five normally achieving fourth graders. Specifically, Anderson found that the syntax of the learning-disabled group was significantly less proficient than their normally achieving peers. Poplin, Gray, Larsen, Banikowski, and Mehring (1980) compared the written products of learning-disabled with their non-disabled peers at three grade levels using a practical standardized assessment tool. Comparisons of performance were made of the vocabulary, thematic maturity, spelling, punctuation, and word usage. Specifically, Poplin et al. (1980) found these children substantially deficient on some of the more mechanical aspects of written expression, for example, spelling, word usage, and spelling style.

The above research studies reveal important aspects of the writing abilities of learning-disabled children. Specifically, the learning-disabled population demonstrated pervasive deficiencies in both the mechanical and syntactical structures of written expression. The findings are an important foundation on which to gain an understanding of writing performance among learning-disabled children. Moreover, research findings can be translated into effective instructional practice in the classroom setting.

Current Research

Within the past two decades, the focus in language arts instruction has been shifting from an emphasis on reading to an expanded view of holistic language learning. Barrs (1983) suggests "The shift can partly be explained by social and political factors, such as the development of the concept of literacy" (p. 829). Glazer and Curry (1988) believe that the expanded view of literacy demands that regular and special class teachers not only address reading problems, but also the problems that children experience in writing. Consequently, we have witnessed an increasing interest in written language as a focus for educational research and classroom instruction. Moreover, a renewed interest in written language has been paralleled with a shift in research and pedagogy from a product focus to the process approach to the teaching and learning of written expression.

Extensive research over the past decade has tended to concentrate on the complex cognitive activities used in written composition. There is general agreement among prominent researchers that the writing process is composed of several subprocesses that occur simultaneously including planning, translating, editing, and revising. Wong, Wong, Darlington, and Jones (1991) refer to the processes of planning, writing fluency, revising, awareness of audience as

higher-order cognitive and metacognitive processes. Wong, Wong, et al. (1991) in discussing written language difficulties among learning-disabled students propose that "These composing problems consist of lower-order cognitive problems in spelling, punctuation, and grammar, and higher-order cognitive and metacognitive problems in planning, writing fluency, revising, and awareness of audience" (p. 117). With the complexity of the writing process, it is not surprising that many learning-disabled students experience deficiencies in one or more of the subprocesses involved in written expression. Flower & Hayes (1980) maintain that writing is a complex cognitive process in which writers move back and forth among various subprocesses during written composition. Morocco and Neuman (1986) maintain:

> Students lack the cognitive strategies more experienced writers use for managing the basic writing processes. This lack of facility with the basic mental processes needed in writing is usually coupled, by the fourth grade, with anxiety about failing in school (p. 244).

It has been concluded that many learning-disabled students can be characterized as deficient in activating and strategically applying higher-order cognitive processes (Englert, Raphael,

Fear, & Anderson, 1988; Torgenson, 1977).

A review of the current research literature suggests problems in written composition among students with learning disabilities are manifested in three major areas: idea generation, text organization, and metacognitive knowledge (Englert & Raphael, 1988; Scardamalia & Bereiter, 1986). These three areas will be addressed in the following section.

Idea Generation

Particularly significant to the research in written composition among students with learning disabilities are the findings on idea generation or planning (Scardamalia & Bereiter, 1986). Specifically, Scardamalia and Bereiter say the process of planning depends on a student's ability to retrieve ideas from background knowledge, possess a knowledge of memory search strategies, find and focus on a topic, and possess the ability to research in order to obtain information about a topic.

Hillocks (1986) suggests inefficient writers spend less time than skilled writers during planning processes such as idea generation. Moreover, inefficient writers are said to make use of a less efficient "knowledge telling" strategy, that is, they write down whatever comes to mind about a topic in a non-reflective manner (Scardamalia & Bereiter, 1986). Englert & Raphael (1988) explain "With the knowledge telling strategy, poor writers tell everything they know about a topic in whatever order the ideas come to mind, resulting in text that is generated in a linear and associative fashion" (p. 514). In contrast, successful writers retrieve and organize ideas from background knowledge, indicating the presence of "metamemorial" strategies (Englert & Raphael, 1988; Scardamalia & Bereiter, 1986). Metamemorial search strategies

enable skilled writers to retrieve ideas from background knowledge and group related ideas into the context of their writing plan (Englert & Raphael, 1988).

The work of Thomas et al. (1987) convincingly demonstrates many learning-disabled students experience significant difficulties retrieving and employing relevant schema from memory. Although it has been suggested that learning-disabled students may lack knowledge about assigned topics rather than content-generation problems, recent research suggests problems in written composition among learning-disabled students are partly due to problems they encounter in expressing their knowledge about a particular topic in written form (Graham & Harris, 1989; Thomas et al., 1987). This suggestion is supported by MacArthur & Graham (1987) who found that learning-disabled students may possess more knowledge about a topic than is reflected in their written compositions; and their oral compositions were longer and of better quality. Englert and her research colleagues (Englert & Raphael, 1988; Englert, Raphael & Anderson, 1986; Thomas et al., 1987) have further argued that learning-disabled students experience content generation problems because they are not successful in actively applying self-directed memory search strategies. Taken together, these studies suggest learning-disabled students display a discrepancy between the knowledge they have about a particular

topic and their ability to express this knowledge in written form. Moreover, current research suggests that learning-disabled students are not particularly adept at retrieving and employing strategies to assist them in activating more complete knowledge searches (Englert & Raphael, 1988).

Text Organization

Another significant element important to writing is the writer's ability to generate and arrange ideas sequentially in a structured organizational plan. Current research investigating knowledge of text organization and structure among learning-disabled students reveals these children perform below their non-learning-disabled peers in their ability to create an organizational plan that structures and categorizes ideas (Englert et al., 1988). Similarly, research reveals that learning-disabled students display significant difficulties in their ability to plan and make organizational decisions pertaining to the presentation and arranging of ideas during writing activities (Scardamalia & Bereiter, 1986).

Nodine et al. (1985) found that unlike the narrative stories of normally-achieving peers, stories written by subjects with learning disabilities lacked an understanding of story schema. Nodine et al. (1985) explain "Story schema is a set of expectations about the structure of stories that make both comprehension and recall more efficient" (p. 167). Englert et al. (1986) found learning-disabled students experience difficulty categorizing ideas into superordinate categories. The research investigating knowledge of text organization reveals that many school-age children with

learning disabilities perform below their normally achieving peers on their knowledge of text organization structure of the writing process. Similarly, researchers Englert et al. (1988) administered a writing interview to learning-disabled and regular classroom students. Their findings revealed that learning-disabled students differed from their non-learning-disabled peers in their ability to generate ideas into categories of information as suggested by their responses.

Metacognitive Knowledge

A relatively new area of research conducted primarily in the decade from 1980 to 1990 on "metacognition" offers a new perspective on the writing difficulties of some learning-disabled children. Research thus far indicates a deficiency in metacognitive sophistication among learning-disabled children.

Metacognition refers to an individual's knowledge about his or her own cognitive performance and strategic regulation of cognition and learning (deBettencourt, 1987). Some metacognitive skills include self-monitoring, selecting and applying successful strategies, planning effective organizational schemes for approaching tasks in learning and studying, and problem solving (deBettencourt, 1987; Englert & Raphael, 1988).

As normally achieving children mature, they acquire self-regulatory skills which form the basis for planning, thinking and problem solving across the curriculum areas (Borowski, 1992). Englert et al. (1988) state "Throughout the writing process, writers employ their metacognitive knowledge to recognize what strategies are needed and to regulate strategy use depending on whether a procedure has been successful or unsuccessful" (p. 19). However, research suggests that many learning-disabled students do not acquire metacognitive

knowledge with the same efficiency as their non-disabled peers. Baker (1982) characterizes learning-disabled students as individuals deficient in the cognitive processes needed to accomplish a task or monitor their own thinking processes. Similarly, Palinscar and Klenk (1992) maintain "Young children with learning disabilities typically encounter difficulty with academic tasks requiring intentional effort and effective use of metacognitive skills - qualities that competent readers and writers possess" (p. 211).

A number of significant studies have dealt specifically with the use of metacognitive knowledge during writing activities among learning-disabled students. Nodine et al. (1985) found that learning-disabled children experienced more difficulties than their non-disabled peers during story writing activities. Specifically, the researchers reported that the written work of the learning-disabled children was characterized by simplistic pictorial descriptions or idiosyncratic remarks unrelated to the visual writing prompts provided by the investigators. More recently, Englert et al. (1988) compared results from a metacognitive interview with written text using the compare/contrast and explanation formats. Specifically, the researchers found that children with learning disabilities were less aware than their non-learning-disabled peers of writing strategies, organizing and presenting expository ideas, the steps of the writing process,

and effective procedures for selecting and integrating information from various sources. Similarly, Wong, Wong, and Blenkinsop (1989) investigated the metacognitive knowledge of learning-disabled adolescents in relation to their ability to compose argumentive and reportive essays. They found the essays composed by the learning-disabled students were vastly inferior than those composed by their non-learning-disabled peers in "interestingness", clarity in communication, and word choice. Moreover, learning-disabled students were less familiar with writing activities than their normally achieving peers and were deficient in their megacognitive knowledge about the writing process. These findings led the researchers to conclude that the learning-disabled students were developmentally delayed in both the cognitive and metacognitive processes involved in writing.

The metacognitive knowledge of children and adolescents with learning disabilities has become a significant research area with extensive implications for classroom instruction. Because a learning-disabled child with problems in written language may experience difficulties with any or all of the above subprocesses of written language, the classroom teacher must consider what teaching techniques can be effective for learning-disabled children with writing problems (Graham & Harris, 1992).

The written language deficiencies among children with

learning disabilities has only recently received attention in the educational literature and pedagogical practice. The quality of the research, development of assessment tools and techniques, and the diverse instructional approaches have been extremely helpful in the understanding and programming of children with learning disabilities specific to writing.

Current Instructional Approaches to Writing

Typically, writing has been a difficult task for students with learning disabilities (Shannon & Polloway, 1993). To a large extent, the teaching of writing has been product-oriented for a number of years. Students taught with this traditional approach have been practising specific skills on grammar, spelling, and handwriting as strategies to strengthen component skills of written language (Tompkins & Friend, 1986). The emphasis of the product oriented approach is on the end product, not on the process that writers experience during composing activities.

Traditionally, teachers of learning-disabled children with writing difficulties have focused on teaching the mechanical aspects of writing in isolation with little emphasis on assisting learning-disabled writers to develop composing skills (Kerchner & Kistinger, 1984). Roit and McKenzie (1985) maintain that curriculum in special education has been "typified" by the task-analysis perspective which assumes that concept development is at the end of the writing hierarchy. They argue:

> By continuing to assume that concept development is the final stage of the written language hierarchy, and that mastery must be attained at each of the

> "lower" stages, the learning-disabled student may forever have his potential for growth in written language confined to good spelling and clear handwriting instead of meaningful thought (p. 258).

Although this traditional product-oriented approach to writing instruction may be suitable for normally achieving children, it may not be an effective instructional method for learning-disabled students with writing problems. Graves (1985) contends "Children with learning disabilities often work on skills in isolation, disconnected from learning itself, and therefore disconnected from themselves as persons" (p. 36). Graves (1985) adds "though their skills may improve slightly in isolation, the children do not perceive the function of the skill" (p. 36). Keefe and Keefe (1993) argue "When language is segmented, the learner is not provided the advantage of all the cuing systems. Likewise, authentic language use cannot be subdivided into parts because each component works with and influences the effectiveness of the other components" (p. 172). Fortunately, the focus in language arts instruction has shifted as teachers have become aware of the benefits of teaching written expression in a more holistic manner.

A recent shift in the emphasis in the teaching of writing from a narrow focus on product to a more holistic approach of

teaching written expression, may provide a promising alternative which writers of varying abilities engage. A decade of writing research by experts in the field (Calkins, 1986; Graves, 1985) have revealed when children write they cycle through a series of recursive stages during the composing process: prewriting, drafting, revising, editing, and sharing (Graves, 1983). The "process approach" to the teaching and learning of written expression focuses on the actual process writers experience as they write (Schwartz & MacArthur, 1990). Vallencorsa, Ledford, and Parnell, (1991) in describing the process oriented approach suggest, "Students are taught to view writing as a process involving planning, drafting, editing, and revising. Rules of grammar, punctuation, capitalization, and spelling are taught as needed within the context of composing" (p. 52).

The process-oriented approach to writing appears to hold great promise for many learning-disabled children experiencing writing difficulties, however, caution must be exercised. Although many children who do not have learning disabilities learn to write naturally through daily exposure to practice (Whitt, Paul, & Reynolds, 1988), simply providing time for learning-disabled writers to write may not be effective in assisting these children develop good written language. Research literature indicates that many learning-disabled students exhibit slow rates of learning in the acquisition of

new concepts and in acquiring proficiency with newly acquired skills upon which higher level learning can be built (Goldman & Pelligrino, 1987). Consequently, direct instruction of writing strategies and modelling of certain aspects of the writing process may be needed to increase the automaticity necessary for growth in written language ability among learning-disabled writers (Graham & Harris, 1989; Majsterek, 1990). Future research must consider which instructional strategies are most effective for teaching writing to learning-disabled students (Graham & Harris, 1992; MacArthur, Schwartz, & Graham, 1992).

The Issue of Curriculum Deficiency

Over the past two decades, a number of researchers have attributed writing disabilities among learning-disabled students to insufficient educational opportunities (Altwerger & Bird, 1982; Graham, 1992; Roit & McKenzie, 1985). Altwerger and Bird charge teachers often focus on drill and practice activities aimed at improving the mechanics of handwriting and spelling.

Recent research by Christenson, Thurlow, Yssledyke, and McVicar (1989) revealed that learning-disabled students did not receive adequate instructional time to develop writing skills and the emphasis was placed on acquiring the mechanics of writing. This focus on the mechanical aspects of writing continues to persist even within remedial and special education settings, even though current research suggests that writing should emphasize the interrelated processes involved in writing (Barenbaum, 1983).

Altwerger and Bird (1982) contend that it is often the deficient curriculum rather than the child that is disabled. Although the issue of curriculum deficiency or "dyspedagogia" has been suggested as a crucial factor in the failure to acquire basic skills, it is believed that the emphasis on the mechanical components of written language may further impede learning-disabled students' abilities to develop as writers.

The current changing perspectives in writing instruction holds promise for learning-disabled students. Educators have become increasingly aware of the benefits of teaching writing in a more holistic manner, providing instruction and support to help students of varying abilities develop and grow as writers.

Microcomputers: Access to the Writing Process

The current whole language philosophy for teaching writing to children at the primary grade level adopted by the Provincial Department of Education for Newfoundland and Labrador (1991), has much in common with what the educational technology literature on microcomputers has to say. Equally important, is the growing body of research literature which suggests that the process-oriented approach to writing instruction, a practice consistent with whole language philosophy, in combination with microcomputer instruction, can be an effective tool for both teaching and reinforcing concepts among learning-disabled writers (MacArthur, Schwartz, & Graham, 1991; Schiffman et al., 1982).

The implementation of computers into the classroom setting has the potential for providing a whole new set of alternatives to educators in the instruction of children with learning disabilities in writing. Word processing programs offer learning-disabled writers a new opportunity to engage in writing. MacArthur (1988) states "Computers can support the cognitive processes involved in planning, writing, and revising text" (p. 536). MacArthur maintains "Computers also can enhance instructinal interactions between teacher and student by providing the teacher a window onto the writing processes of individual students" (p. 541). A variety of

quality computer-assisted instruction (CAI) courseware programs are available to assist students with specific skill areas that have identified as requiring further instruction. Shiffman et al. (1982) discuss the unique features the microcomputer offers in the instruction of children with learning disabilities. They write as follows:

1. Microcomputers are considered user friendly; they can use the students' names when giving lessons and allow them to make mistakes in a nonthreatening environment. Because the microcomputer is nonjudgemental, i.e., it does not chastise the learner for the wrong answer, some of the stress associated with making a mistake is eliminated.

2. The computer can give the child its undivided attention and does not have to be concerned about other children in the room.

3. Students with learning disabilities often work more slowly than others. The computer does not mind; it waits patiently while the child works out the answer. It is not in a hurry to go on to the next child or the next problem. No real adaptation of software is necessary to get the computer to wait.

4. Reinforcement of individual responses is immediate rather than having the student wait until the teacher can grade the work. Children with learning disabilities are sometimes unsure of themselves. Computers can provide continuous positive feedback and praise, thus giving students a higher sense of self-esteem. Raising a student's self confidence level can be a tremendous contribution to the ability to learn.

5. Drill and practice can become exciting through the use of animation, sound effects and game-playing situations.

6. LD students often display a greater need for routine and repetitious practice than their peers. Unlike a teacher or tutor, the computer can have infinite patience. It does not respond on an emotional level and does not mind repeating itself several times (p. 557-558).

There are several unique types of computer applications useful in the instruction of children with learning disabilities specific to writing. However, this review will deal with current applications of computer technology which can be considered useful to enhance or adapt instruction of curriculum content, specifically, word processing, drill and practice, and tutorial courseware.

Word Processing

A growing body of research indicates that word processing programs are enabling tools for children with learning disabilities specific to writing. Arguments to support this claim have been made by a number of prominent researchers in the field of learning disabilities. Graham and MacArthur (1988) contend the editing features of a word processor are particularly suitable to the learning-disabled writer in that it provides the writer with an opportunity to make revisions without tedious recopying. Moreover, the ease of revision may allow learning-disabled writers to concentrate on the content first and the mechanical aspects of the written work later. Outhred (1989) suggests the word processing functions of a microcomputer provide the writer with a final copy of a written story or assignment in a neat, legible fashion. Littlefield (1983) maintains that a word processing package enables students to focus more on the process of writing than on isolated mechanical components of writing. Other researchers have suggested that word processing reduces the demands of handwriting and motoric skills because the formation of letters and staying on the line becomes automatic (Glazer & Curry, 1988). Finally, Vacc, (1987) has suggested that writing on a microcomputer may provide the positive reinforcement that learning-disabled writers require to

encourage them to engage in written language activities.

A study by Kerchner and Kistinger (1984) investigated the effects of word processing in combined with the process approach to writing instruction with elementary level learning-disabled children. Results revealed that elementary students made substantial gains compared with a control group comprised of non-learning-disabled students that received no instructional intervention. A relatively recent case study conducted by Morocco and Neuman (1986) concluded that the word processing features of a microcomputer could facilitate a product oriented skills approach to writing instruction as well as a process approach. In 1983, Lindsay and Marini found that learning-disabled students, ranging in age from 13-19 years reported substantial gains in the fluency and quality of their compositions through the word processing feature of a microcomputer.

In 1989, Outhred investigated the effects of using a word processor for creative writing activities with a small group of children with learning disabilities. Specifically, Outhred found that the effects of using a word processor appeared to be influenced by the writing dysfunction the children were experiencing. First, the use of the word processor with children experiencing severe spelling problems resulted in stories with fewer spelling errors. Secondly, the use of the word processor seemed to result in longer stories for children

who were concerned with the mechanical components of writing during composing activities. Although this study suggests that a word processor may have positive results on written work of children with learning disabilities, replication needs to occur to ensure validity of conclusions derived from the study.

The use of a word processor can provide a vehicle for children who experience difficulty with the physical or motoric aspect of writing. While some students with writing disabilities require specific instruction in the mechanical or composing components of written expression, others need a tool to help them circumvent writing altogether. The child who experiences dysgraphia, often requires instructional tools to strengthen or compensate for weaknesses. According to Cavey (1987), children with dysgraphia have difficulty transducing visual information into motor control with ease and efficiency. Word processing can provide a new vehicle for producing written work. It is an enabling tool that can empower individuals with severe handwriting problems to write (MacArthur & Shneiderman, 1986).

Although a number of research studies and literature reviews have demonstrated the potential of word processing particularly for learning-disabled writers, there have also been a number of cautions voiced throughout the educational research literature. Daiute, O'Brien, Shield, Liff, Wright,

Mazur and Jaivitz (1983) reported on the problems involved in word processing. Specifically, Daiute et al. conveyed the difficulties students had in mastering the word processing features of a microcomputer, for example, the acquisition of typing skills and basic editing commands. Similarly, MacArthur, Haynes, Malouf, Mattson, and Dreyfus (1985) found that fifth and sixth grade learning-disabled students had difficulty using the editing features of a word processing program. While a number of optimistic findings have emerged from the research literature on the use of word processing software learning-disabled writers, more research is needed to determine the kinds of strategies and training that would benefit these children in utilizing word processing software.

As more teachers and students have a greater access to microcomputers and word processing, instruction and practice will be effected significantly. The increasing refinement of word processing software by major educational computing companies is effecting the teaching and learning of writing among students of varying ability levels. Features like flexible editing, spell checkers, a variety of text and format options, and a neatly printed copy, are just a few of the unique advantages a word processor offers students with writing problems (Anderson-Inman, 1991; Day & Sweitzer, 1990). Other recent innovations in microtechnology include synthesized speech to provide sound-symbol correspondence

during writing, revising, and editing; built in style checkers for correct grammar and style; and enhanced graphic capabilities.

Computer enhancements in combination with other advanced technologies hold many possibilities for supporting writing instruction among learning-disabled students. Researchers have experimented with "projection plates" to facilitate writing among learning-disabled students. Anderson-Inman (1990-91) state:

> A projection plate (otherwise known as a PC viewer) connects to a computer and sits on top of an overhead projector, projecting the computer's video signals to a large screen or blank wall. By using a projection plate, teachers can share whatever is on the computer's monitor with a large group of students (p. 27).

As a result of these current innovations in technology, students who have been limited in written language may demonstrate a greater involvement in collaborative writing activities (Anderson-Inman, 1990-91).

Computer Assisted Instruction

Introduction

Computer assisted instruction (CAI) refers to courseware packages that purport to introduce new academic skills or review existing curriculum content. Most computer assisted instructional courseware can be classified under one or more of the following designs: drill and practice, simulations and tutorials (Sitko, 1986). Sitko suggests CAI is particularly beneficial for students with special learning needs who require reinforcement of skills previously taught, or who need additional drill and practice in order to increase the automaticity of certain concepts. Torgenson and Young (1983) believe that computer assisted learning can provide the necessary practice that many learning-disabled students need to acquire skills in language arts and math.

Drill and Practice

Drill and Practice courseware allows students to practice a previously introduced skill for proficiency. Goldman and Pellegrino (1987) suggest that many learning-disabled students exhibit slow rates in the acquisition of certain skills and concepts and in developing efficiency and expertise in applying new skills. They state: "While it could be argued that drill and practice on the microcomputer is just automated

flashcards, the advantage of microcomputer delivery of drill and practice is in the potential for developing automaticity in basic skills" (p. 147).

Chisholm (1987) strongly criticizes the use of drill and practice computer programs. He maintains that drill and practice software perpetuates a passive approach to learning, characteristic to learning-disabled children. However, Sitko (1986) argues that students with exceptional learning needs become more involved, motivated, and interested learners following computer-assisted learning activities.

The ultimate effectiveness of drill and practice courseware with learning-disabled children will greatly depend on the adequacy of teacher training, access to microcomputers, availability of teacher resource support, and further research. While there is still much research to be conducted to determined what is being learned from drill and practice microcomputer instruction, the computer appears to hold tremendous potential to assist learning-disabled writers in the learning process.

Tutorial Courseware

Courseware in tutorial form covers a broad range of curriculum areas, all of which provide instruction to the learner. A tutorial program usually presents academic concepts in a sequenced format. A well-designed tutorial program will present the learner with questions concerning the subject matter to determine comprehension of material.

Many tutorial programs are equipped to provide effective review of subject matter that has been previously introduced before leading the learner to new concepts. This feature can be particularly beneficial to learning-disabled students who often need to review subject matter with which they had prior instruction (Goldman & Pelligrino, 1987). Also, depending on a student's responses and interactions, well-designed tutorial software proceeds to lead to the learner into new information or to another section of the program for review or additional remediation. In addition to providing truly individualized programs of learning, CAI has been shown to have positive effects on the academic achievement of exceptional students (Lindsay & Marini, 1983).

Microcomputer instruction can add a new dimension to educating students with learning disabilities in written expression. The merging tapestry of microtechnology is providing educators with innovative ways to supplement,

enhance, or adapt instruction (Day & Sweitzer, 1990)

Effective Implementation of Microcomputers

Although regular and special class teachers have been quick to embrace microcomputer instruction with special needs children, simply computerizing a classroom should not be equated with effectively matching the instructional needs of learning-disabled children. It is clear that educators must become knowledgeable about quality courseware and develop a degree of expertise in the effective implementation of microcomputer instruction in the classroom setting.

A variety of potentially problematic issues related to the effective implementation have been cited throughout the research and literature. The key areas of concern have been: 1) limited amount of quality courseware to match the individual needs of special learners; 2) the need to evaluate the effectiveness of the microcomputer as an instructional tool with exceptional children; 3) the availability of training and support in the instructional uses of the microcomputer (Kolich, 1985; MacArthur & Malouf, 1990; Peterson & McDonald, 1991; Schiffman et al., 1982). Computers in schools can be helpful but only if properly used. Given time and training, educators can use them to teach more effectively.

The critical role of the classroom teacher as the key factor in the successful implementation of microcomputer instruction has been repeatedly emphasized throughout the

research literature. Sitko (1986) states "The most successful classroom applications of the computer are a direct function of the teacher's ability to determine how best to use the computer's capabilities in the context of the existing curriculum demands and diverse learning needs" (p. 436). Blurton and Harris (1989) maintain "However, the important question seems to be not if but under what circumstances computers can best help students learn; what computer-based technology, with what teaching strategy, with which students, will produce improved cognitive and effective outcomes" (p. 85).

As with any new instructional technique or program, the implementation of microcomputers can be impeded if educators are not adequately prepared to effectively integrate courseware to match the instructional needs of students. Sitko (1986) contends "Probably the most significant aspect of computer technology for classroom teachers is the degree to which the computer can facilitate the match between the curriculum demands of the classroom and the individual learning needs of the students" (p. 436).

Teacher Effectiveness and Computer Instruction

An extensive body of research conducted over the last two decades that establishes the parameters of teacher effectiveness and program implementation, (Brophy & Good, 1986; Mastropieri & Scruggs, 1987; Rosenshine & Stevens, 1986) has much in common with what the educational literature has to say about the use of computers with special needs students. Bear (1984) suggests "until we do learn what key factors contribute to the successful integration of CAI with microcomputers at school level, one would be wise to apply what we already know about school and teacher effectiveness to the usage of microcomputers" (p. 12). Similarly, Sitko (1986) suggests "In essence, implementing computer software for the special needs student requires the same adherence to effective teaching and learning principles and procedures that is necessary for bringing about any change through programming" (p. 436).

Recently, elements from the "effective teaching" literature have been described for teaching special needs students in the mainstream classroom. Specifically, Mastropieri and Scruggs (1987) state:

> Teachers who use effective teaching variables teach to prespecified objectives; provide systematic

> presentations that go directly, step by step, to the point of the content being taught; ask specific questions related to instructional objectives; provide specific guided and independent practice activities; and monitor student progress toward the meeting of instructional objectives (p. 396).

Equally important is the growing body of research literature on the effective microcomputer instruction for learning-disabled students (Lindsay & Marini, 1986; Montague, 1987; Schiffman et al., 1982; Torgensen & Young, 1983). Specifically, Montague (1987) describes a number of recommendations for effective microcomputer instruction with learning-disabled students. Recommendations include: "establishing a teacher - microcomputer instructional partnership, teaching a comprehensive strategy as a process before introducing microcomputer instruction, and utilizing available technology to realize instructional goals" (p. 129).

Although it has yet to be determined empirically through research whether or not the elements of effective instructional practice will be found to be linked to the effective use of microtechnology, the implementation of microcomputers at the school level in combination with sound elements of effective teaching practice appears to have the potential to greatly enhance the instructional effectiveness

in the classroom. Lillie, Hannum and Stuck (1989) contend "What is known about effective instruction can clearly be used to guide and structure methods for using computers in the classrooms" (p. 8). Lillie et al. (1989) concluded knowledge about effective teaching principles has implications for determining how to select and utilize software for instruction.

Recently, a number of prestigious researchers have published materials describing the use of effective teaching principles in instructional practice (Glassman, 1990; Weisgerber & Rubin, 1985; Wepner, 1992). Specifically, Weisgerber and Rubin (1985) in their four-year research on identifying effective instructional uses of microtechnology with the learning-disabled, developed lesson plans for selected pieces of courseware. Lesson plans were divided into three sections: a pre-computer activity to be done with students before using the computer with selected courseware, an activity in connection with the computer, providing practice or instruction of certain academic skills or concepts, and a post computer activity in attempt to demonstrate skill attainment or transfer of learning.

An instructional plan such as the one presented by Weisgerber & Rubin (1985) can be extremely beneficial to many learning-disabled students who may require a very structured, systematic approach to learning. Additional research is

needed in an effort to define the relationship between effective teaching practices and principles and effective microcomputer instruction in the classroom environment.

Concluding Comments

The microcomputer is viewed as one of the most promising of current technologies for exceptional children, particularly for those with learning disabilities. In fact, a growing body of research suggests that the unique features of the microcomputer are ideal for assisting in the teaching of written expression to students with learning disabilities specific to writing. Therefore, regular and special class teachers should be encouraged. Educators are beginning to recognize the need for ongoing research to help identify specific strategies and classroom models to assist in the effective implementation of microcomputers into classroom instruction.

CHAPTER III

METHODOLOGY AND PROCEDURE

Analysis of Users and Conditions of Use

Intended Users

The primary audience that this resource guide is prepared for are the elementary regular and special class teachers in the schools of Newfoundland and Labrador. Although the author has designed this resource guide for teachers of learning-disabled writers, teachers will discover that the information presented may assist them in helping students with other special learning needs. Since the contents of this resource guide are not restricted to one particular region, this resource guide can be used by teachers throughout Canada.

Conditions of Use

The author places no restrictions on the use of this resource guide. Teachers, administrators, and parents may avail of its use. It will be made available through the Curriculum Materials Section, Vaughn Library, Memorial University of Newfoundland.

Objectives of the Resource guide

This resource guide is an attempt to assist teachers in the effective integration of microcomputer instruction into the writing process specific to children with learning disabilities in writing. As a result of this resource guide, the following objectives should be realized:

(a) Provides the author's rationale for developing a resource guide on the integration of microcomputer instruction into the writing process specific to children with learning disabilities in writing;

(b) Provides the reader with a general overview of the writing difficulties specific to children with learning disabilities in writing;

(c) Provides a general awareness of how microcomputer applications can support writing instruction;

(d) Describes three main uses of microcomputers specific to children with learning disabilities in writing;

(e) Provides the reader with some general guidelines for selecting appropriate instructional courseware specific to children with learning disabilities in writing;

(f) Provides the reader with a general understanding of how microcomputers are integrated into effective instruction in the regular or special class setting;

(g) Identifies a range of sources of information on the use

of microtechnology with learning-disabled students;

(h) Lists a number of recommended courseware packages that are: a) specifically designed to meet the needs of children with learning disabilities specific to writing, b) easily adapted to meet the needs of these children;

(i) Provides a brief review of some basic terminology used throughout the current research literature in writing instruction;

(j) Provides the reader with a glossary of terms on microcomputer technology;

Organization of Resource Guide Contents

To achieve the objectives stated above, the resource guide is organized in the following manner:

Title: Enriching the Learner: A Resource Guide on Effective Microcomputer Instruction with Learning-disabled Writers

Table of Contents:

- Principles to Assist Teachers of LD Students with Drill and Practice Courseware in the Writing Process.

Tutorial Courseware

- Generalizations about the Use of Tutorial Courseware with LD Writers.
- Principles to Assist Teachers of LD Students with Tutorial Courseware in the Writing Process.

13. Integrating Microcomputers into Effective Instruction

Introduction

Effective Instructional Elements

- Pre-Computer
- On-Computer
- Post-Computer

14. Effective Instructional Approaches in Writing

15. Teacher Effectiveness and Effective Microcomputer Instruction

16. **Effective Instructional Plan #1**

- Program Description
- Instructional Activities
- Procedural Teaching Example

17. **Effective Instructional Plan #2**

- Program Description
- Instructional Activities
- Procedural Teaching Example

18. **Effective Instructional Plan #3**

- Program Description
- Instructional Activities
- Procedural Teaching Example

19. **Effective Instructional Plan #4**

    - Program Description
    - Instructional Activities
    - Procedural Teaching Example

20. Contemporary Issues in the Microeducational Environment

21. Closing Message

22. References

23. Appendix A: Current Writing Terminology

24. Appendix B: General Guidelines for Selecting Effective Curriculum Support Courseware

25. Appendix C: List of Publications, Organizations, and Courseware

26. Appendix D: Glossary of Computer Terms

27. Appendix E: Metacognitive Strategies

    - The Idea Diagram
    - The COPS Strategy

Description of Resource Guide Contents

Introduction:

This section provides the reader with a rationale for using microcomputers as an instructional tool specific to children with learning disabilities in writing.

Objectives:

This section provides the reader with the resource guide objectives which have been set out by the author.

Resource Guide Limitations:

This section provides the reader with a number of limitations identified by the author during the development process.

Overview:

This section provides the reader with an overview of the resource guide contents.

Definition of Learning Disability:

This section introduces the reader is introduced to the widely recognized definition of learning disability adopted by the Canadian Association of Children and Adults with Learning Disabilities.

Characteristics of Learning-disabled Students:

This section provides the reader with a number of general characteristics typical of children with learning disabilities.

Learning-disabled Writers and the Writing Process:

This section introduces the reader to a brief theoretical overview of the myriad of writing problems displayed by children with learning disabilities specific to writing.

Model of Writing Dysfunction:

This section provides the reader with a visual model, designed by the author, as a representation of the myriad of writing deficits experienced by learning-disabled writers. The model is based on current research conducted in the field of learning disabilities (Englert & Raphael, 1988; Englert, Raphael, & Anderson, 1986; Scardamalia, & Bereiter, 1986; Wong, Wong, Darlington, & Jones, 1991).

Current Instructional Approaches in Writing:

This section provides the reader with a general overview of current writing instructional approaches occurring in language arts instruction.

The Microcomputer: A Link to the Writing Process:

This section provides the reader with a brief theoretical overview of the integration of microcomputers into current instructional practice in writing.

Educational Applications of the Microcomputer:

This section introduces three computer applications, specifically, drill and practice, tutorial, and word processing. A general description of each application is

presented along with the potential benefits for learning-disabled writers.

Integrating Microcomputers into Effective Instructional Practice:

This section provides the reader with a theoretical overview of effective integration of microcomputers into the writing process, specific to children with learning disabilities in written expression. The effective integration of microcomputers into writing instruction is presented by means of the following instructional elements; pre-computer classroom activities, on-computer classroom activities, and post-computer activities which attempt to determine whether gains observed in microcomputer interactions carry over to other curriculum related activities. Included in this section are four systematic instructional plans, designed to link the effective integration of microcomputers into instructional practice.

Contemporary Issues in the Microeducational Environment:

This section briefly addresses a number of issues involved in the implementation of microcomputers in the classroom setting.

Closing Message:

This section brings together in summary, the various issues discussed throughout the resource guide and makes

some observations about the future use of microcomputers in the instruction of children with learning disabilities.

References:

This section provides the reader with a list of references from the theoretical research and literature used throughout this resource guide.

Appendix A:

This section provides the reader with a glossary of terms used throughout the current research literature in writing.

Appendix B:

This section provides the reader with a number of general guidelines for selecting appropriate instructional courseware specific to children with learning disabilities. Included in this section is one of the many courseware evaluation tools available to assist teachers in the selection of instructionally sound microcomputer courseware for learning-disabled students.

Appendix C:

This section identifies a range of information pertaining to the instructional use of microcomputers with exceptional students. Contents include: a) a list of educational publications and organizations that provide information pertaining to microcomputer use with

learning-disabled students, and b) a list of recommended courseware deemed suitable and appropriate in the instruction of learning-disabled students.

Appendix D:

This section includes a glossary of practical computer-related terminology.

Appendix E:

This section provides the reader with a visual representation of the metacognitive learning strategies used in the effective instructional plans.

Formulative Evaluation

Definition

Educational materials (i.e., textbooks, microcomputers, filmstrips, books, etc.), are essential components in classroom instruction. Therefore, the effectiveness of such products is of interest and concern to educators. The function of formative evaluation as suggested by Borg & Gall (1989) is to gather information about educational materials while they are still being developed. Formulative evaluation provides useful information at each stage of the development process. The suggestions can be used to revise and modify the product so it will adequately meet the needs of the target population.

Outline of the Development Process

The development of resource materials for teachers is a complex, systematic process. Taba (1962) has formulated a seven step curriculum development model. Taba maintains "there is such an order and that pursuing it will result in a more thoughtfully planned and a more dynamically conceived curriculum" (p. 12).

The Taba Curriculum Development Model was followed in the development of this resource guide. Taba (1962) formulated the following model:

Step 1: Diagnosis of needs;

Step 2: Formulation of objectives;

Step 3: Selection of content;

Step 4: Organization of content;

Step 5: Selection of learning experiences;

Step 6: Organization of learning experiences;

Step 7: Determination of what to evaluate and of the ways and means of doing it (p. 12).

During the development of the resource guide, the author consulted with the thesis supervisor who provided systematic instructional strategies throughout the developmental process. Taba's plan was followed in a manner appropriate for the production of this resource guide. At each stage of the development process, there was provision for adaptations and modifications.

Step 1: Diagnosis of Needs. In this step, the author approached 10 specialists in the field of education to determine if such a need for a resource guide exists.

Step 2: Formulation of Objectives. The formulation of objectives for this resource guide were developed as a result of a review of the research on microcomputers in special education.

Step 3: Selection of Content. The selection of content for this resource guide derived from a review of the literature on microcomputer instruction with learning-disabled students.

Step 4: Organization of Content. The organization of content was determined through consultation with the author's thesis supervisor, Dr. Marc Glassman.

Step 5: Selection of Learning Experiences. The selection of learning experiences included in this resource guide derived from a review of the research literature on effective microcomputer instruction with learning-disabled students.

Step 6: Organization of Learning Experiences. The organization of learning experiences was determined through consultation with the thesis supervisor, Dr. Marc Glassman who provided systematic instructional strategies throughout the development process.

Step 7: Evaluation. To complete the formative evaluation

process, a summative evaluation tool was developed in consultation with the thesis supervisor, to determine if the resource guide has met the formulated objectives set out by the author. In addition to rating the resource guide objectives, the chosen participants were asked to comment on the strengths and weaknesses of the resource guide.

CHAPTER IV

Summative Evaluation

Definition

In defining summative evaluation, Borg and Gall (1989) state "The summative function of evaluation occurs after the product has been fully developed. Summative evaluation is conducted to determine how worthwhile the final product is, especially in comparison with other competing products" (p. 764). In the context of this thesis, summative evaluation was conducted to judge how well the objectives set out for the handbook had been achieved.

Preparation of the Evaluation Tool

In consultation with the thesis supervisor, a summative evaluation tool based on a five-point likert scale was designed to determine if the resource guide has met the objectives set out by the author. The chosen participants were provided with an opportunity to comment on the strengths and weak points of the resource guide as well as make suggestions, comments, and recommendations.

The summative evaluation tool is comprised of three sections. Results from Section A assisted the author in determining the need for effective integration of microcomputers with special needs students. Section B assisted the author in determining whether or not the

objectives set out by the resource guide were achieved. Section C provided an opportunity for the chosen participants to comment on the strengths and weak points of the resource guide for possible revisions.

In consultation with the thesis supervisor, it was decided to ask permission to anonymously use direct quotations from the written transcriptions of the research participants. All participants agreed to the request made by the author (See Appendix A). A general description of the summative evaluation tool including the written transcriptions of the research participants is offered in the remainder of this chapter.

Submission of the Resource Guide and Evaluation Tool

A letter was sent to 10 specialists with expertise in the field of learning disabilities and/or computer technology (See Appendix A). All 10 specialists expressed a desire to participate in the evaluation of the resource guide. A total of 10 copies of the resource guide and evaluation tool were made and delivered to the participants. All 10 evaluation tools and resource guides were returned to the author. The rapid rate of return can be attributed to the author personally delivering and picking up the distributed materials.

Results of the Evaluation Tool

Section A: Needs Assessment

To assist the author in determining the need for microcomputer resource materials in education, the participants were asked to circle an appropriate response. All 10 participants circled a yes response when asked if they felt a need for resource materials designed to assist educators in the effective integration of microcomputers into curriculum areas with special needs students (See Appendix A). Nine out of 10 participants commented. Responses are as follows:

1. "There is no question of the potential effectiveness of computers as an exciting learning tool. It can facilitate, expedite, expand, and enhance many kinds of learning experiences. It presumes expertise, background knowledge of both programs and processes on the teacher's part - and in the case of the LD student, it provides the ideal learning situation: one-on-one instruction (structured of course)."

2. "I feel that computers have an invaluable role to play in programming for special needs students. Teachers generally agree but feel they need guidance in selection of appropriate programs."

3. "Due to such large numbers of students in special education classes and regular classes, the teachers are left with very little time to peruse and select computer resource materials. A guide to help with the selection would be a useful tool. Microcomputers are a very motivational teaching tool for all students. Using computer resource materials has made teaching more exciting and interesting for me as well."

4. "Computers are everywhere and if we wish to bridge the gap between education and technology, (cultural lag), and the business world, we must, as educators, use all of the necessary tools or instruments that we can find. Thus, both the regular classroom teacher and special needs teachers must help every child develop to his/her maximum potential and use all of the necessary instruments that will help them grow."

5. "It was very refreshing to read material that was both informative and practical for classroom use."

6. "I agree with your premise that the very nature of a learning-disabled child makes it imperative that alternate methods or procedures be used in instruction and thus the computer. It is particularly helpful to

have a guide that lists computer programs that have been effective with other students. A computer is only as good as its software and the software is only as good as the person selecting it - so resources and guides are valuable and necessary to help teachers make informed selections."

7. "Most definitely. However, in our schools, children with special needs are being grouped in large numbers, thus taking emphasis off individual instruction. In most cases, there is one computer in each resource room where special needs children attend. It is often inappropriately used for entertainment purposes."

8. "We have worked long and hard to have computers introduced into our schools. For the most part, today, with the help of PTA's and fundraisers, most schools have some computers. The hardware is in place, what we lack now is appropriate software, and the raising of teachers' awareness of the educational capabilities of these machines. Teachers <u>want</u> to use computers but many see them as something extra, or additional to the curriculum. I feel teachers need to be using computers more themselves, so that they can gain the necessary comfort level to use a computer with their students."

9. "I am using a microcomputer with my students in the areas of language and math. I feel very fortunate to have access to a microcomputer and the students that I work with thoroughly enjoy using it. After reading this thesis research I realize that many times the microcomputer is used in isolation rather than complementing and enhancing the curriculum. Effective integration of the microcomputer into curriculum areas can only be achieved by providing teachers with sufficient training and resource materials, such as that which I have just studied."

Section B: Findings of the Summative Evaluation Tool

Section B provided an opportunity for the participants to evaluate whether the objectives stated for the resource guide were achieved. Participants were asked to evaluate each objective on a scale of 1 to 5 ranging from poor to excellent. Participants indicated their evaluation of each of the objectives by circling one of the numbers according to the degree which they felt the resource guide had achieved that objective. The findings of the summative evaluation tool are indicated in Table 1.

Findings of Summative Evaluation Tool

TABLE 1

	Objective	Rating 1 2 3 4 5	Mean
a)	Provides the author's rationale for developing a resource guide on the integration of microcomputer instruction into existing language arts curricula specific to children with learning disabilities; in writing;	3 7	4.7
b)	Provides the reader with a general overview of the writing difficulties specific to children with learning disabilities in writing;	1 1 8	4.7
c)	Provides a general awareness of how microcomputer applications can support writing instruction;	1 1 8	4.7
d)	Describes three main uses of the microcomputer specific to children learning disabilities in written expression;	3 7	4.7
e)	Provides the reader with some general guidelines for selecting appropriate instructional courseware specific to children with learning disabilities in writing;	4 6	4.7
f)	Provides the reader with a general knowledge understanding of how microcomputers are integrated into effective instruction in the regular or special class setting;	3 2 5	4.2
g)	Identifies a range of sources of information on the use of microtechnology with learning-disabled students and children with other special learning needs;	2 0 8	4.6
h)	Lists a number of recommended courseware packages that are: a) specifically designed to meet the needs of children with learning disabilities specific to writing, b) easily adapted to meet the needs of these children;	2 2 6	4.4
i)	Provides a brief review of some basic terminology used throughout the current research literature in writing instruction;	2 8	4.8
j)	Provides the reader with a glossary of terms on microcomputer technology.	1 2 7	4.6

N = 10

Section C: General Comments

Section C provided an opportunity for the chosen participants to comment on the strengths and weak points of the resource guide. The author, in consultation with the thesis supervisor compiled direct transcriptions of written comments (See Appendix B). They are as follows:

1. "The resource guide is very user friendly, easy to read, and contains succinct, practical information. Descriptions of good programs and their uses are particularly useful for classroom teachers."

2. "Unfortunately, children with learning disabilities are not being given individual assistance with their needs and strengths. This has to happen before we can get the teachers to use resource guides such as these."

3. "It was interesting and easy to read. It would be an excellent tool for the regular classroom teacher because it gives more insight into the life of an LD child with writing difficulties. It would be an excellent resource to have in every classroom and the teachers could make modifications depending on the student's needs, abilities, grade level, etc."

4. "I would love to have a copy of this resource guide in my classroom."

5. "Your paper is very, very broad in scope and for that reason I seem to be left with an overall impression that it lacks depth or substance. Should you explore more the LD profile; i.e., specific to language arts, and the programs available? This is not a criticism as much a question. What you have here is a wide perspective of possible uses of technology but I can find little of great substance to set me in any clear direction."

6. "A very practical guide, well organized, very clear, coherent, and user friendly. It contains a lot of information that would be helpful to any teacher using a computer. Regarding the instructional plans - I would have liked to see a very specific lesson plan teaching one specific skill within the package, e.g., Punctuation Put On."

7. "Your work is extremely well done and very readable. My capacity to read as a novice those sections of the guide dealing with LD is better and perhaps more useful than the sections dealing with computers and software. More specifically, I do not have much background in the area

of learning-disabled students and the writing process. With this is mind, I found what you had to say and the research very interesting and useful towards a greater understanding of the teaching and learning process with these students. The computer sections are again very readily and well organized. I especially like your focus on the pre-activities. How many times do I see teachers load the software and walk away with no pre or post activities, let alone worry about whether or not this makes any sense from the aspect of the curriculum. In integrating microcomputers into effective instruction you often stress the important link between the computer software and the teacher. Also pointed out are the obstacles preventing teachers from utilizing and integrating computers with students. You address the research and courseware needs. I realize that it is not the scope of this paper, but you may consider an appendix dealing with places or means for teachers to become trained in the use of computers. The evaluation of courseware is deserving of a complete thesis on its own. Your reference to Lee (1987) is good. As you mention there are many evaluation forms. I'm not familiar with the one you include by Hannaford and Sloane (1981). My feeling is that teachers need something less threatening and time consuming. In this province, we should be

evaluating courseware on the principles in the provincial "Learning to Learn" document. The basic principles and outlines you provide for using software apply whether you are on a 128K, Apple II, a MacLCII, or a IBM 486. This might be pointed out to your readers."

8. "The section on word processing is really effective and convincing in demonstrating its usefulness. It was a good idea to mention the instruction of keyboarding skills. I liked your choice of quotes throughout this paper. The text is very readable and interesting. I feel that this resource guide will prove useful in its collection of research as well as the practical suggestions for teachers in terms of instruction. Bringing in the provincial perspective throughout the paper is effective in that it confirms the importance of this piece of work. Your work is very thorough and extremely well detailed. It leaves no doubt as to the importance of helping teachers make the best use of computers in their classrooms."

9. "I would be interested in purchasing a copy of this resource guide if they were available. It would serve as a reference tool, as well."

10. "A very comprehensive resource guide with many practical suggestions for the effective integration of microcomputers into the curriculum for learning-disabled writers. In particular, I found the instructional plans to be well developed and informative. Overall - my reaction - successful integration of microcomputers into the curriculum must be approached in a systematic manner taking into account the individual needs of the writer."

Discussion

The evaluation data for the 10 objectives indicated that the participants felt the objectives stated for the resource guide were achieved. Point scale ratings obtained from the evaluation tool ranged from good to excellent (See Table 1).

The summative evaluation tool also included a section for participants to comment on the strengths and weak points of the resource guide. The author received a number of suggestions for improvement and subsequently included these suggestions into the resource guide. In consultation with the thesis supervisor, the author responded to a number of comments made by the participants on the strengths and weak points of the resource guide.

In response to **Section C, #6**, the author reminds readers that the resource guide is designed to present a link between effective instructional principles and the integration of microcomputers into writing instruction. The four instructional plans serve as models. Integrating microcomputers with classroom curricula requires teachers to be flexible decision-makers who can modify instructional plans of various types according to the existing demands of the curriculum and the diverse learning needs of students in the classroom. Thus, it is up to each individual teacher to adapt instructional plans of various types of the context of the curriculum, student learning styles, and classroom

environment.

In response to **Section C, #5**, the author reminds readers that the resource guide is an attempt to assist teachers with effective integration of microcomputer instruction into the writing process, specific to children with learning disabilities in writing. A significant component of the resource guide is a general overview of the myriad of writing problems expereinced by many learning disabled children. The author reminds readers that the LD profile specific to language arts is addressed more extensively in the main body of the thesis. Furthermore, as suggested throughout the research literature, there exists a paucity of microcomputer courseware specifically designed for learning-disabled children in language arts. Nevertheless, an extensive search was carried out for courseware that can be adapted to meet the needs of LD children in language arts. Appendix C of the resource guide lists courseware deemed suitable for learning-disabled students.

In response to **Section C, #2**, the author reminds readers that current research and development in the field of special education is providing educators and practitioners with a better understanding of students with a variety of learning styles. As teachers begin to recognize and understand individual learning differences among children, curriculum modifications of content and instruction will occur. It is the author's belief that providing teachers with practical and

informative resource materials in combination with appropriate in-service training is necessary in order to achieve the goal of effective integration of microcomputers into curriculum areas.

It was recommended by one of the respondents that an appendix including places or means for teachers to become trained in the use of computers be included in the resource guide, **Section A, #7**. It was determined by the author that computer training can be obtained at all major teacher training institutions across Canada. It is up to each individual teacher to determine the appropriate educational facility to become trained in the use of computers.

A recommendation was made to include a less comprehensive courseware evaluation tool in the resource guide, **Section A, #7**. In consultation with the thesis supervisor the author included a second evaluation tool to be considered for use by teachers. The author reminds teachers that the evaluation tools included in the resource guide are two examples of the many varieties available. It is up to the individual teacher to choose an evaluation tool that can facilitate the match between the courseware to be evaluated, and the individual learning needs of the students.

The evaluation data for the 10 objectives indicated that the objectives stated for the resource guide were achieved. The comments were helpful and the suggested changes were implemented.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONS

Introduction

This thesis research has reviewed the literature on effective microcomputer instruction in the teaching of children with learning disabilities in writing. In doing so, the author has incorporated relevant theory and research into the design of a resource guide, appropriate for teachers of learning-disabled writers at the elementary school level.

The need for such a resource guide was supported by a survey questionnaire designed by Collins (1991) on the educational role of computers in education. The survey questionnaire was distributed to special education teachers in one school board in Newfoundland. The results of the data gathered by Collins (1991), revealed that 100% of the respondents would make more use of CAI if software and a curriculum guide were made available. A review of the research literature, conducted by the author, supports the need for educators to become proficient in effective computer integration with exceptional students. The need for such a resource guide was also substantiated by a summative evaluation tool distributed by the author, to a number of specialists in the field of education. The results revealed

that 100% of the respondents indicated a need for such a resource guide. Finally, the Newfoundland and Labrador's Provincial Department of Education's Distance Education/Learning Resource Section, has formed a group comprised of educational specialists who are currently working together in a collaborative effort to identify computer technologies to meet the curriculum needs of students, including individuals with special needs (Newfoundland and Labrador Dept. of Education, 1992).

This resource guide represents an attempt to meet the above needs by providing educators with a practical guide in the effective integration of microcomputers into the writing process, specific to elementary school children with learning disabilities in writing. This resource guide is based on an extensive review of the research on the microcomputer instruction in the teaching of LD writers in combination with the author's clinical experience in the field of Special Education.

Conclusions

Based on an extensive review of the research literature on microcomputer instruction in combination with the development of this resource guide, the author has reached a number of conclusions. They are as follows:

1. The participants of the summative evaluation process feel there is a need for microcomputer resource materials designed to assist teachers in the effective integration of microcomputers into curriculum areas with special needs students.

2. Elementary teachers recognize that microcomputers as instructional tools have the potential to enhance the educational experiences of special needs students based on the information presented in this resource guide.

3. Elementary teachers are better prepared to use microcomputers with children experiencing learning disabilities specific to writing based on the information presented in this resource guide.

4. Elementary teachers are familiar with the educational relevance of using effective teaching variables in the integration of microcomputers into the curriculum based on the contents of this resource guide.

5. The resource guide developed in this thesis provides teachers with curriculum support material designed to assist with the effective integration of microcomputer instruction for learning-disabled writers.

6. The resource guide identifies a range of sources of information on the use of technology with learning-disabled students.

7. That effective integration of the microcomputer into the curriculum requires ongoing teacher training and resource materials.

Recommendations

As a result of the summative evaluation tool, a review of the research and literature on learning-disabled writers, and the development of the resource guide, the author recommends:

1. That educators receive ongoing support and in-service on the effective integration of microcomputers into curriculum areas.

2. That educators receive appropriate teacher resource materials such as the guide that has been developed for this thesis.

3. That the provincial government set up a collection of educational courseware programs deemed appropriate for the exceptional student population. The programs could be made available through the Instructional Materials Division of the Provincial Department of Education for Newfoundland and Labrador.

4. That educators be encouraged to recognize and develop individualized educational programs for a growing number of exceptional students in the regular classroom setting. As with any successful, new educational movement, the integration of exceptional students into the regular

classroom setting depends on proper teacher training and teacher resource support. Educators must receive ongoing support and teacher training in the instruction of special needs students in the classroom setting.

5. That teachers keep abreast of new developments in educational technology.

6. Language arts and special education coordinators should examine the resource guide for the purpose of evaluating its contents for use within their school board.

7. That the resource guide be used during in-service for the elementary language arts curriculum or in other applicable areas, such as special education, whole language, or individualized instruction.

8. That teachers become increasingly involved in research projects exploring the use of microcomputers in special and regular classroom settings.

9. That future research consider the most effective strategies for integrating microcomputers into the writing process, specific to children with learning disabilities in writing.

10. That teachers modify the instructional plans in the resource guide according to the context of the existing curriculum demands, available courseware and resources, and the diverse learning needs of the students.

11. That further research be conducted to assess the resource guide's effect on the writing process, specific to children with learning disabilities in writing.

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APPENDIX A

Summative Evaluation Tool

Summative Evaluation Tool

Section A: Determining the Need for Microcomputer Resource Materials

To assist the writer in determining the need for microcomputer resource materials in education, please circle the appropriate response.

1. I (do, do not) feel there is a need for microcomputer resource materials designed to assist teachers in the effective integration of microcomputers into curriculum areas with special needs students.

   Comments: _____

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Section B: Rating of resource guide objectives

This informal evaluation tool was designed to evaluate if the resource guide has met the objectives set out by the developer. Each objective should be rated on a five point scale as follows: Poor (1); Fair (2); Good (3); Very Good (4); and Excellent (5). Please indicate by circling your choice.

(a) The resource guide provides the reader with a rationale for the development of a resource guide on the integration of microcomputer instruction into existing language arts curricula specific to children with learning disabilities; in writing;

(1, 2, 3, 4, 5)

(b) The resource guide provides the reader with a general overview of the writing difficulties specific to children with learning disabilities in writing;

(1, 2, 3, 4, 5)

(c) The resource guide provides a general awareness of how microcomputer applications can support writing instruction;

(1, 2, 3, 4, 5)

(d) The resource guide describes three main uses of the microcomputer specific to children learning disabilities in written expression;

(1, 2, 3, 4, 5)

(e) The resource guide provides the reader with some general guidelines for selecting appropriate instructional software specific to children with learning disabilities in writing;

(1, 2, 3, 4, 5)

(f) The resource guide provides the reader with a general understanding of how microcomputers are integrated into effective instruction in the regular or special class setting;

(1, 2, 3, 4, 5)

(g) The resource guide identifies a range of sources of information on the use of microtechnology with learning-disabled students and children with other special learning needs;

(1, 2, 3, 4, 5)

(h) The resource guide lists a number of recommended courseware packages that are: a) specifically designed

to meet the needs of children with learning disabilities specific to writing, b) easily adapted to meet the needs of these children;

(1, 2, 3, 4, 5)

(i) The resource guide provides a brief review of some of the basic terminology used throughout the current research literature in writing instruction;

(1, 2, 3, 4, 5)

(j) The resource guide provides the reader with a glossary of terms on microcomputer technology.

(1, 2, 3, 4, 5)

SECTION C: COMMENTS

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Section A

Samples of Written Transcriptions

1. "There is no question of the potential effectiveness of computers as an exciting learning tool. It can facilitate, expedite, expand, and enhance many kinds of learning experiences. It presumes expertise, background knowledge of both programs and processes on the teacher's part - and in the case of the LD student, it provides the ideal learning situation: One-on-one instruction (structured of course)."

2. "I feel that computers have an invaluable role to play in programming for special needs students. Teachers generally agree but feel they need guidance in selection of appropriate programs."

3. "Due to such large numbers of students in special education classes and regular classes, the teachers are left with very little time to peruse and select computer resource materials. A guide to help with the selection would be a useful tool. Microcomputers are a very motivational teaching tool for all students. Using computer resource materials has made teaching more exciting and interesting for me as well."

4. "Computers are everywhere and if we wish to bridge the gap between education and technology, (cultural lag), and the business world, we must, as educators, use all of the necessary tools or instruments that we can find. Thus, both the regular classroom teacher and special needs teachers must help every child develop to his/her maximum potential and use all of the necessary instruments that will help them grow."

5. "It was very refreshing to read material that was both informative and practical for classroom use."

6. "I agree with your premise that the very nature of a learning-disabled child makes it imperative that alternate methods or procedures be used in instruction and thus the computer. It is particularly helpful to have a guide that lists computer programs that have been effective with other students. A computer is only as good as its software and the software is only as good as the person selecting it - so resources and guides are valuable and necessary to help teachers make informed selections."

7. "Most definitely. However, in our schools, children with special needs are being grouped in large numbers, thus

taking emphasis off individual instruction. In most cases, there is one computer in each resource room where special needs children attend. It is often inappropriately used for entertainment purposes."

8. "We have worked long and hard to have computers introduced into our schools. For the most part, today, with the help of PTA's and fundraisers, most schools have some computers. The hardware is in place, what we lack now is appropriate software, and the raising of teachers' awareness of the educational capabilities of these machines. Teachers want to use computers but many see them as something extra, or additional to the curriculum. I feel teachers need to be using computers more themselves, so that they can gain the necessary comfort level to use a computer with their students."

9. "I am using a microcomputer with my students in the areas of language and math. I feel very fortunate to have access to a microcomputer and the students that I work with thoroughly enjoy using it. After reading this thesis research I realize that many times the microcomputer is used in isolation rather than complementing and enhancing the curriculum. Effective integration of the microcomputer into curriculum areas

can only be achieved by providing teachers with sufficient training and resource materials, such as that which I have just studied."

Section C

Samples of Written Transcriptions

1. "The resource guide is very user friendly, easy to read, and contains succinct, practical information. Descriptions of good programs and their uses are particularly useful for classroom teachers."

2. "Unfortunately, children with learning disabilities are not being given individual assistance with their needs and strengths. This has to happen before we can get the teachers to use resource guides such as these."

3. "It was interesting and easy to read. It would be an excellent tool for the regular classroom teacher because it gives more insight into the life of an LD child with writing difficulties. It would be an excellent resource to have in every classroom and the teachers could make modifications depending on the student's needs, abilities, grade level, etc."

4. "I would love to have a copy of this resource guide in my classroom."

5. "Your paper is very, very broad in scope and for that reason I seem to be left with an overall impression that

it lacks depth or substance. Should you explore more the LD profile; i.e., specific to language arts, and the programs available? This is not a criticism as much a question. What you have here is a wide perspective of possible uses of technology but I can find little of great substance to set me in any clear direction."

6. "A very practical guide, well organized, very clear, coherent, and user friendly. It contains a lot of information that would be helpful to any teacher using a computer. Regarding the instructional plans - I would have liked to see a very specific lesson plan teaching one specific skill within the package, e.g., Punctuation Put On."

7. "Your work is extremely well done and very readable. My capacity to read as a novice those sections of the guide dealing with LD is better and perhaps more useful than the sections dealing with computers and software. More specifically, I do not have much background in the area of learning-disabled students and the writing process. With this is mind, I found what you had to say and the research very interesting and useful towards a greater understanding of the teaching and learning process with these students. The computer sections are again very readily and well organized. I especially like your focus

on the pre-activities. How many times do I see teachers load the software and walk away with no pre or post activities, let alone worry about whether or not this makes any sense from the aspect of the curriculum. In integrating microcomputers into effective instruction you often stress the important link between the computer software and the teacher. Also pointed out are the obstacles preventing teachers from utilizing and integrating computers with students. You address the research and courseware needs. I realize that it is not the scope of this paper, but you may consider an appendix dealing with places or means for teachers to become trained in the use of computers. The evaluation of courseware is deserving of a complete thesis on its own. Your reference to Lee (1987) is good. As you mention there are many evaluation forms. I'm not familiar with the one you include by Hannaford and Sloane, (1981). My feeling is that teachers need something less threatening and time consuming. In this province, we should be evaluating courseware on the principles in the provincial Learning to Learn document. The basic principles and outlines you provide for using software apply whether you are on a 128K, Apple II, a MacLCII, or a IBM 486. This might be pointed out to your readers."

8. "The section on word processing is really effective and

convincing in demonstrating its usefulness. It was a good idea to mention the instruction of keyboarding skills. I liked your choice of quotes throughout this paper. The text is very readable and interesting. I feel that this resource guide will prove useful in its collection of research as well as the practical suggestions for teachers in terms of instruction. Bringing in the provincial perspective throughout the paper is effective in that it confirms the importance of this piece of work. Your work is very thorough and extremely well detailed. It leaves no doubt as to the importance of helping teachers make the best use of computers in their classrooms."

9. "I would be interested in purchasing a copy of this resource guide if they were available. It would serve as a reference tool, as well."

10. "A very comprehensive resource guide with many practical suggestions for the effective integration of microcomputers into the curriculum for learning-disabled writers. In particular, I found the instructional plans to be well developed and informative. Overall - my reaction - Successful integration of microcomputers into the curriculum must be approached in a systematic manner taking into account the individual needs of the writer".

APPENDIX B

Written Correspondence

March 27, 1992
19 McFarlane Street
St. John's, Newfoundland
Canada A1C 4T5

Mrs. G. Roe
Associate Superintendent of Curriculum
R.C. School Board for St. John's

Dear Mrs. Roe:

I am presently working on a Master's Degree thesis in the Curriculum and Instruction Department of the Faculty of Education, Memorial University of Newfoundland. I am also employed as a special education teacher with the R.C. School Board for St. John's. My teaching experience at the Student Resource Centre has inspired me to investigate the area of microcomputer instruction with children experiencing writing deficits.

Personal observations as a special educator, combined with the findings of a number of experts, suggest that children with learning disabilities specific to writing have special learning needs with regard to instruction and learning materials. Also, a growing body of research reveals that the microcomputer can be a valuable instructional tool for children with difficulties in written language. Moreover, as microtechnology continues to enter our classroom environments, microcomputers can assist teachers in making appropriate curriculum modifications for special needs learners. However, using microcomputers in this way will require both regular and special class teachers to become proficient in the selection and effective integration of curriculum support software to match the educational needs of the learners.

As I have gleaned from a review of the research as well as from conversations with colleagues in education, the need for resource materials to assist teachers with effective computer implementation. It is the purpose of my thesis to design a resource guide, appropriate for teachers of learning-disabled writers at the elementary school level. This resource guide will attempt to provide educators with a basic knowledge of effective computer integration with children experiencing deficits in written language. Teachers will discover that the information presented in this guide may assist them in helping students with other exceptionalities.

My thesis title is The Development of a Resource Guide on the Integration of Microcomputer Instruction into the Writing Process, Specific to Children with Learning Disabilities in Writing.

By way of this letter, I am requesting assistance from the R.C. School Board in the following manner:

1) That I have access to the Student Resource Centre, 40 Alexander Street, during the summer of 1992. The access will provide me with the opportunity to evaluate software in terms of its appropriateness for children experiencing writing problems.

2) In consultation with my thesis supervisor, it was decided to prepare a summative evaluation tool in questionnaire form to determine if the resource guide has met the objectives which have been set out by the writer. I would like to submit the questionnaire and resource guide to the following educators and school board personnel for evaluation (see attached letter).

3) That the Roman Catholic School Board consider supporting me in the printing of the resource guide for interested teachers at the elementary school level.

In summary, the rapid growth of computers is perhaps no more evident than in the field of education. To achieve effective implementation into our classrooms, educators must be provided with appropriate resource materials. It is the writer's belief that using microtechnology effectively can facilitate the match between the curriculum demands and the individual needs of children experiencing written language problems.

Attached to this letter is a tentative outline of the resource guide. Thanking you in advance for your consideration in this matter.

Sincerely yours,

Pauline Pineau
Special Educator

Graduate Studies Division
Department of Curriculum and Instruction
Memorial University of Newfoundland
February 28, 1993

To Whom It May Concern:

In order to assure anonymity, it was decided to remove the names of the summative evaluation participants from the letter addressed to Mrs. G. Roe, Roman Catholic School Board for St. John's.

Sincerely yours,

Pauline Pineau
Special Educator
Learning Disabilities

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1992 04 22

Ms. Pauline Pineau
19 McFarlane Street
St. John's
Newfoundland
A1C 4T5

Dear Pauline,

This is in reply to your request for assistance with research for your Master's thesis.

I have made arrangements for you to have access to the Student Resource Centre during the summer months. You may contact our Director of Maintenance, Mr. Pat Royle, (753-8530, ext. 254) to make arrangements for a key and obtain the security code. Since the maintenance staff will not be there during the summer you will be held responsible for security of the building.

Permission is granted to you to circulate the questionnaire and Resource Guide to the persons named in your letter. I cannot make any commitment now regarding printing of the Guide but it may be possible to supply a copy to each school.

Best wishes for success in your work.

Yours truly,

Geraldine Roe
Associate Superintendent
Curriculum/Instruction

/msc

Graduate Studies Division
Department of Curriculum and Instruction
Memorial University of Newfoundland
September 12, 1992

Dear Colleague:

Presently, I am working on a thesis to be submitted in partial fulfillment of the requirements for the degree of Masters in Education, Memorial University of Newfoundland. A major component of this thesis is the development of a resource guide on the integration of microcomputer instruction into the writing process, specific to children with learning disabilities in the area of written expression.

It is clear that the new technology and increased use of classroom computers hold significant benefits for special needs students in both regular and special class settings. Specifically related to this thesis, is a growing body of research which reveals that through the use of microcomputers, learning-disabled students with writing problems can receive effective instruction, demonstrate knowledge and understanding, and become active participants in the classroom setting. Moreover, microcomputers can assist teachers in making appropriate curriculum modifications for students with diverse learning needs.

Now that microcomputers are becoming widely used in many of our Newfoundland schools, regular and special classroom teachers must be prepared to teach with these current technologies. Moreover, with the rapid proliferation of microcomputers in our Newfoundland schools, educators must be provided with appropriate training and resource support in the instructional uses of microcomputers. This resource guide represents an attempt to meet this need by providing educators with a guide in the effective integration of microcomputers into the writing process specific to children with learning disabilities in writing.

In consultation with my thesis supervisor, it was decided to prepare a summative evaluation tool in questionnaire form, to evaluate how well the objectives stated for the resource guide were achieved. The chosen participants, all of whom possess experience with microcomputers and/or learning-disabled students, will be provided with an opportunity to comment on the strengths and weak points of the resource guide, and make suggestions for further revisions.

I am requesting your participation in this summative evaluation process. Your professional input and response will be of great assistance to me in my thesis research. I intend to follow up this letter with a telephone call to determine whether or not you are interested in participating in this summative evaluation process. Thanking you in advance for your consideration.

Sincerely yours,

Pauline Pineau
Special Educator

Dear Colleague,

In order to evaluate if the resource guide has met the objectives set out by the writer, I have designed the following evaluation tool. Your professional input will be of great assistance to me in my thesis research. I strongly encourage you to add any comments on the space provided in Section B of this evaluation tool. Thank you again for your willingness to cooperate in this summative evaluation process.

Yours sincerely,

Pauline Pineau

Graduate Studies Division
Department of Curriculum and
Instruction
Memorial University of Newfoundland
February 12, 1993

Dear Colleague:

Thank you for participating in the summative evaluation process. Your professional input has been of great assistance in the development of the microcomputer resource guide.

In consultation with the thesis supervisor, it was decided to ask for permission to anonymously use direct quotations from your written response on Section A and Section C of the Summative Evaluation Tool. It is important for educators to share their opinions and experiences pertaining to microcomputer integration in education. Your professional input will be beneficial to other educators who are interested in the use of microcomputers in the classroom setting. Thanking you in advance for your consideration.

Sincerely yours,

Pauline Pineau
Special Educator
Learning Disabilities

To help determine your reaction to my request, please circle the appropriate response.

I (do, do not) agree to the use of my written response in the main body of the author's thesis.

Attached to this letter are the sections of your written transcription that the author wishes to use in her thesis research. Please read over the direct quotations and respond to the following section.

The following quote(s) have been taken from my written transcription on the Summative Evaluation Tool. Circle the appropriate answer.

Yes No

APPENDIX C

Microcomputer Resource Guide

MEMORIAL UNIVERSITY OF NEWFOUNDLAND

Enriching the Learner:

A RESOURCE GUIDE

ON

EFFECTIVE MICROCOMPUTER INSTRUCTION

WITH

LEARNING DISABLED WRITERS

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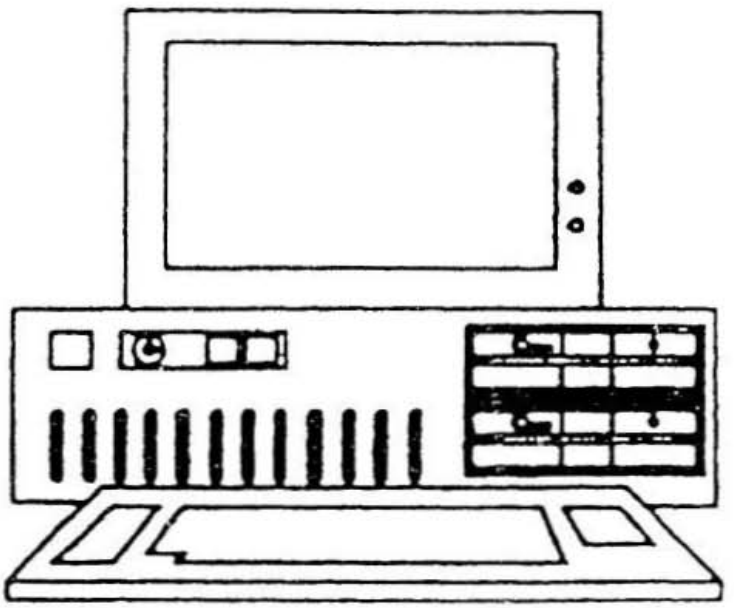
MEMORIAL UNIVERSITY OF NEWFOUNDLAND

ENRICHING THE LEARNER:
A RESOURCE GUIDE
ON
EFFECTIVE MICROCOMPUTER INSTRUCTION
WITH
LEARNING-DISABLED WRITERS

1994

TABLE OF CONTENTS

FIGURES



Preface

Enriching the Learner: Effective Microcomputer Instruction with Learning-disabled Writers, presents special and regular educators with a non-technical resource guide designed to assist with the effective integration of microcomputer instruction into the writing process, specific to children with learning disabilities in writing.

What makes this resource guide unique and appealing to educators is its attempt to present a link between effective instructional principles and the integration of microcomputers into writing instruction. This resource guide is an outgrowth of the author's extensive research and clinical experience with learning-disabled students.

The completion of this resource guide would not have been possible without the assistance of a number of individuals. The foremost among these is my thesis supervisor, Dr. Marc Glassman. He is gratefully acknowledged for his consistent input and guidance throughout the development process. Secondly, an acknowledgement to the Roman Catholic School Board for St. John's for the continued support I received throughout my Masters in Education Program. A special acknowledgement is given to the many students who provided me with the motivation to pursue this resource guide. A final acknowledgement is given to my colleagues in education for their willingness and interest in evaluating this resource guide.

Introduction

In 1990, Kelly, A. wrote:

> "Each student is unique. Each student has strengths, abilities, and areas of relative weakness. Recognition of these strengths and weaknesses, as well as knowledge of individual learning styles, should be the basis for modification of both instruction and evaluation" (Newfoundland and Labrador Dept. of Education, 1990, p. 22).

The microcomputer has emerged as an innovative tool to enhance a child's learning in the classroom setting. The widespread use and increasing refinement of hardware and software is affecting the way children of varying abilities are educated.

During the past decade the suggested efficacy of microcomputers in education has specifically received support for their potential use with learning-disabled (LD) children. Specifically, a growing body of research suggests that computers have enormous potential for expanding the instructional possibilities particularly for children with learning disabilities specific to writing. It has been suggested in current research literature that through the use

of microcomputers, learning-disabled children impaired in one or more of the subprocesses of written expression, may demonstrate an increased involvement in the writing curriculum (Graham & MacArthur, 1988; Outhred, 1989).

The author's personal observations as a special educator working with learning-disabled students, in combination with research findings, suggests that children with learning disabilities specific to writing have special needs with regards to instruction and learning materials. Additionally, as educators continue to implement microcomputers into classroom environments, microcomputers can assist educators in making effective curriculum modifications and adaptations to meet individual learner needs. However, essential to the success of microcomputers with learning-disabled children is the need for regular and special educators to become proficient in the effective integration of curriculum support software to match the individual needs of the learners.

A review of the research as well as conversations with colleagues in education, has determined the need for resource materials to assist teachers with effective computer implementation. In response to this need, the author has incorporated relevant theory, research, and personal experience into the design of a resource guide appropriate for elementary teachers of children with LD specific to writing. This non-technical resource guide is an attempt to provide

educators with a general understanding of the effective integration of microcomputer instructional practice with learning-disabled writers.

While the use of the term "children" is mentioned throughout this resource guide, the author acknowledges that learning disabilities are persistent and occur in persons of all ages.

This resource guide is appropriate for use in the elementary grade levels where the instructional practices are or can be considered consistent with whole language philosophy.

This resource guide is limited to the extent that it is intended for use by elementary educators who teach children with learning disabilities specific to writing. Although this guide is directed towards teachers of learning-disabled children, many of the instructional strategies that are effective with learning-disabled students are helpful to students with other special learning needs. In 1988, Stevens wrote "Teaching techniques that are appropriate for the learning-disabled are appropriate for others as well. Special instructional methods adopted to help an LD child frequently result in better learning for all the students and increased efficiency for the teacher" (p. 173). Teachers will discover that the information presented in this resource guide may assist them in helping students with other exceptionalities.

Objectives of the Resource Guide

As with any new educational intervention or teaching method, the integration of microcomputers into effective instructional practice largely depends on appropriate teacher training and adequate resource support. This resource guide represents an attempt to meet this need by providing educators with a practical guide in the effective integration of microcomputers into the writing process specific to elementary school children with learning disabilities in writing. As a result of this resource guide, the following objectives should be realized:

(a) Provides the author's rationale for developing a resource guide on the integration of microcomputer instruction into the writing process, specific to children with learning disabilities in writing;

(b) Provides the reader with a general overview of the writing difficulties specific to children with learning disabilities in writing;

(c) Provides a general awareness of how microcomputer applications can support writing instruction;

(d) Describes three main uses of the microcomputers specific to children learning disabilities in writing;

(e) Provides the reader with some general guidelines for selecting appropriate instructional courseware specific to children with learning disabilities in writing;

(f) Provides the reader with a general understanding of how microcomputers are integrated into effective instruction in the regular and/or special class setting;

(g) Identifies a range of sources of information on the use of microtechnology with learning-disabled students;

(h) Lists a number of recommended courseware packages that are: a) specifically designed to meet the needs of children with learning disabilities in written expression, b) easily adapted to meet the needs of these children;

(i) Provides a review of some of the basic terminology used throughout the current research literature in writing instruction;

(j) Provides the reader with a glossary of terms on microcomputer technology.

Resource Guide Limitations

As with any instructional tools or resource materials, limitations exist. The following are a number of limitations identified during the development process:

1. The specific dimensions that characterize learning-disabled individuals have been extensively investigated throughout the research literature. The current research suggests that learning disabilities may be manifested by difficulties in any of the following areas: memory, attention, reasoning, coordination, communication, reading, writing, math, social behaviour, and maturation. Given the heterogeneity of the population, the author found it necessary to limit the research to one specific subtype of learning disabilities. Therefore, for the purpose of this resource guide, the research is limited to learning-disabled children who display cognitive problems manifested in written expression.
2. Microcomputers have come to be used in a variety of ways in our educational settings during the past decade. Specifically, within the context of education, microcomputers have been used in three major ways: (a) as an object of instruction, that is, learning about the programming functions of the computer, (b) as a medium of instruction, that is, the use of the computer to

complement and/or supplement the curriculum content; and (c) the computer as a catalyst of instruction, that is, the use of the computer to increase and enhance learning. The scope of microcomputer applications in education is broad. Therefore, the author has limited the review of the research and contents of this resource guide to microcomputer use as a medium and catalyst of instruction specific to children with learning disabilities in written expression.

3. As gleaned from a review of the research literature, there exists a paucity of microcomputer courseware specifically designed for learning-disabled children with writing problems. Nevertheless, an extensive search was carried out for courseware that can be adapted to the unique needs of learning-disabled children experiencing writing problems.

4. Because of the rapid production of courseware, it is impossible to peruse all resources recommending courseware for special education populations. A large number of catalogues and resources were sampled. Similarly, it is impossible to preview all courseware packages deemed adaptable or specifically recommended for learning-disabled children with writing difficulties. In consultation with the thesis supervisor, a substantial number of courseware packages were sampled throughout the

research process. Four pieces of educational courseware were selected as models for the instructional plans in the resource guide.

5. Although the resource guide lists a number of courseware packages deemed adaptable or specifically recommended for learning-disabled children, the sample resources are not described or evaluated. It is up to each individual teacher to choose and evaluate curriculum support courseware according to the diverse learning needs of the students and the context of the curriculum.
6. Finally, the recommended courseware and instructional activities presented in this resource guide are only guidelines and suggestions that do not ensure improved written language abilities among learning-disabled children with writing difficulties.

Description of Resource Guide Contents

To achieve the objectives stated in the previous section, this resource guide has been organized in the following manner:

Introduction.

This section provides a rationale for using microcomputers as an instructional tool specific to children with learning disabilities in writing.

Objectives.

This section provides the resource guide objectives which have been set out by the author.

Resource Guide Limitations.

This section provides a number of limitations identified by the writer during the development process.

Overview.

This section provides an overview of the resource guide contents.

Definition of Learning Disability.

This section introduces the widely recognized definition of learning disability adopted by the Canadian Association of Children and Adults with Learning Disabilities.

Characteristics of Learning-disabled Students.

This section provides a number of general characteristics typical of children with learning disabilities.

Learning-disabled Writers and the Writing Process.

This section introduces a brief theoretical overview of the myriad of writing problems displayed by children with learning disabilities specific to writing.

Model of Writing Dysfunction.

This section provides a visual model designed by the author, as a representation of the myriad of writing deficits experienced by many learning-disabled writers. The model is based on current research in the field of learning disabilities (Englert & Raphael, 1988; Englert, Raphael, & Anderson, 1986; Scardamalia & Bereiter, 1986; Wong, Wong, Darlington, & Jones, 1991).

Current Instructional Approaches in Writing.

This section provides a general overview of current writing instructional approaches occurring in language arts instruction.

The Microcomputer: A Link to the Writing Process.

This section provides a brief theoretical overview of the integration of microcomputers into current instructional practice in writing.

Educational Applications of the Microcomputer.

This section introduces three computer applications, specifically, drill and practice, tutorial, and word processing. A general description of each application is presented along with the potential benefits for learning-disabled writers.

Integrating Microcomputers into Effective Instructional Practice.

This section provides a theoretical overview of effective integration of microcomputers into effective writing instruction, specific to children with learning disabilities in written expression. The effective integration of microcomputers into writing instruction is presented by means of the following instructional elements; pre-computer classroom activities, on-computer classroom activities, and post-computer activities which attempt to determine whether gains observed in microcomputer interactions carry over to other curriculum related activities. Included in this section are four systematic instructional plans, designed to link the effective integration of microcomputers into instructional practice.

Contemporary Issues in the Microeducational Environment.

This section briefly addresses a number of issues involved in the implementation of microcomputers into

classroom setting.

Closing Message.

This section brings together in summary, the various issues discussed throughout the resource guide and makes some observations about the future use of microcomputers in the instruction of children with learning disabilities.

References.

This section provides a list of references from the theoretical research and literature used throughout this resource guide.

Appendix A.

This section provides a glossary of terms used throughout the current research literature in writing.

Appendix B.

This section provides a number of general guidelines for selecting appropriate instructional courseware specific to children with learning disabilities. Included in this section is one of the many courseware evaluation tools available to assist teachers in the selection of instructionally sound microcomputer courseware for learning-disabled students.

Appendix C.

This section identifies a range of information pertaining to the instructional use of microcomputers with

exceptional students. Contents include: a) a list of educational publications and organizations that provide information pertaining to microcomputer use with learning-disabled students, and b) a list of recommended courseware deemed suitable and appropriate in the instruction of learning-disabled students.

Appendix D.

This section includes a glossary of practical computer related terminology.

Appendix E.

This section provides the reader with a visual representation of the metacognitive learning strategies used in the effective instructional plans.

Definition of Learning Disability

A number of children who experience learning problems and school failure are sometimes referred to as "learning-disabled". Although there exists a variety of prevailing opinions throughout the educational community regarding the categorization of exceptional children, we cannot disregard the current research findings identifying specific areas of cognitive deficiencies in learners. It is important to note that the definition of learning disabilities and associated terminology will continue to change as new research emerges into the 1990's and beyond.

The official definition adopted by the Canadian Association for Children and Adults with Learning Disabilities on October 18, 1981 is as follows:

> Learning Disabilities is a generic term that refers to a group of disorders due to identifiable or inferred central nervous system dysfunction. Such disorders may be manifested in delays in early development and/or difficulties in any of the following areas: attention, memory, reasoning, coordination, communicating, reading, writing, spelling, calculation, social competence, and emotional maturation (Learning Disabilities Association of Canada, 1991, p. 2).

"Learning Disabilities are not due primarily to visual, hearing, or motor handicaps; to mental retardation, emotional disturbance, or environmental disadvantage; although they may occur concurrently with any of these" (Learning Disabilities Association of Canada, 1991, p. 2).

Common Signs of Learning Disabilities

A learning disabled child may exhibit:

1. Average to average intellectual ability but display a significant difference between ability and academic performance;
2. A pattern of uneven academic abilities;
3. Verbal language skills better than written;
4. Attention Deficit Disorder with/without hyperactivity;
5. Coordination and Spacial Disorientation;
6. Difficulties in auditory and/or visual memory;
7. Social Skills Deficit.

(Smith, 1991)

Learning-disabled Writers and the Writing Process

In 1986, Morocco and Neuman wrote:

> Students lack the cognitive strategies more experienced writers use for managing the basic writing processes. This lack of facility with the basic mental processes needed in writing is usually coupled, by the fourth grade, with anxiety about failing in school (p. 244).

Many children with learning disabilities specific to writing find tasks that require writing exasperating if not impossible. Typically, children who experience learning problems specific to writing have repeatedly encountered failure and humiliation in attempting to express themselves in written form. In 1988, Stevens wrote, "A learning-disabled child is reminded on a daily basis of how difficult life is, of how arduous it is to achieve satisfactory results (while all the other children seem to have an easy time), and of how impossible it is to excel" (p. XIV). Moreover, as the demands for writing increase throughout the upper grade levels, many students who experience difficulties in writing often consider themselves to be non-writers and display anxiety and reluctance during writing activities.

Over the past two decades, the focus in language arts

instruction has been shifting from an emphasis on the acquisition of reading skills, to a more expanded view of holistic language learning. Consequently, the educational community has witnessed an increasing interest in written language as a focus for research and instruction. During the past decade specifically, prominent researchers have been examining the written expression of children with learning disabilities, in an effort to provide insight into specific areas of writing dysfunction.

It is important to keep in mind that although the research literature is current, diverse, and far from complete, it provides educators with valuable insight into the kinds of writing deficiencies that many LD children encounter. An examination of the current research on writing disabilities reveals that writing difficulties among learning-disabled students are manifested in: (1) spelling, punctuation, and grammar (Wong, Wong, Darlington, & Jones, 1991), (2) handwriting skills (Cicci, 1979; Majsterek, 1990), and (3) a lack of efficient planning, composing, editing/revising, and awareness of audience (Graham & Harris, 1992; Scardamalia & Bereiter, 1986). Specifically, Wong et al. (1991) state "These composing problems consist of lower-order cognitive problems in spelling, punctuation, and grammar, and higher order cognitive and metacognitive problems in planning, writing fluency, revising, and awareness of audience" (p. 117).

Because a learning-disabled child with problems specific to writing may experience difficulties with any or all of the above subprocesses of written expression, the classroom teacher must consider instructional methods that can be effective in the teaching of learning-disabled children with writing problems. The following model Figure 1.1 developed by the author, represents specific and overlapping deficit areas associated with specific writing disabilities. The model is based on current research in the field of learning disabilities (Cavey, 1987; Englert & Raphael, 1988; Englert, Raphael, & Anderson, 1986; Scardamalia & Bereiter, 1986; Wong, Wong, Darlington, & Jones, 1991).

MODEL OF WRITING DYSFUNCTION

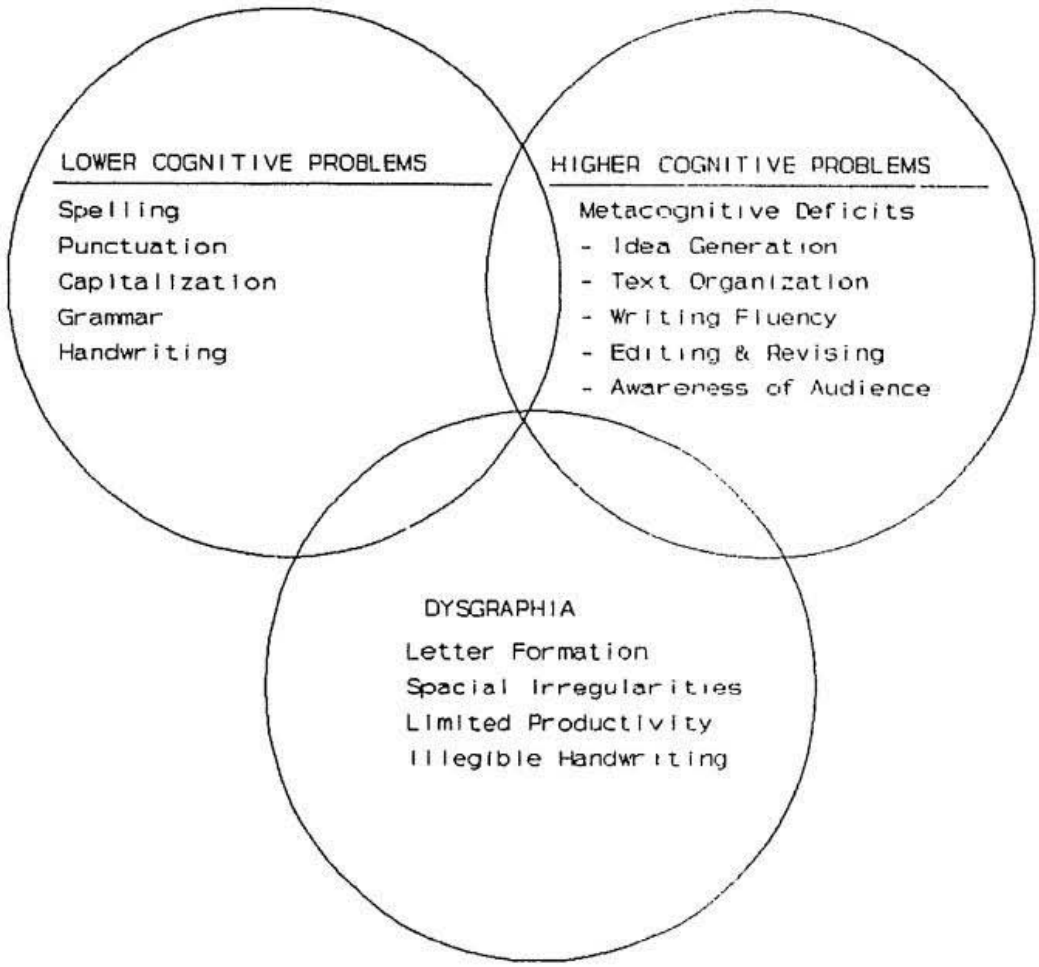


Figure 1.1

NOTE: Because children with writing disabilities reveal themselves in different levels of severity, a learning-disabled student experiencing writing dysfunction may have difficulty with all or any of the above subprocesses of writing.

Current Instructional Approaches in Writing

For a number of years, teaching writing in language arts has been product-oriented. Teachers using this approach have focused on teaching the mechanical aspects of writing in isolation with little emphasis on assisting writers develop higher cognitive skills in writing (Tompkins & Friend, 1986). In 1985, Graves wrote "Children with learning disabilities often work on skills in isolation, disconnected from learning itself, and therefore disconnected from themselves as persons. Though their skills may improve slightly in isolation, they do not perceive the function of the skills" (p. 36). The emphasis on the product-oriented approach is on the end product, not on the process that students experience during composing activities.

Fortunately, the focus in the teaching of language arts instruction has shifted as teachers have become aware of the benefits of teaching language arts in a more holistic manner. Locally, the Provincial Department of Education for Newfoundland and Labrador (1991) has adopted the "Whole Language Philosophy" in language arts instruction. A statement from the Newfoundland and Labrador Department of Education's "Primary Language Curriculum Guide" (1991) suggests: "The primary language program values the use of holistic strategies which are concerned with all the systems

of learning such as quality literature for reading instruction and the use of children's own language for reading and writing activities" (p. 14).

The current process approach to writing instruction, a practice consistent with whole language philosophy, focuses on the actual steps children experience as they write. It has been suggested throughout the research literature that the teaching of writing from a narrow focus on product to a more holistic approach of teaching written expression, may provide a promising opportunity which writers of various abilities engage (Graves, 1985; Graham, 1992).

Specifically, the process oriented approach to writing instruction appears to hold great promise for LD children experiencing writing difficulties. However, caution must be exercised when utilizing this approach. While many normally achieving students learn to write naturally through daily exposure and practice, simply providing the time for learning-disabled writers to write may not be effective in assisting these children to become proficient writers (Whitt, Paul, & Reynolds, 1988).

Current research suggests that direct instruction of writing strategies and modelling of certain aspects of the writing process, is needed to increase the automaticity necessary for growth and proficiency in written language ability (Graham & Harris, 1989; Majsterek, 1990). Although

the process oriented approach to writing instruction appears to be particularly well suited to the unique learning needs of learning-disabled writers; future research must consider the most effective strategies for integrating the process oriented approach with learning-disabled students (Graham & Harris, 1992; MacArthur, Schwartz, & Graham, 1991).

NOTE: Many learning disabled individuals exhibit slow rates of learning in the acquisition of new concepts and in acquiring proficiency with newly acquired skills upon which higher level learning can be built (Goldman & Pelligrino, 1987).

NOTE: Many learning disabled students lack the cognitive strategies efficient writers use for managing the basic writing processes (Morroco & Neuman, 1986).

NOTE: Many learning disabled students can be characterized as deficient in activating strategically higher-order cognitive processes (Englert, Raphael, Fear, & Anderson, 1988).

The Microcomputer: A Link to the Writing Process

The growing body of research knowledge on the process oriented approach to instruction, a practice consistent with the whole language philosophy, has much in common with what the educational technology literature on microcomputers says. In fact, current research suggests that the process-oriented approach to writing instruction can be facilitated by using the microcomputer in the instruction of LD writers (MacArthur, Schwartz, & Graham, 1992).

Equally important, is the growing body of research knowledge suggesting that learning-disabled writers may possess certain characteristics which require the kinds of instructional modifications that microcomputers can provide. In fact, there exists throughout the educational technology literature, a growing body of research on the promised benefits of microcomputer instruction for children with learning disabilities specific to writing.

Shiffman, Tobin and Buchanan (1982) outline some unique features the microcomputer offers in the instruction of students with learning disabilities. They are listed as follows:

1. Microcomputers are considered user friendly; they can use the students' names when giving lessons and allow them to make mistakes in a nonthreatening

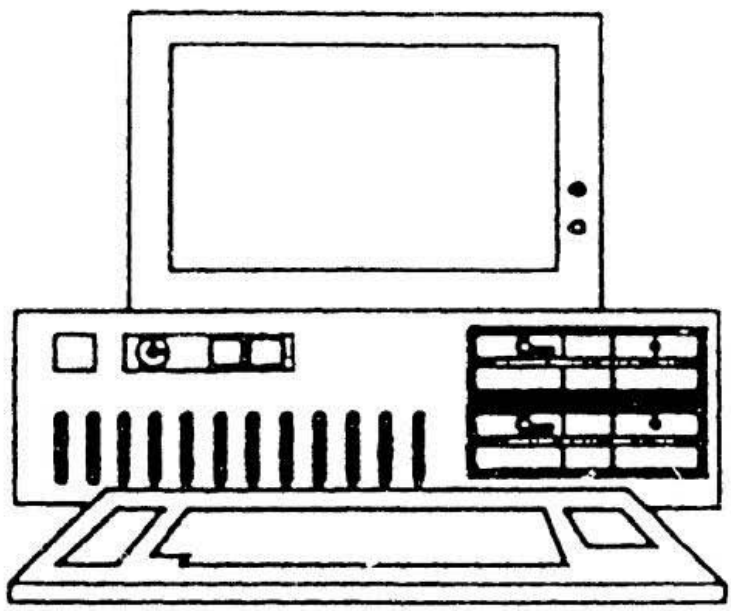
environment. Because the microcomputer is nonjudgemental, i.e., it does not chastise the learner for the wrong answer, some of the stress associated with making a mistake is eliminated.

2. The computer can give the child its undivided attention and does not have to be concerned about other children in the room.

3. Students with learning disabilities often work more slowly than others. The computer does not mind; it waits patiently while the child works out the answer. It is not in a hurry to go on to the next child or the next problem. No real adaptation of software is necessary to get the computer to wait.

4. Reinforcement of individual responses is immediate rather than having the student wait until the teacher can grade the work. Children with learning disabilities are sometimes unsure of themselves. Computers can provide continuous positive feedback and praise, thus giving students a higher sense of self-esteem. Raising a student's self confidence level can be a tremendous contribution to the ability to learn.

5. Drill and Practice can become exciting through the use of animation, sound effects and game-playing situations.



EDUCATIONAL APPLICATIONS OF THE MICROCOMPUTER

Introduction

There are several unique types of computer applications useful in the instruction of children with learning disabilities specific to writing. The suggested efficacy of computer technology in the instruction of LD students was addressed throughout the research literature of the past decade (Kolich, 1985; Schiffman et al. 1982; Torgenson & Young, 1983).

The next section introduces three computer applications, specifically, Word Processing, Drill and Practice, and Tutorial courseware. A description of each application is presented along with its potential benefits for learning-disabled writers.

WORD PROCESSING

In 1989, Outhred wrote:

> Many children with learning disabilities are reluctant writers because their written work has been criticized for its illegibility and misspellings. These children commonly develop strategies to cope with writing - for example, limiting their vocabulary to known words, avoiding complex ideas, and making any written work as short as possible (p. 262).

Introduction

A word processing package is considered to be a productivity tool used to support the writing process by providing users with an opportunity to electronically produce, edit, store, retrieve, and print text. Moreover, word processing often provides instruction and/or assistance in the mechanics, usage, editing, or presentation of the final product.

A recent body of research on microcomputers in education suggests that word processing programs are enabling tools particularly those who experience difficulty with aspects of written expression (Outhred, 1989; Rosegrant, 1985). It has

been suggested that when teachers receive appropriate training and access to word processing software, students who are impaired in their written language may demonstrate a greater involvement in the writing curriculum (Graham & MacArthur, 1988). Furthermore, it has been suggested that through the use of a word processor, children may develop a positive attitude towards written work, particularly for children with learning disabilities specific to writing, who struggle daily with aspects of written expression (Bobrow, 1985).

Producing written language is commonly one of the most difficult challenges for many children with LD. These children must cope with the mechanical aspects of grammar, punctuation, and spelling, while at the same time attempt to generate meaningful ideas, arrange ideas in acceptable syntactical patterns, and produce a coherent sequence of ideas in paragraph form. Typically, many students with LD specific to writing meet with failure in the existing school system because so much of our testing and evaluation is based on written forms of assessment.

Consider a child with handwriting problems. These children, often diagnosed as dysgraphic, experience frustration at not being able to express themselves in writing. For many, the fine motor and spacial demands of writing present a laborious task. A word processing package enables children who are impaired in the motoric aspects of

writing compose, unhindered by the arduous difficulties imposed by handwritten activities (Graham & MacArthur, 1988).

While some students with writing disabilities require specific instruction in the mechanical or composing subprocesses of written expression, others need a tool to help them circumvent writing altogether. The child who experiences dysgraphia, that is, a specific handwriting or motoric disability, often requires instructional modifications to strengthen or compensate for weaknesses. Word processing can provide a new vehicle for producing work (MacArthur & Shneiderman, 1986).

It is obvious that, as regular and special class teachers have greater access to microcomputers and word processing, instruction and practice will be affected significantly. Unique features like flexible editing, spell checkers, and a neatly printed copy are just a few of the advantages a word processor offers while instructing students with writing problems. As a result of the current innovations in educational courseware, a microcomputer equipped with quality word processing software can empower those who have difficulty with handwriting, composing skills, and spelling. A number of advantages pertaining to the use of word processors with LD writers are listed as follows:

1. Word processors can facilitate a collaborative relationship between the student and the teacher. The

upright monitor and clear print creates a unique writing environment enabling the teacher to stimulate the child during all aspects of the writing process (Morocco & Neuman, 1986).

2. The ability to produce a neat, printed copy may be particularly motivating for those children whose written work is characterized by illegible handwriting and mechanical errors (MacArthur & Shneiderman, 1986).
3. Word processing provides motor support for children experiencing handwriting difficulties, replacing handwriting with typing to compose text (Kolich, 1985).
4. Ease of revision may allow students to concentrate on content first and the mechanical aspects of the writing later (Morocco & Neuman, 1986).

Generalizations About the Use of Word Processing Courseware with LD Writers

> In 1988, Stevens wrote:
>
> By adjusting materials and adapting assignments to fit the limitations of learning disabled students, teachers make it possible for these youngsters to learn in spite of their problem. Classroom computers now make a whole new set of alternatives available to teachers who are trying to adapt assignments in accord with an LD student's impaired skill in writing (p. 170-171).

Although research on the use of word processing in the writing curriculum is current and ongoing, a number of generalizations can be made in reference to LD students:

1. LD students seem to write more when using a word processor (Outhred, 1989).
2. The use of a word processor with children experiencing spelling difficulties can result in fewer spelling errors (Outhred, 1989).
3. The word processor circumvents the anxiety many LD children experience feel during pencil and paper tasks (Stevens, 1988).

4. Word processing programs have the capability to involve thought processing on four sensory levels: visual, auditory, kinesthetic, and tactile (Rosegrant, 1985).
5. Word processors usually produce a heightened interest and increased motivation for students who struggle daily with the process of traditional handwriting methods (Morocco & Neuman, 1986).

Principles to Assist Teachers of LD Students with Word Processing and the Writing Process

> In 1992, Graham wrote:
>
> Both the popular press and many educators have voiced the concern that schools do not do enough (or enough of the right things) to promote students' literacy growth. I am especially concerned about the quantity and quality of writing instruction that students classified as learning disabled (LD) receive (p. 134-135).

The following list contains a number of general principles to assist teachers of LD students with word processing and the writing process.

General Suggestions

1. Emphasize the communicative role of writing.
2. Allow sufficient time for writing instruction and practice activities.

NOTE: Research on effective instruction has emphasized the importance of instructional and practice time in increasing student achievement across all areas of the curriculum.

3. Provide frequent and meaningful writing activities. A number of suggestions to make writing experiences more meaningful are as follows:

- Allow students to choose for themselves what they will write about.

- Assist students in establishing goals for what they want to achieve with their writing.

- Arrange it so students have opportunities to work on the same writing activity over an extended period of time.

- Provide writing activities that are designed to serve real purposes. In classroom environments where writing is process oriented, students write for their peers, teachers and parents. A sense of audience is developed and internalized.

- Arrange it so that the writing experience can become a component in a larger theme or curriculum area.

4. Teach writing as a process. By now, most writing researchers agree that writing is a process and advocate that it should be taught as such. In most cases, researchers agree to variations of a three step model which includes:

Pre-Writing -- Planning

Writing -- Transcribing/Composing

Rewriting -- Revising/Editing

5. Revise and adapt word processing documentation. In many instances, accompanying word processing courseware manuals and documentation are complex and will be problematic to students with learning disabilities. Adaptations may be necessary for independent use by the learner. For example:

   - **Instructions should be concise and redundant for key concepts.**
   - **Present concrete and visual examples for terms and concepts introduced when necessary.**

6. Teach Keyboarding Skills. Typically, most students discover that typing is slower at first and requires more concentration than handwriting. This is especially true of many learning-disabled students with handwriting difficulties. In fact, a number of research studies have found (Daiute, O'Brien, Shield, Liff, Wright, Mazur & Javitz, 1983; MacArthur & Graham, 1988; MacArthur & Shneiderman, 1986) that learning to use a word processor is often problematic and presents a barrier to LD writers. Similarly, Daiute et al. (1983) maintained that without adequate training, students using computers may find writing more difficult. Finally, Crealock, Sitko, Huchinson, Sitko & Marlett (1985) argue that exceptional students must devote considerable time to learn both keyboarding and word processing skills in order to effectively utilize word processing during writing activities.

7. Operation of a Word Processor. In addition to the acquisition of keyboarding for efficient text production, students need to acquire the text editing printing functions of word processing software. Although improvements in the ease of use of word processing software have occurred, beginners of various ages experience some obstacles in learning to use a word processing program. This is particularly noticeable with LD students. Specifically, MacArthur and Shneiderman (1986) described two obstacles that LD students have in using a word processor with efficiency:

- **Misunderstanding of the key functions which cause problems during revising and printing;**
- **Confusion about procedures for saving and loading files.**

To assist LD students with the efficient use of word processing software you can:

1) Provide systematic keyboarding instruction prior to using word processing software. A number of highly recommended typing tutorials are available to provide sequenced, systematic instruction. These skills are critical to the efficient use of the microcomputer by LD students.
2) Choose a typing tutor that includes a game component to enhance interest and motivation.

3) Provide direct instruction in the operation of a word processor.

4) Carefully select appropriate software for age level and learner characteristics.

5) Display visual instructional clues to assist students with word processing functions.

6) Gradually introduce the editing features of word processing which enable writers of various abilities to make revisions in spelling, word usage, and movement of text without the tedious recopying required during paper and paper activities.

7) Gradually introduce spelling checkers which can relieve children from the laborious task of locating and correcting their spelling errors.

8) Keep in mind that a word processing program can facilitate a narrow skills approach to writing instruction as well as a holistic, meaning centered, process-oriented approach to writing.

NOTE: It is not yet clear how much time or what level of word processing and keyboarding instruction is needed to benefit the writing skills of learning disabled students. On-going research that incorporates structured keyboarding and word processing training is critical and needs to be conducted (Daiute, O'Brien, Shield, Liff, Wright, Mazur, & Jawitz, 1983).

Computer Assisted Instruction

In 1986, Sitko, wrote:

> CAI is particularly helpful for students with special learning needs who need to review materials with which they have prior familiarity, or who require a great deal of drill to master rudimentary concepts and achieve "automaticity" in such areas as reading decoding and basic computational skills (p.409).

Introduction

Computer Assisted Instruction (CAI) refers to the use of computer systems by teachers for instructional purposes in the classroom setting. Computer software associated with CAI is often referred to as courseware. CAI courseware purports to introduce new academic skills or review previously taught curriculum content. CAI courseware can be classified under the following instructional designs: drill and practice, tutorials, and simulations. The author is particularly interested in drill and practice courseware and tutorial courseware for the purpose of this resource guide.

Drill and Practice

In 1984, Torgenson wrote:

> In contrast to teachers, computers are uniquely suited to delivering large amounts of closely monitored and individualized practice in basic skills. They can be programmed to provide practice in a variety of interesting formats that will maintain interest and motivation, and they have the capacity to monitor both speed and accuracy of students' responses. Thus, using computers to provide large amounts of closely monitored practice would be one way to utilize the unique capabilities of computers in the education of mildly handicapped children (p. 42).

A growing body of research suggests that instructionally sound drill and practice courseware has the potential for providing learning activities that are associated with effective instruction for learning-disabled students (Goldman & Pelligrino, 1987). Typically, many LD children exhibit slow rates in the acquisition of new concepts in reading, writing and math and then in developing further proficiency in applying new skills (Goldman & Pellegrino, 1987).

Sitko (1986) maintains that CAI is particularly

beneficial for students with special learning needs who require reinforcement of skills previously taught, or who need additional drill and reinforcement in order to increase the automaticity of certain concepts (Torgenson & Young, 1983). While there is still research needed to determine the effectiveness of drill and practice courseware with LD children, the use of drill and practice programs appear capable of providing the necessary repetition and reinforcement that LD children often require for the attainment of basic skills. A number of specific advantages pertaining to the use of drill and practice courseware with LD children are listed as follows:

1. Typically, learning-disabled children exhibit a greater need for repetitious practice of basic skills and concepts in language arts and math. The microcomputer can provide infinite patience and tireless drill and practice activities to assist in basic skill retention (Goldman & Pellegrino, 1987).
2. Drill and Practice courseware, because of their interactive abilities engage and motivate students of varying abilities (Schiffman et al. 1982).
3. LD students have displayed improved attention span during coursework following computer assisted instructional activities (Sitko, 1986).
4. The individualized nature of CAI makes this medium particularly suitable to children with learning

disabilities (Kolich, 1985).

5. Drill and Practice courseware can provide immediate feedback, self-pacing, and offer a positive, non-threatening learning environment (Kolich, 1985).
6. The multi-sensory approach to learning combined with non-threatening interactive features, has proven to be effective and popular with LD students who often require a combination of visual, auditory and kinesthetic experiences during the learning process (Schiffman et al. 1982).

Although drill and practice activities appear particularly appropriate for LD children, caution needs to be exercised. Specifically, Goldman and Pellegrino (1987) maintain:

> Extended practice that leads to the automatic execution of process components of more complex tasks is a desirable, albeit not a singular, educational goal. This is especially true for basic skills in areas of mathematics, reading, and writing, although we do not mean to imply that the introduction and mastery of higher-order and more complex skills should be delayed until automaticity has been achieved. Quite the contrary, overlap is both necessary and important (p. 146).

Generalizations About the Use of Drill and Practice Courseware with LD Writers

> In 1982, Schiffman et al. wrote:
>
> LD students often display a greater need for routine and repetitious practice than their peers. Unlike a teacher or tutor, the computer can have infinite patience. It does not respond on an emotional level and does not mind repeating itself several times (p. 558).

Although research on the use of drill and practice in the writing curriculum is current and ongoing, a number of generalizations can be made in reference to LD students:

1. LD children become motivated, active, learners during drill and practice activities (Sitko, 1986).
2. Effective drill and practice paradigms allow student(s) to review skills that are first introduced and taught by teachers (Schiffman et al. 1982).
3. Drill and practice courseware can provide the extended reinforcement with specific problematic skills and concepts (Goldman & Pelligrino, 1987).
4. Positive outcomes are associated with extended practice on the microcomputer (Kolich, 1985).

Principles to Assist Teachers of LD Students with Drill and Practice Courseware and the Writing Process

> In 1984, Torgenson wrote:
>
> Assuming that they are used in a way that is consistent with sound educational practice, children should benefit from instruction delivered by these newer systems. After all, good CAI systems simply follow many of the procedures that good teachers follow (p. 39).

The following list contains a number of general principles to assist teachers of LD students with drill and practice courseware and the writing process.

General Suggestions

1. Determine areas of strengths and weaknesses. Target areas for supplementary instruction. Choose appropriate curriculum support courseware to match learner needs.
2. Completely familiarize yourself with the courseware before introducing the lesson to your student(s).
3. Keep the instructional objective in mind during computer activities. This enables the teacher to provide guidance and corrective feedback only for aspects related to the teaching objective.

4. Establish teaching sequence and instructional method.

NOTE:	Microcomputer drill and practice courseware cannot make the learning disability disappear, however, drill and practice courseware does offer effective ways of dealing with the deficient information processing skills of many LD students.

Tutorial Courseware

Introduction

CAI courseware supporting the teaching of new skills and concepts is commonly referred to as tutorial courseware. Courseware in tutorial form covers a broad range of curriculum areas, all of which provide instruction to the learner. Many tutorial programs are equipped to provide a sequenced review of subject matter that has been previously introduced before leading the learner to more complex concepts. This feature is particularly beneficial to LD students who often have difficulty understanding a concept during initial instruction (Goldman & Pelligrino, 1987). Also, depending on the students' responses and interactions, tutorial courseware proceeds to lead the learners into higher level learning or to another section of the program for further remediation. A number of specific advantages pertaining to the use of tutorial courseware with LD children are listed as follows:

1. Tutorial courseware can provide error diagnosis of student responses. This can assist the teacher to identify strengths and areas of weakness experienced by the child (Sitko, 1986).
2. Tutorial courseware can provide branching, that is, the ability to provide alternate instructional modes to correct understanding and/or provide alternate explanations of the concept being presented (Freeze,

1988).

3. Tutorial courseware can provide specific feedback at the point of misunderstanding and/or reinforcement to students at the point of understanding (Freeze, 1988).

NOTE:	In addition to providing truly individualized programs of learning, some CAI courseware has shown to have positive effects on the academic achievement and motivation of learning-disabled students (Lindsay & Marini, 1983).

Generalizations About the Use of Tutorial Courseware with LD Writers

Although research on the use of tutorial courseware in the writing curriculum is current and on-going, microcomputer tutorials appear to have some potential advantages for LD writers. Stevens (1988) suggests "By altering texts and materials used with LD students, teachers make it possible for them to learn successfully despite their weaknesses in some of the basic skills" (p. 151). A number of generalizations can be made in reference to LD writers.

1. Tutorial courseware is particularly beneficial for students with LD who often require reinforcement of skills previously taught (Sitko, 1986).
2. Tutorial courseware can provide a window on the learning process for teachers of LD writers. Specific error diagnosis of student responses assists teachers in identifying areas of strengths and weakness (Sitko, 1986).
3. Alternate explanations of material are often provided.
4. Immediate feedback and positive reinforcement is provided (Schiffman et al. 1982).

Principles to Assist LD Students with Tutorial Courseware and the Writing Process

The following list contains a number of general principles to assist teachers of LD students with tutorial courseware and the writing process.

General Suggestions

1. Conduct a learner analysis. Determine areas of strengths and weakness and choose appropriate curriculum support software to match learner needs. Target the skill that requires reinforcement.
2. Completely familiarize yourself with the courseware before introducing the lesson to your student(s).
3. Keep the instructional objective in mind during computer activities. This enables the teacher to provide guidance and corrective feedback only for aspects related to the teaching objective.
4. Establish teaching sequence and instructional method.

NOTE:	Keep in mind that microcomputer tutorials cannot make the learning disability problems disappear, however, if quality courseware is utilized effectively, remediation of weakness may occur.

Integrating Microcomputers into Effective Instruction

Introduction

Although it has not been determined up to this point through research whether or not elements from the "effective teaching" literature will be found to be linked to the effective use of microtechnology in instructional practice, the implementation of microcomputers at the school level in combination with sound elements of effective teaching practice has the potential for enhancing the instructional effectiveness in the classroom (Mastropieri & Scruggs, 1987).

In defining effective teaching Mastropieri and Scruggs (1987) suggest "Effective teaching refers to those variables produced by teachers that result in higher levels of student achievement" (p. 19). Lillie, Hannum, & Stuck (1987) maintain that knowledge about effective teaching principles has solid implications for determining how to select and use curriculum support software. They contend (1987) "What is known about effective instruction can clearly be used to guide and structure methods for using computers in the classroom" (p. 8). Vockell & Mihail (1993) argue that microcomputer use in the classroom setting is frequently undertaken without any theoretical framework. They maintain:

Teachers often tell their students to run software

> simply because it is "good", it is related to the subject matter, or the students seem to like it, without relating this use to any theoretical principles or specific instructional strategies. This is ironic, because in recent years there has been a considerable growth in solid research demonstrating the effectiveness of specific instructional strategies (p. 39).

As educators continue to introduce microcomputers into their classrooms, microcomputers can assist teachers in making curriculum modifications and adaptations for students with diverse learning needs. However, simply computerizing a classroom should not be equated with effectively matching the individual needs of children. In fact, integrating the microcomputer into instructional curricular activities for special needs students will require educators to become proficient at selecting and effectively integrating curriculum support courseware to match the unique needs of students. Sitko (1986) states "The most successful classroom applications of the microcomputer are a direct result of the teacher's ability to determine how best to use the computer's capabilities in the context of the existing curriculum demands and diverse learning needs" (p. 436).

An extensive body of research conducted over the past two decades on teacher effectiveness and program implementation

has a lot in common with what the educational literature has to say about the instruction of special needs students in mainstream classrooms. Specifically, Mastropieri and Scruggs (1992) contend:

> Teachers who use effective teaching variables teach to prespecified objectives; provide systematic presentations that go directly, step by step, to the point of the content being taught; ask specific questions related to instructional objectives; provide sufficient guided and independent practice activities; and monitor student progress toward the meeting of instructional objectives (p. 396).

Equally important, is the growing body of research literature on the effective integration of microcomputer instruction into curricula with learning-disabled students (Montague, 1987; Schiffman et al. 1982; Torgenson & Young, 1983). Specifically, Montague (1987) makes a number of recommendations for effective microcomputer instruction with learning-disabled students. They include: "a) The need to establish a teacher-microcomputer instructional partnership; b) The need to systematically teach a comprehensive strategy as a process before introducing microcomputer instruction; and c) The need to utilize available technology to realize instructional goals" (p. 129).

Effective Instructional Elements

Recently, a number of researchers have developed instructional plans which use elements of effective instruction and teaching principles in the selection and use of curriculum support software for instructional purposes (Weisgerber & Rubin, 1985; Wepner, 1992). Bear (1984) wrote "It is likely that future research will find CAI to be effective in those classrooms that are characterized by the same elements of instruction that previous research has shown to be associated with effective teachers" (p. 12). The application of effective instructional practice is especially important to many learning-disabled students who often require a very structured, systematic, approach to learning.

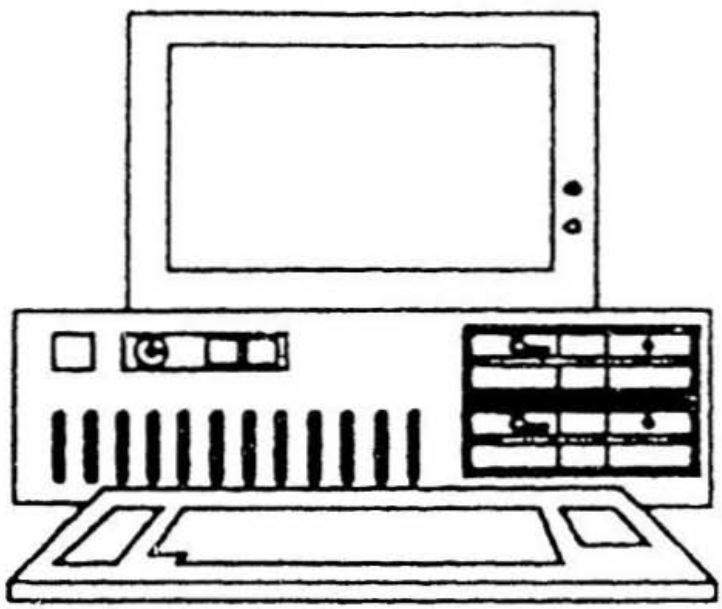
The following section introduces the reader to a systematic instructional plan designed to assist with the effective integration of microcomputers into instructional practice in the area of written expression. Specifically, four instructional plans are presented using four pieces of educational courseware easily adapted to meet the needs of LD writers at the elementary school level. A description of each program is presented along with teacher directed activities in an effort to link effective microcomputer instruction with LD writers. Additionally, three major approaches to teaching writing specific to learning-disabled writers are presented.

Each of the four instructional plans will include three instructional elements designed to link the integration of microcomputers to effective instruction. The instructional lessons include elements from the effective teaching principles in instructional practice (Weisgerber & Rubin, 1985). The three instructional elements are described as follows:

1. **Pre-Computer Activities**: Pre-computer activities include any introductory activities for beginning a session of instruction. Pre-computer activities are typically listening, and paper-and-pencil-activities, however, a computer activity may be appropriate. The pre-computer and introductory activities establish a context for instruction. In essence, pre-computer activities prepare the student for the acquisition of new skills and concepts.

2. **On-Computer Activities**: On-Computer Activities include any instructional activities used in connection with the microcomputer. The microcomputer is used during on-computer activities, although the teacher continues to guide and monitor the learning process. This is particularly important for many LD writers who often require extended practice and guidance in order to achieve understanding and automaticity of new skills and concepts.

3. **Post-Computer Activities**: Typically, post-computer activities are designed to demonstrate transfer of knowledge from microcomputer activities to pencil tasks. While follow-up activities are appropriate for many learning-disabled students, these activities must take into consideration the nature of the writing disability. Children with handwriting problems may need a computer to help them circumvent handwriting altogether.



Effective Instructional Approaches in Writing

> In 1991, Harris and Pressley wrote:
>
> Good strategy instruction is not rote. Students are not just memorizing steps and mechanically executing them: strategy instructors are not drill sergeants. Rather, good strategy instruction entails making students aware of the purposes of strategies, how and why they work, and when and where they can be used (p. 401).

Microcomputers, can be used as an effective instructional resource for all educators, providing them with the opportunity to integrate courseware into the curriculum. Moreover, specific teaching strategies and methods to meet the diverse population of children in our classrooms are beginning to emerge throughout the research literature. Specifically, Morroco and Neuman (1986) described three major approaches in the instruction of learning-disabled writers. To a large extent, the three approaches are consistent with what the Newfoundland Department of Education (1991) says about microcomputers, the writing process, and special needs students.

Substantive Instruction

In substantive instruction, the teacher and the child determine word order, organize, and discuss ideas together, in a collaborative manner. This instructional technique is particularly beneficial for many learning-disabled writers who experience difficulty with the higher cognitive processes in writing presented earlier in the model of writing dysfunction, Fig. 1.2. In substantive instruction, the teacher may use a number of instructional techniques to assist students with idea generation, text organization, and developing and accessing metacognitive processes. A number of teaching strategies consistent with substantive instruction are presented in combination with a three part instructional plan with selected pieces of courseware.

Procedural Instruction

In procedural instruction, the teacher and child discuss a strategy or procedure that the child can activate during some aspect of the writing process. Activities during procedural instruction usually focus on teaching specific strategies to children to assist them with aspects of the writing process. Strategies may include planning, organization, editing and revising, and the mechanics of writing. Procedural instruction is particularly beneficial to learning-disabled students who are characterized as being

strategy deficient in aspects of cognition (Goldman & Pelligrino, 1987; Englert, Raphael, Fear, & Anderson, 1988; Palinscar & Klenk, 1992). A number of teaching strategies consistent with procedural instructional techniques are presented along with a three part instructional plan with selected pieces of courseware.

Direct Instruction

During direct instruction, teachers directly teach specific skills to students. This approach usually focuses on the direct teaching of writing skills including spelling, style, and word usage. Collaboration during direct instruction focuses on a number of specific techniques such as modelling, rehearsing, demonstration, and role playing. This approach is particularly beneficial to learning-disabled writers who often experience lower cognitive problems in written expression (Poplin, Gray, Larson, Banikowski, & Mehring, 1980; Poteet, 1978; Wong, Wong, Darlington & Jones, 1991). A number of teaching strategies consistent with direct instruction are presented in the microcomputer instructional plans that follow.

INDIVIDUAL MICROCOMPUTER INSTRUCTIONAL PLANS

Introduction

The increased use of microcomputers in education has significant prospects for increasing the quality of education provided to special needs students. As we move into the 1990's and beyond we can expect to see an increased production of educational hardware and software for diverse student populations. Moreover, the increased production of hardware as well as dramatic cost reductions have contributed the rapid acquisition of microtechnology in education.

Although the current research on the suggested efficacy of microcomputers with diverse learning populations appears promising, it presents educators with a number of relevant concerns. Questions like, "How do I effectively use this technology in the classroom setting?", "How do I select appropriate hardware and software?", "How do I match microcomputer instruction to individual learning styles?", and "How do I match microcomputer instruction with curriculum objectives?".

To assist teachers with the effective integration of microcomputers into classroom instruction, the author has developed four instructional plans which attempt to link a number of elements from the effective teaching research and literature, with the use of microcomputers in instructional practice. The author emphasizes that it is not necessarily

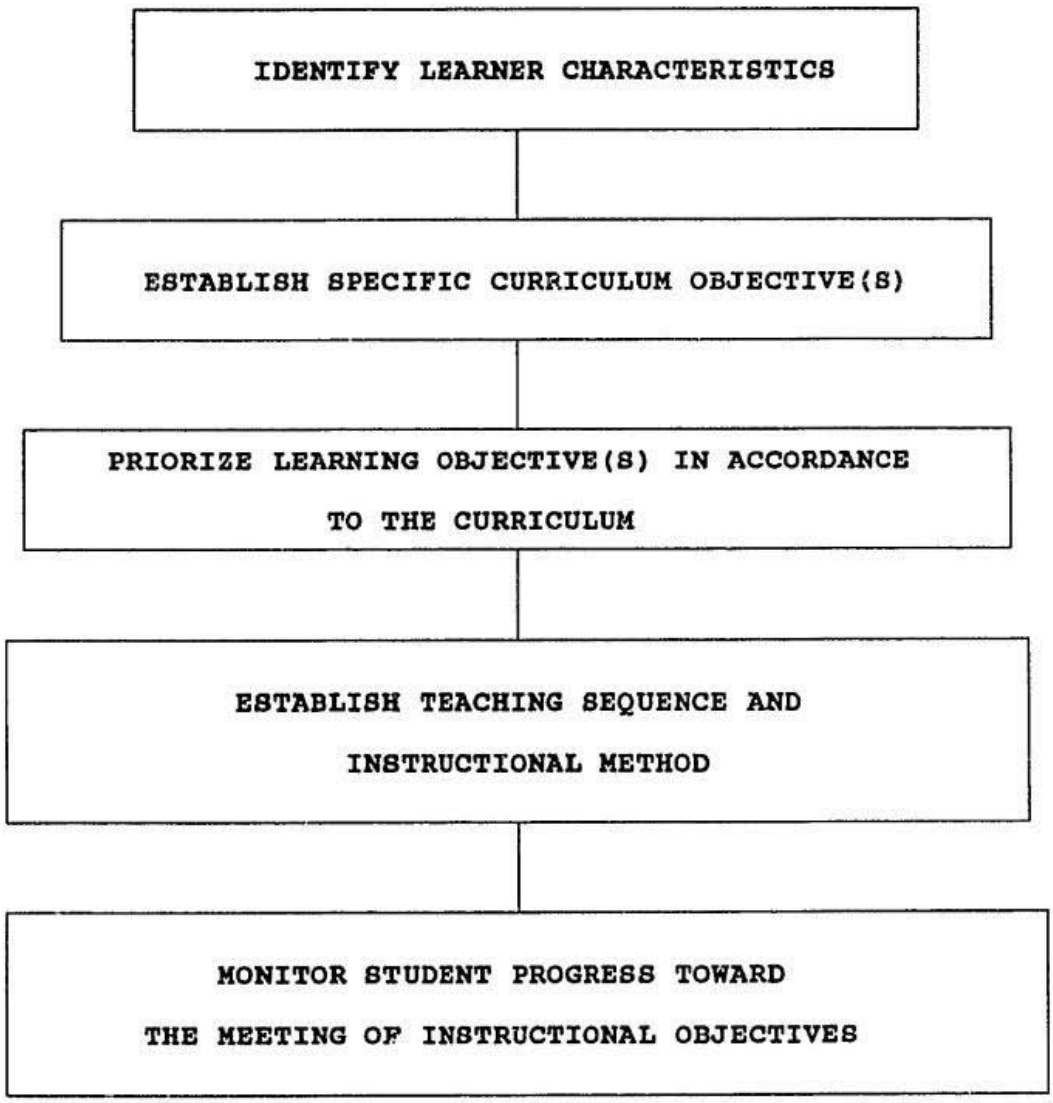
the type of hardware and software that is used during instruction but rather, how it is used in the context of the curriculum and individual student learning styles. Furthermore, it is important to recognize that the basic principles and procedural teaching examples provided, apply whether you are on a 128K, Apple II, a MacLCII, or a IBM 486.

The readers are reminded that the lesson plans are general in nature, designed to serve as a model. Teachers are encouraged to adapt lesson plans according to the demands of the total teaching learning situation.

Getting Started

1. Determine how much computer knowledge your student(s) or group of students already have.
2. Identify specific areas of strengths and weaknesses. Learner characteristics are usually attained through diagnostic assessment of a student or group of students. The identification of strengths and weaknesses is central to any targeted instructional plan or specific objective.
3. Establish educational objectives involving microcomputer instruction for a individual student or group of students. These are the objectives that you want your student(s) to achieve.
4. Priorize computer learning objectives in the existing curriculum.
5. Establish a teaching sequence for achieving the learning objective(s).
6. Monitor student progress toward the meeting of instructional objectives (See Figure 1.2).

LINKING EFFECTIVE TEACHING PRINCIPLES, INDIVIDUAL LEARNING STYLES, AND CURRICULUM OBJECTIVES



NOTE: This framework identifies key components found to be crucial in effective teaching practice.

Figure 1.2

Instruction Plan #1

Educational Courseware Description

Software Program	Success with Writing
Curriculum Area	Language Arts
Topic	Writing Process
Users	(Upper Elementary and Beyond)
Editor	Scholastic
Copyright	1990

Courseware Description: This program is an easy to use, versatile writing program designed to help students understand and master the process oriented approach to writing, an approach consistent with the whole language philosophy. **"Success with Writing"** is designed to support the four stages of the writing process. This tutorial program is composed of four distinct modules organized around the acronym **PACE** -- **Prewrite, Arrange, Compose,** and **Edit/Evaluate.** It guides students from the prewriting stage of idea generation to a finished composition. Additionally, because of the flexibility of the program, you can choose to use the modules in any order. Furthermore, teachers can print student work with the word processing component of the program.

Program Features

Pre-writing - This module features activities designed to help students generate their ideas and get started writing.

Arranging - This module features activities designed to

help students organize their ideas into a logical outline appropriate to any type of writing activity (i.e.: essays, stories, letters, reports).

Composing - This module features a word processor designed to help students type and edit drafts of their work from the prewriting stage to a finished composition.

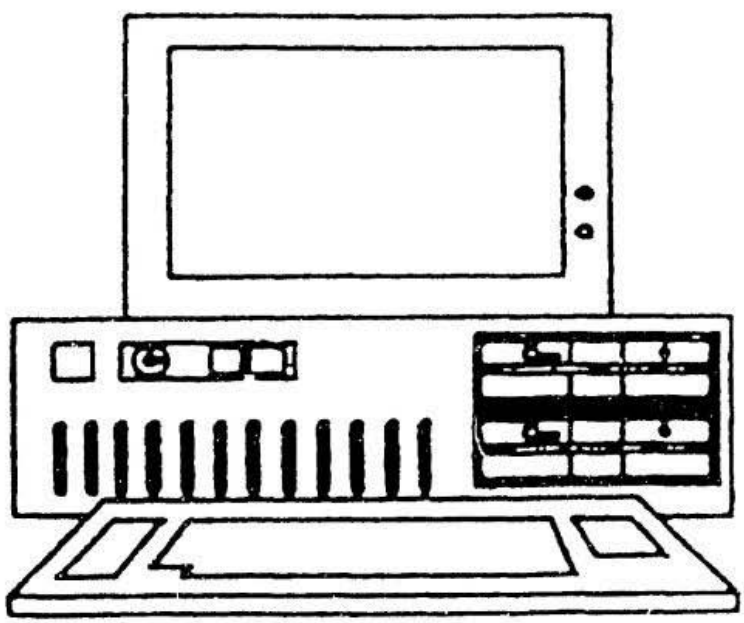
Editing/ Evaluating - This module is designed to help students review and revise their work.

Package Contents:

1) Package Manual;
2) Two sets of **"Success with Writing"** program disks;
3) A teacher utility disk to modify and create you own; **"Success and Writing"** activities;
4) A **"Success with Writing"** student activity book; accompanied by an activity disk.

The Integration of "Success with Writing" into the Writing Process, with LD Writers

"Success with Writing" provides an excellent tool to use within the writing process. Because "Success with Writing" contains the complete writing process on a disk, it can be used as a basis for a computer-based writing program or to supplement an existing writing curriculum. This program is a useful to particularly for learning disabled students who may require reinforcement of skills previously taught or an instructional modification in order to understand certain aspects of the writing process.



Effective Instructional Activities

Courseware	Success with Writing
Courseware Type	Tutorial
Subject Area	Language Arts: The Writing Process
Specific Concept	Composition: Prewriting/Idea Generation
Target Population	LD Writers: Elementary School Level

Teaching Objective: To help student(s) understand the prewriting stage of the writing process by introducing a specific prewriting strategy.

Instructional Approach: Substantive & Procedural (see discussion of substantive and procedural instructional techniques, pp. 242-244)

Machine Requirements: Apple 11e, with 128K, 11c or 11GS, Macintosh 1MN, MS-DOS - 256K.

Materials Needed: **"Success with Writing"** courseware and manual.

The **"Idea Diagram"** prewriting strategy.

Time Required: Variable, depending on age, skill level, group size and individual learner characteristics.

Procedure: The integration of **"Success with Writing"** into

effective instruction for LD writers is presented by means of the following instructional elements: pre-computer classroom activities, on-computer activities which include tasks in connection with the computer, and post-computer activities which attempt to demonstrate transfer of knowledge gained from the instructional lesson.

Procedural Teaching Example

Pre-Computer Activities

1. Introduce to the student(s) the definitions of prewriting and brainstorming.
2. Provide activities that help students select topics, consider goals for writing, develop an awareness of audience and generate and organize ideas for writing activities.
3. Essential to this aspect of the writing process for LD students is the importance of modelling the cognitive processes involved in prewriting, providing time to plan, and providing writing activities that have real purposes.
4. Model the prewriting strategy and self-instructions. There are a number of prewriting strategies to assist children in the writing process. This instructional plan will focus on one prewriting strategy considered to be effective in the instruction of LD writers, The IDEA DIAGRAM. A copy of the **"Idea Diagram"** is included in Appendix E. Write about the topic on the chalkboard or on an overhead transparency. By modelling writing processes for a student or group of students, teachers provide useful insights about the writing process. During this time, teachers can use a **THINK ALOUD** strategy to share and translate their ideas into print.
5. Encourage class interaction during process.

*6. Provide controlled practice of prewriting strategy. During this step, students are presented with a copy of the **"Idea Diagram"** to practice brainstorming activity. The teacher provides a list of possible topics to write about and students are given the option to select their own. Guidance and prompting is provided by the teacher throughout the activity; prompting is faded after a number of practice sessions when independent performance is achieved.

7. Independent performance is encouraged!

On-Computer Activities

1. Familiarize yourself completely with the **"Success with Writing"** Program.
2. Introduce students to **"Success with Writing"**. Model the procedure that students will be engaged in.
3. Some students may require visual cues as reminders during on-computer activities.
4. Now that the students have practised the prewriting strategy **"Idea Diagram"** with pencil and paper, they are ready to try the brainstorming/prewriting activities with the **"Success with Writing"** program disk.
5. Encourage students to use ideas generated during the pencil and paper activities. This provides LD students with the structure they require during idea generation

activities.

6. Monitor prewriting activities. Provide controlled support and practice. As part of effective modelling procedures, teachers verbalize steps during on-computer activities in the context of the writing process.
7. Encourage independent and small group use of computer activities. The teacher can gradually shift responsibility to students.
8. Reward students for small achievements!

Post-Computer Activities

1. Encourage students to use a prewriting strategy like the **"Idea Diagram"** during writing activities across the curriculum areas.
2. Encourage students to develop their own prewriting techniques. Allow and encourage students to share their ideas during classroom activities.

Instructional Plan #2

Educational Courseware Description

Courseware Program	Capitalization Plus
Curriculum Area	Language Arts
Topic	Writing Process (Mechanics)
Users	(Grades 4 and up)
Publisher	Mindscape
Copyright	1983

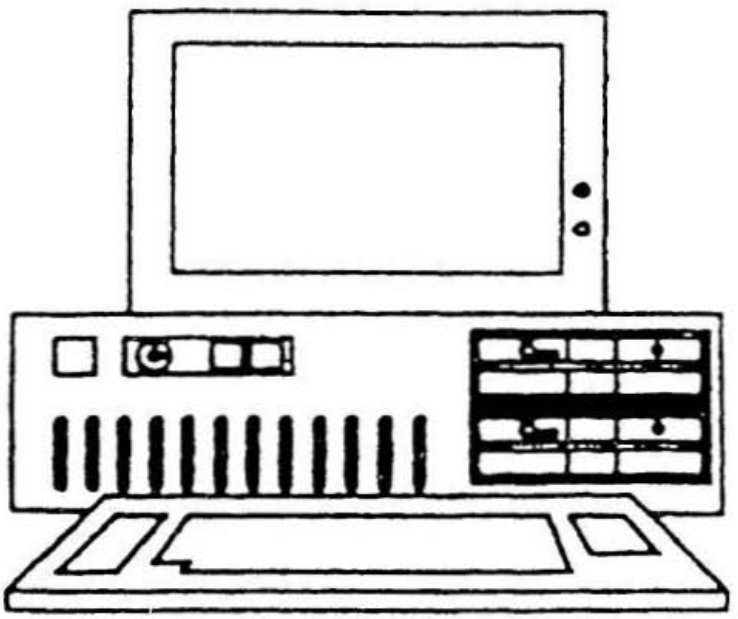
Courseware Description: This program is an easy to use, interactive, tutorial program designed to teach and/or reinforce the many uses of capitalization rules. Specifically, **"Capitalization Plus"** is designed to teach students 38 capitalization rules in a motivating format. Error analysis and personal feedback follow each problem providing the teacher and the student with an opportunity to identify areas of difficulty. A diagnostic test is a unique feature of this program, designed to pinpoint student weaknesses as well as providing a review of material. Results can be printed out at any time. **"Capitalization Plus"** is composed of five distinct components, four of which are designed specifically for student use. The fifth component provides the teacher with flexibility to edit the word lists. All directions for student use are clear, concise, and contained in the program. The Main Menu lists four components of the program for the student:

- **Study Rule**

- **Do Exercise**
- **Do Diagnostic Test**
- **Review Rules**

Package Contents

- Courseware Manual
- **"Capitalization Plus"** Program Disk
- Complementary Back-Up Program Disk



The Integration of "Capitalization Plus" into the Writing Process with LD Writers

Essential to the process oriented approach to writing instruction is that the teacher allows writing proficiency to develop naturally, providing corrective feedback and rules of the mechanical elements of grammar, spelling, punctuation, and capitalization as they are needed. Although many children who do not display writing problems learn to write naturally through daily exposure and practice (Whitt, Paul, & Reynolds, 1988), simply providing time for LD writers to write does not ensure an increased proficiency in written expression. Consequently, direct instruction and modelling certain aspects of the subprocesses of writing is needed to increase understanding and automatically of a particular concept.

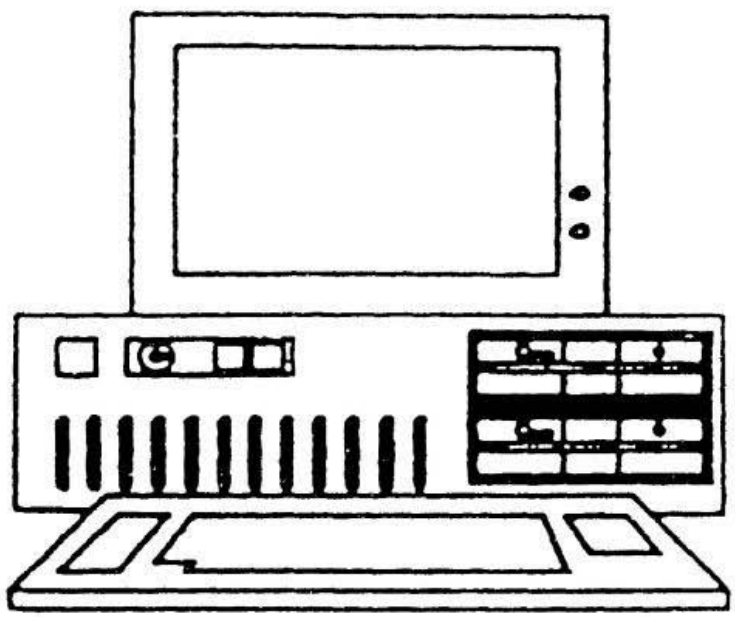
"Capitalization Plus" provides effective repetition of capitalization rules in a motivating format. This tutorial program can be particularly beneficial to LD students who often need supplementary instructional opportunities to gain understanding of mechanical subprocesses in writing.

Effective Instructional Activities

Courseware	Capitalization Plus
Courseware Type	Tutorial
Subject Area	Language Arts: The Writing Process
Specific Concept	Capitalization: Direct Quotations
Target Population	LD Writers: Elementary School Level
Teaching Objective:	To help student(s) understand the various capitalization rules in direct quotations through the assistance of the **"Capitalization Plus"** courseware program.
Instructional Approach:	Substantive, Procedural, and Direct (see discussion of these instructional approaches, pp. 242-244).
Machine Requirements:	Apple 11, 11+, 11e, 11c.
Materials Needed:	"Capitalization Plus" courseware and manual, the "COPS" editing strategy.
Time Required:	Variable, depending on age, skill level, group size, and individual learner characteristics.

Procedure: The integration of **"Capitalization Plus"** into effective instruction for LD writers is presented by means of the following instructional elements: pre-computer classroom activities, on-computer activities which

include tasks in connection with the computer, and post-computer activities which attempt to demonstrate transfer of knowledge gained from the instructional lesson.



Procedural Teaching Example

Pre-Computer Activities

1. Discuss and model for the student(s) the use of capitalization rules in direct quotations.
2. Provide visual examples on the board or on overhead projector using examples in relation to your own writing. Verbalize and use **THINK ALOUD** strategies during lesson.
3. Have student(s) practice using their own writing to ensure a meaningful, useful experience.
4. Introduce any instructions necessary for the efficient use of **"Capitalization Plus"**.
5. Provide on-computer instruction for students who require the supplementary instruction.

On-Computer Activities

1. Familiarize yourself completely with **"Capitalization Plus"** courseware.
2. Introduce to student(s) to **"Capitalization Plus"**. Model the loading process that student(s) will be engaged in.
3. Some students may require visual cues to assist with loading courseware and accessing specific parts of the program.
4. Model the sequence of steps involved in practice activities.
5. Student(s) will receive specific rules and practice

activities for the capitalization rules in direct quotations.

6. Encourage independent and small group use of courseware.
7. Reward students for small achievements!

Post-Computer Activities

1. Encourage students to use knowledge gained from computer activity during all writing activities when applicable.
2. Monitor writing assignments regularly to help determine if understanding of concept has been acquired.
3. Intrc uce **"COPS"**, a self-correcting strategy to assist students in proofreading their own writing after completion of a rough draft. A copy of this strategy is included in Appendix E.

Cops: Self Correcting Strategy

C - Capitalization Rules

O - Overall Appearance

P - Punctuation

S - Spelling

Instructional Plan #3

Educational Courseware Description

Courseware Program	Punctuation Put-On
Curriculum Area	Language Arts
Topic	Writing Process (Mechanics)
Users	(Grades 3 and up)
Publisher	Sunburst
Copyright	1984

Courseware Description: This innovative, easy to use language arts program in gamelike fashion places students in the writer's chair, making punctuation decisions based on meaning and placement within sentences. **"Punctuation Put-On"** is designed to offer the student a motivating format for enjoyable practice. This program also provides teachers with diagnostic support and the flexibility to use various options for individualizing instruction. The teacher documentation is concise, well organized, and provides some good suggestions for classroom implementation.

Package Contents

- Courseware Manual
- One Teacher Diskette
- Three Student Diskettes

The Integration of "Punctuation Put-On" into the Writing Process with LD Writers

It has been strongly suggested throughout the research literature that LD students demonstrate pervasive difficulties in mechanical and syntactical structures of written language (Poplin et al. 1980; Poteet, 1978). Moreover, it has been suggested that LD students exhibit slow rates in the acquisition in certain skills and concepts and that drill and practice courseware can provide the necessary practice that many LD students require in language arts (Goldman & Pelligrino, 1987).

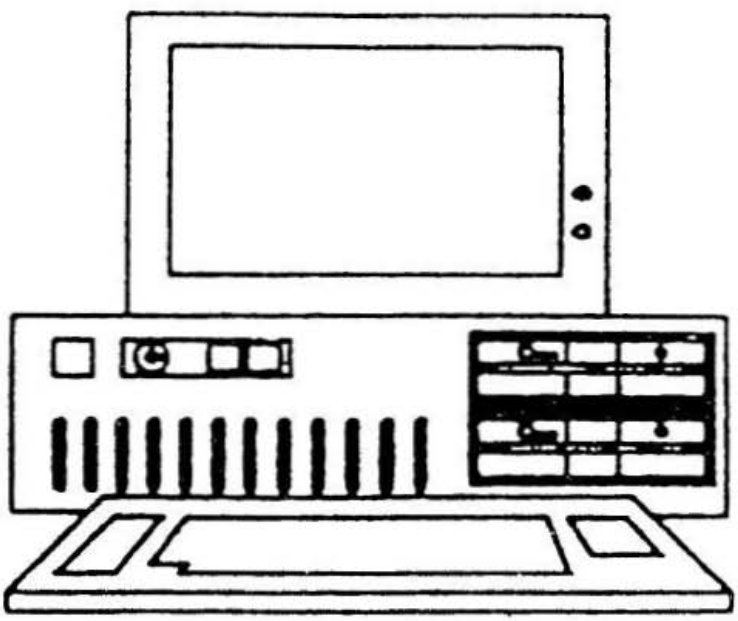
"Punctuation Put-On" provides effective practice of punctuation usage. This program is particularly useful for LD students who often require additional drill and practice opportunities to increase automaticity in this area.

Effective Instructional Activities

Courseware	Punctuation Put-On
Courseware Type	Drill and Practice
Subject Area	Language Arts: The Writing Process
Specific Concept	Punctuation Rules: Periods
Target Population	LD Writers: Elementary School Level
Teaching Objective:	To provide student(s) with an opportunity to practice punctuation skills to gain automaticity through the use of the **"Punctuation Put-On"** courseware program. In this specific lesson, students work with the use of periods.
Instructional Approach:	Substantive, Procedural, and Direct (see discussion on page 15).
Machine Requirements:	Apple 11, Apple 11GS, 128K IBM PC/PC jr.
Materials Needed:	**"Punctuation Put-On"** courseware and manual. The **"COPS"** self-correcting strategy
Time Required:	Variable, depending on age, skill level, group size, and individual learner characteristics.

Procedure: The integration of **"Punctuation Put-On"** into effective instruction for LD writers is

presented by means of the following instructional elements: pre-computer classroom activities, on-computer activities which include tasks in connection with the computer, and post-computer activities which attempt to demonstrate transfer of knowledge gained from the instructional lesson.



Procedural Teaching Example

Pre-Computer Activities

1. Discuss with the student(s) the use of periods in writing.
2. Use your own writing to model and provide examples on the board or an overhead projector. Verbalize and use **THINK ALOUD** strategies during lesson.
3. Have student(s) practice using their own writing to ensure a meaningful, useful experience.
4. Introduce any instructions necessary for the efficient use of the **"Punctuation Put-On"** courseware.
5. Provide on-computer instruction for students who may require additional practice.

On-Computer Activities

1. Familiarize yourself completely with **"Punctuation Put-On"** courseware.
2. Introduce the student(s) to **"Punctuation Put-On"**. Model the loading process that student(s) will be engaged in.
3. Provide visual cues to assist with loading procedures and program instructions.
4. Model the sequence of steps involved in the practice activities.
5. Encourage independent and small group use of software.
6. Reward student(s) for small achievements!

Post-Computer Activities

1. Encourage students to use knowledge gained from practice activities during all writing tasks in the classroom setting.
2. Monitor writing assignments regularly to determine if generalization from computer activity has occurred.
3. Introduce **"COPS"**, a self-correcting strategy to assist students in proofreading their own writing after completion of a rough draft. A copy of this strategy is included in Appendix E.

Cops: Self Correcting Strategy

C - Capitalization Rules

O - Overall Appearance

P - Punctuation

S - Spelling

Instructional Plan #4

Educational Courseware Description

Courseware Program	Kidwriter
Curriculum Area	Language Arts
Topic	Writing Process
Users	(Early Elementary and Up)
Publisher	Spinnaker
Copyright	1984

Courseware Description: This language arts program is a courseware package that provides students with the opportunity to create a colorful picture and write a story about that picture using the word processing functions of the program. The word processor allows student(s) to correct typing errors, erase and retype parts of the story, and insert new parts of the story. **"Kidwriter"** motivates students to write by making it fun. The program is designed to present easy to read letters, simple editing features, and a choice of 99 different characters and objects, that allow students to create their own picture settings. **"Kidwriter"** encourages creativity while introducing children to the basics of word processing. This is an easy to use, versatile piece of courseware designed for children to use with minimal supervision. Four special options allow the student to:

(M)ake a new picture-story
(L)oad an old picture-story
(D)irectory of picture-stories
(Q)uit for now

Package Contents

- Courseware Manual
- **"Kidwriter"** Program Disk

The Integration of "Kidwriter" into the Writing Process with LD Writers

Typically, learning disabled students have a difficult time getting off to a good start in writing and have experienced humiliation and failure in attempting to express themselves in written form. Children who experience difficulty with writing activities often blame themselves or their intelligence. Essential to the improvement in writing of LD students is the opportunity to engage in successful writing experiences in the early grades.

The **"Kidwriter"** writing assistance program allows students to illustrate, write, and edit their own stories in a creative way. The option to create an illustration before writing is particularly suited to many LD writers with artistic talent. In fact, drawing a picture prior to writing is an effective, motivating, prewriting strategy. The **"Kidwriter"** provides children with an opportunity to participate in this kind of activity.

Effective Instructional Activities

Courseware	Kidwriter
Courseware Type	Word Processing
Subject Area	Language Arts: The Writing Process
Specific Concept	Idea Generation
Target Population	LD Writers: Elementary School Level
Teaching Objectives:	To help students understand the prewriting stage of the writing process by introducing drawing and illustration in idea generation.
Instructional Approach:	Substantive & Procedural (see discussion on page 15).
Machine Requirements:	IBM PC compatible, IBM PS/2; Apple 11e, 11gs
Materials Needed:	**"Kidwriter"** courseware and manual
Time Required:	Variable, depending on age, skill level, group size and individual learner characteristics

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Procedure: The integration of **"Kidwriter"** into effective instruction for LD writers is presented by means of the following instructional elements: pre-computer classroom activities, on-computer activities which include tasks in connection with the computer, and post-computer activities which attempt to demonstrate transfer of knowledge gained from the instructional lesson.

Procedural Teaching Example

Pre-Computer Activities

1. Discuss and model for the student(s) the use of drawing and illustration as a prewriting activity.
2. Provide visual examples on the board or an overhead transparency using examples of your own drawing or a student's illustration.
3. Have the student(s) practice drawing as a prewriting activity.
4. Introduce any computer instructions necessary for the efficient use of the **"Kidwriter"** courseware.

On-Computer Activities

1. Familiarize yourself completely with the **"Kidwriter"** courseware.
2. Introduce the student(s) to the **"Kidwriter"** courseware. Model the loading process that students will be engaged in.
3. Some students may require visual cues to assist with loading courseware and accessing specific parts of the program.
4. Model the various options available in the **"Kidwriter"** program.
5. Encourage independent use of courseware.
6. Reward students for small achievements!

Post-Computer Activities

1. Encourage students to use drawing and illustration as a prewriting strategy during story writing activities.
2. Monitor story writing assignments regularly to determine if this strategy helps students to generate ideas while writing.

Contemporary Issues in the Microeducational Environment

It is clear that the new technology and increased use of classroom computers hold significant promises for learning-disabled students in both regular and special settings. However, the implementation of the microcomputer as an instructional tool for learning-disabled students is not a simple task. Sitko (1986) maintains "The most successful classroom applications of the computer are a direct function of the teacher's ability to determine how to best use the computer's capabilities in the context of the existing curriculum demands and diverse learning needs" (p. 436).

As a result of the current research in microcomputers in education and conversations with colleagues, the author of this resource guide acknowledges a variety of problematic issues related to effective microcomputer implementation. Specifically, three key areas of concern are: 1) the limited amount of quality courseware available to match individual needs of special learners, 2) the need for on-going research to evaluate the effectiveness of the microcomputer as an instructional tool for exceptional children, and 3) the availability of training and support in the instructional uses of the microcomputer. Furthermore, microcomputers in schools can be helpful but only if properly utilized. Given time and training, educators can use microcomputers to effectively

match the curriculum goals with the individual needs of the learner.

There continues to be a number of issues and concerns dealing with the successful implementation of microcomputers with exceptional students. Simms (1986) suggests, "Effective course offerings, inservice and extra service staff training to ensure our teachers utilize effectively a learning resource with proven teaching and learning potential" (p. 44). It is imperative that teachers be provided with adequate teacher training and resource support in order to achieve effective computer implementation in today's classrooms. This will assist in the necessary changes which need to occur towards the implementation of this progressive technology.

Finally, a collaborative effort amongst educators throughout the school will be necessary in planning appropriate computer instruction for special needs students. The atmosphere in a school must be such that educators support each other. Additionally, the administration must be committed to providing professional opportunities so educators can keep abreast of new developments in computer technology.

Closing Message

As educators continue to implement microcomputers into their classrooms, microcomputers can help teachers to make appropriate curriculum modifications and adaptations for students with learning disabilities. In 1979, Smith wrote "The needs of learning-disabled children are so great that demands of their teachers are very great, and they need solid support from their supervisor, principal, and the school administration in general" (p. 89).

The establishment of microcomputers in the classroom setting have enormous potential for expanding the instructional possibilities for LD writers. As we move into the 1990's and beyond, we can expect a continuous growth in classroom applications of microcomputers. Similarly, we can anticipate growing numbers of students with diverse learning needs integrated into the regular classroom setting. Consequently, educators must be prepared to utilize new approaches to instruction like the implementation of microtechnology presented in this resource guide. In doing so, we are attempting to meet the individual needs of our students.

While the author acknowledges that technological advancements, specifically, the establishment of microcomputers in the education of LD students, it is

recognized that computers cannot make a learning disability go away. However, if properly developed and carefully planned, these new technologies will play an important role in the lives of individuals who have learning disabilities. Furthermore, by preparing our children to become active participants in a microeducational environment, we are providing them with opportunities to reach potential with a sense of security and empowerment.

We as educators now have a responsibility to become computer literate, so we can assist our students in today's modern technological society. Educational institutions must be sure that future teachers are exposed to microcomputers and can use them competantly as an instructional tool in the school environment. It is the author's belief that using the computer to enhance or adapt instruction, can allow students with writing disabilities to participate more actively in the curriculum, and assist them in becoming an educated, independently functioning individual, in this modern technological age.

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APPENDIX A

Current Writing Terminology

Writing Glossary

Cognition	This is defined as the process of knowing. Thinking skills and processes are cognitive skills.
Cognitive Strategy	This is defined as any systematic sequence of processing activities that helps the learner regulate his/her cognitive behaviour.
Curriculum Modification	This is defined as the process of modifying or personalizing curriculum materials to match the individual needs of the learner.
Drafting	The process of transcribing ideas into visible language.
Dysgraphia	This is defined as impairment in spontaneous writing.
Editing	This is the process of preparing the written text to share with an audience. It involves making changes in the conventions of writing: spelling, punctuation, and capitalization.
Encoding	The process of translating thoughts and ideas into words or symbols.

Expressive Language This is defined as language that children produce, specifically, speaking and writing.

Expressive Writing This is defined as writing that derives from personal experience.

Linguistics This is defined as the scientific study of human language including its sounds, history, nature, structure, etc.

Metacognition This is defined as the ability and awareness needed to perform a task effectively.

Mnemonic Devices This is defined as methods and strategies to assist memory.

Prewriting Prewriting is the systematic planning phase of writing. It involves deciding on a purpose; idea generation and narrowing a topic; establishing an audience; developing a format and organizational plan; and experimenting with ideas on paper.

Process Approach to Writing	This is defined as a holistic approach to writing instruction considered to be consistent with the whole language philosophy. Students are taught to view language as an interactive recursive process involving planning, drafting, revising and editing and sharing and publication.
Revising	The process of reviewing the content, expanding ideas, and reorganizing structure of writing to make improvements in the written product.
Semantics	This is defined as a linguistic term referring to the meaning system in language.
Semantic Quality	This includes elements of the written product which relate to meaning (i.e., coherence, sequence and logical organization of ideas, use of idioms, etc.).

Syntactic Quality This includes elements of the written product which relates to the grammatical components of writing (i.e., subject-verb agreement, punctuation, etc.).

Whole Language The whole language philosophy stresses that the language processes of reading, writing, listening, and speaking are interrelated and assist children in making sense of the world around them.

Writing Conventions This is defined as the common writing elements that influence the quality of a piece of writing. These elements include: spelling, punctuation, correct word usage, and handwriting.

APPENDIX B

General Guidelines for Selecting Effective Curriculum Support Courseware

Guidelines for Selecting Effective Curriculum Support Courseware

For learning disabled children, the educational potential of microcomputers is now being examined throughout educational research literature. Today's educators are beginning to realize that computers can provide opportunities for enhancing learning with learning disabled children.

Using microcomputers for classroom instructional purposes requires careful consideration and planning that teachers would give to any new instructional strategy or innovation. A difficult step in this process is in the selection of instructicnally sound educational courseware to match learner characteristics. Following are a number of suggestions for choosing effective curriculum support courseware for special needs learners as suggested by Hannaford and Sloane, 1981.

1) **INSTRUCTIONAL USEFULNESS OF COURSEWARE**. Educators must determine the educational usefulness of any new materials before considering curriculum integration. The instructional usefulness of courseware is usually determined by: a) how well the courseware matches the individual needs of the learner, b) how well the courseware fits into the curriculum, and c) compatibility with the teachers instructional style, goals, and organization of classroom environment.

2) **INSTRUCTIONAL DESIGN ADEQUACY**. For microcomputer

courseware to be utilized effectively for instructional purposes, teachers must give consideration to a number of elements of instructional design. Several instructional design factors include:

a) The courseware should be guided by specific goals and objectives.

b) The option for assessing student level performance and "branching" features to a learners ability level should be present.

c) The visual presentation of material should be considered (i.e.; size and clarity of letters and other visual representations, amount of material presented on the screen at one time, appropriate reading level).

d) Is the courseware of appropriate length of the learner?

e) Can the learner control the pace and speed of the program?

f) Does the courseware allow a teacher to tailor and modify instructional content to meet individual learner needs?

g) What type of response feedback does the courseware provide?

3) **TECHNICAL ADEQUACY**. Another important consideration in the selection of curriculum support courseware deals with the technical adequacy and ease of use. Some questions

educators need to ask are:

a) Will the courseware work the particular microcomputer being used?

b) Is the courseware programmed to use the particular capabilities of the microcomputer being used? (i.e., color graphics, sound, peripheral devices such as light pens, printers, voice synthesizers, etc.).

c) Are visual graphics displayed appropriately with as little clutter as possible?

d) Does the courseware contain supplementary material for post computer activities?

e) Consider how the material is packaged?

Microcomputer Courseware Evaluation Guidelines for Teachers of Students with Learning Disabilities

Lee (1987) presented several essential components to consider when selecting and evaluating curriculum courseware for learning disabled students. They include:

1. Directions the students must read should be simple enough as not to interfere with the students' comprehension.
2. The courseware must provide alternate means of presenting the same concept if students do not comprehend the first presentation (recasting).
3. The screen must be uncluttered.
4. Students should be able to operate the progra· with minimal keyboard skills.
5. The program must provide praise/feedback regarding the correctness or incorrectness of responses.
6. The courseware must provide adequate opportunities for students to review concepts.
7. The courseware must teach very basic skills that nonhandicapped students would learn incidentally (p. 437).

Following, are two examples of the many available evaluation forms designed to assist teachers in the selection and evaluation of curriculum support courseware.

FORM #1
Evaluation Form for Microcomputer Software

Learner/Teacher	YES	NO
1. Does the program reach the target population for which it was designed?		
2. Will the program motivate the students to learn?		
3. Is the content relevant to the instructional needs of the students?		
4. Will the material be effective with individual learning styles?		
5. Does the format appeal to the students?		
6. Is the material relevant experiences?		

Instructional Integrity	YES	NO
1. Does the program state behavioral/ instructional objectives?		
2. Is the teaching/learning mode identified (drill and practice, diagnosis, tutorial, simulation, inquiry, game, problem solving)?		
3. Is the program organized and presented in a sequential manner and in appropriate developmental steps?		
4. Is the material presented at a concrete level and in a variety of ways?		
5. Is the content presented clearly?		
6. Does the program use a multi-sensory approach?		
7. Are the use of graphics, sound, and color appropriate?		
8. Does the program provide meaningful interaction for the students?		
9. Does the program provide for user self-pacing?		
10. Does the material require the purchase of accompanying printed material, or is it self-sufficient?		
11. Does the material prescribe to a number of sources or just the publisher's own materials?		
12. Does the material provide direct instruction?		
13. Does the material provide immediate feedback?		
14. Does the material provide a variety of built-in reinforcements?		
15. Does the program offer supplementary materials or suggested activities for reinforcement?		
16. Does the content use past learning or experimental background?		

	YES	NO
17. Is the material presented on a meaningful and appropriate language level?	—	—
18. Is the required reading presented at the students' level of functioning?	—	—
19. Does the program provide "flexible" branching so the content and reading levels meet the needs of individual student levels?	—	—
20. Does the program allow the student adequate time to complete learning segments?	—	—
21. Is the program designed to alert the teacher to a student who is experiencing difficulty with the content?	—	—
22. Does the material meet race, sex, and cultural distributions of the student population?	—	—

Technical Adequacy and Utility	YES	NO
1. Are the teacher's instructions well organized, useful, and easy to understand?	—	—
2. Does the material require extensive preparation or training on the teacher's part?	—	—
3. Is the material of high quality?	—	—
4. Is the material re-usable?	—	—
5. Is the material durable for repeated and prolonged use?	—	—
6. Is the size of the print clear and well spaced?	—	—
7. Does the speed of presentation match individual learning styles?	—	—
8. Does the student need typing skills to use the program?	—	—
9. Is it "kid-proof?"	—	—
10. Can a student use the program without supervision?	—	—
11. Is a printout of student performance available, if desired?	—	—
12. Is the initial cost of this non-consumable material reasonable?	—	—
13. Is the program packaged so that it can be easily and safely stored?	—	—
14. Can the program be used in a regular classroom, resource room, media center, agency, or institution?	—	—
15. Does the publisher provide a policy for replacement of parts?	—	—
16. Does the publisher provide for preview and/or demonstration of the program?	—	—
17. Has the publisher produced the program so that it is available for use on at least two different models of microcomputer hardware?	—	—

Hannaford & Sloane (1981)

Form 2

Computer Software Evaluation
R.C. School Board for St. John's,
Draft

Software Title: _____

Publisher: _____

Instructional Strategy: (please check)

Tool [ ] Drill & Practice [ ] Tutorial [ ] Simulation [ ]

Other (specify): _____

Subject Area(s): _____

Topic(s) Covered: _____

_____

Grade Level(s): _____

Is the program educationally valuable to you? Why? _____

_____

_____

Describe how the program could be integrated into the curriculum. _____

_____

_____

To what extent is the student an active participant in the program? _____

_____

_____

Describe the quality of the graphics, colour and sound. _____

_____

_____

Does the program offer an approach to teaching/learning which is otherwise not available? To what extent does the program offer something unique? _____

_____

_____

Please describe any advantages or disadvantages you foresee in using this program with your students.

_____

_____

Would you recommend this software program to other teachers? _____

_____

Bill Jameson (1990)

APPENDIX C

List of Publications, Organizations, and Courseware

List of Publications

The following is a list of recommended sources for obtaining practical information concerning educational courseware for students with diverse learning abilities.

Alberta Education Response Center

6240-113 Street

Edmonton, Alberta T6H 3L2

Title: Computer Courseware for Special Education, Volume 1

Cost: Free

Description: A practical guide containing information for teachers of special needs students. This guide contains courseware reviews, and practical ideas for the integration of courseware into the curriculum.

Closing the Gap

Box 68, Henderson, MN 56044 USA

Cost: $41.00 (US funds)

Description: A widely recognized bi-monthly newsletter featuring all aspects of microtechnology for the disabled.

Computers in Education

Moorehead Publications Ltd.

1300 Don Mills Road

North York, ON M3B 3M8

Cost: $25.00 per year

Description: A magazine of practical ideas, features, reports, and reviews of hardware and software use in education.

The Computing Teacher

International Council for Computers in Education

University of Oregon

1778 Agate Street

Eugene, OR 97403 USA

Cost: $28.50 (U.S. Funds)

Description: An internationally distributed journal providing articles and reviews on many aspects of using microcomputers in education. Published nine times a year.

Exceptional Children

Council for Exceptional Children

1920 Association Dr.

Reston, VA 22091 USA

Cost: $30.00 (US funds without membership to CEC)

Description: A monthly journal featuring articles on the use of microtechnology with special needs students.

The Exceptional Parent

Psy-Ed Corporation

605 Commonwealth Ave.

Boston, MA 02215 USA

Cost: $18.00 (US funds)

Description: A bi-monthly publication featuring regular articles on the use of technology with special needs children.

Focus on Exceptional Children

Love Publishing Co.

1777 S. Bellaire St.

Denver, CO 80222 USA

Cost: $18.00 (US funds)

Description: A monthly journal (except summer); featuring articles on microcomputers and exceptional children.

IBM National Support Center for Persons with Disabilities

3500 Steeles Avenue East

Markham, Ontario L3R 2Z1

Cost: Free

Description: The National Support Center responds to requests for information on how microcomputers can assist individuals with impairments affecting learning, mobility, vision, hearing and speech.

Toll free Number: 1-800-465-1234

Internet

Department of Computing and Communications

Henrietta Harvey Building

Memorial University of Newfoundland

Elizabeth Avenue

St. John's, Newfoundland

A1C 5S7

Description: An on-line, world-wide international network, primarily used by college/university educators, researchers and libraries, but with increasing use by K-12 educators. The Internet communications network links people, information, archives, databases, and libraries.

National Support Centre for Persons with Disabilities

Department 31/270

3500 Steeles Avenue East

Markham, Ontario

Toll Free: 1-800-465-1234

Cost: Free

Description: The National Support Centre responds to requests for information on how microtechnology can assist people with various disabilities. Information is provided in well designed resource guides for the following disabilities: Speech/Language, Vision, Hearing, and Learning Disabilities.

Journal of Learning Disabilities

The Professional Press, Inc.

11 East Adams St. Ste 1209

Chicago, Il 60611 USA

Cost: $50 (US funds)

Description: A monthly journal (except summer); features a section on technology in each issue.

Journal of Special Education Technology

Managing Editor

Exceptional Child Centre, UMC 60

Utah State University, Logan, UT 84322 USA

Cost: Included in membership in Technology and Media Division, Council for Exceptional Children.

Description: An internationally distributed journal featuring research-oriented articles in the education of special needs students.

Microcomputer Science Centre Inc.

5220 Bradco Blvd.

Mississauga, Ontario L4W 1G7

Description: The Microcomputer Science Centre carries a complete line of educational support services to respond to the computer needs of disabled individuals. A team of professionals provide sales, service and training in technology including special support with various types of disabilities.

Only the Best

Education News Service

P.O. Box 1789, Carmichael, CA 95609 USA

Cost: $27.95 (US funds)

Description: An annual guide to the highest-rated educational software/multimedia for preschool-grade 12.

STEM-Net

Contact: Mr. Harvey Weir
G.A. Hickman Building
Memorial University of Newfoundland
St. John's, Newfoundland
A1B 3X8

Description: A wide-area computer communications network for K-12 and college educators in Newfoundland and Labrador. Services that will be made available to users include: electronic mail, general information bulletin boards, access to a range of on-line general library and database resources, and access to the Internet (a world-wide database network). STEM-Net will be available to users in the fall of 1993. An excellent resource.

Teaching and Computers

Scholastic, Inc.

730 Broadway

New York, NY 10003 USA

Cost: $19.95 (US funds)

Description: An educational publication that features practical information for using the computer in the classroom setting. Teaching and Computers is issued eight months/year.

Technological Horizons in Education (THE)

Information Synergy

2626 S. Pullman

Santa Ana, CA 92705 USA

Cost: Free

Description: A publication that features software and hardware updates and announcements for planning computer implementation in education. (THE) is issued 10 months/year.

Windows on Technology

Ontario Ministry of Community and Social Services

880 Bay St., Toronto, Ontario M7A 1E9

Description: A bi-monthly newsletter of information on technology for the disabled.

Organizations and Resources

The following list includes a number of sources for obtaining information concerning hardware and courseware for special needs students.

Center for Special Education Technology Information Exchange

1920 Association Drive

Reston, Virginia 22091

Description: This centre carries and exchanges information about using technology with special needs students.

CPR Software

P.O. Box 431

Brantford, Ont. N3T 5N3

FAX: 519-752-8168

Description: CPR Software carries a complete line of educational software for computer using teachers. A well recognized educational resource!

Educational Resources

3911 Victoria Avenue

P.O. Box 644

Vineland, Ont. L0R 5C0

FAX 416-562-7992

Description: Educational Resources is an educational clearinghouse that carries an extensive line of educational resources for computer using teachers. Excellent resource!

ECOO (Educational Computing Organization of Ontario)

The Ontario Institute for Studies in Education

252 Bloor Street West

Toronto, Ontario M5S 1V6

Description: This organization carries a complete line of educational support services about using technology in the education of children and youth.

The Learning Disabilities Association of Canada

323 Chapel Street

Ottawa, Ontario K1N 7Z2

Description: The main objective of the learning Disabilities Association of Canada is to promote better understanding and services to individuals with learning disabilities. An excellent resource for both parents and educators.

Learning Disabled Students and Computers: A Teacher's Guide

International Council for Computers in Education

135 Education

University of Oregon

Eugene, OR 97403 USA

Description: This guide presents special and regular educators with information for planning computer implementation with learning disabled students.

McGill University: Centre for Continuing Education

Distance Education

Faculty of Education,

McGill University

3700 McTavish Street

Montreal, Quebec H3A 1Y2

519-398-7043

Description: McGill University distance education programme presently offers a number of specialized courses in educational computing. The courses are based on educational software for three computer systems, the Apple II family, the Macintosh family and the MS-DOS family.

Toronto PET Users Group (TPUG)

1912A Avenue Road, Suite #1

Toronto, Ontario M5A 4A1

Description: Members have access to the club's extensive library of computer programs for all Commodore computers.

Recommended Courseware for Learning Disabled Writers

Currently there is a paucity of courseware development for the learning disabled. However, there exists a variety of courseware programs found to be effective in the instruction of learning disabled students. A number of courseware programs recommended for use with learning disabled students specific to writing are listed below.

Educational Courseware List

	COURSEWARE	PUBLISHER
I.	**Keyboarding Skills**	
1.	Success with Typing	Scholastic
2.	Microtype: Wonderful World of Paws	Scholastic
3.	Typing Tutor III	Scholastic
II.	**Word Processing**	
4.	Bank Street Writer III	Broderbound Software
5.	Magic Slate	Sunburst Communications
6.	Milliken Word Processor	Milliken Publishing Co.

7.	Talking Text Writer/Speller	Scholastic

III. **Language Arts**

8.	Capitalization Plus	Mindscape
9.	Grammar Problems: Pronouns, Verbs	Milliken
10.	Kidwriter	Spinaker
11.	Magic Spells	Scholastic
12.	Master Spell	MECC
13.	Punctuation Put-On	Sunburst
14.	Sentence Combining	Milliken
15.	Spell It!	Davidson and Associates
16.	S--p-e-l-l: The Reading/ Writing Connection	Sunburst
17.	That's My Story	Learning Well
18.	The Story Tree	Scholastic
19.	Story Machine	Spinaker
20.	Student Stories	Mecc
21.	Success with Writing	Scholastic

APPENDIX D

Glossary of Computer Terms

Glossary of Computer Terms

Application Programs designed to instruct the computer to perform various tasks, such as word processing.

Boot The process of loading the operating system into the main memory so the computer can begin to operate.

Branching A programming feature which sends the user to another part of the program for enrichment or remediation purposes.

Courseware Software designed for educational purposes.

Disk A storage device with a magnetic coating surface for storage information.

Disk Drive A device needed to run disks.

Graphics Pad A flat surface capable of sensing the position of a writing apparatus, finger, light pen, etc., and communicating this information to the computer.

Joy Stick An input device which allows the user to move in various directions causing a corresponding movement of things on the screen.

Keyboard An input device resembling a typewriter; includes extra keys for special purposes.

Light Pen An input device that allows the user to enter information by drawing on the screen.

Monitor A television-like device that displays visual information.

Mouse An input device connected to the computer that can be moved across a desktop by hand to control the cursor movement.

Peripheral Devices used for communicating with the computer which adds extra features to what the computer can do.

Printer An output device that provides the user with a paper copy of their information.

Public Domain Software Programs that can be freely copied and distributed.

Simulation A CAI program which allows the user to experience a particular situation and determine a course of action.

Switch An input device which allows the user to operate a computer without a keyboard.

Touch Screen An input device composed of horizontal and vertical wires that can transmit information to the computer.

APPENDIX E

Metacognitive Strategies

NOTE: The Metacognitive Strategies in this section can be found in Spelt: A Strategies Program for Effective Learning and Thinking. Cognitive Education Project. The University of Alberta, 1986.

(COPS: SELF-CORRECTING STRATEGY*)

Description of Strategy

C -- Are the first words in each sentence as well as the proper names capitalized?

O -- How is the overall appearance and readability? (i.e., spacing, legibility, indentation of paragraphs, neatness, complete sentences ...)

P -- Is the punctuation correct? (i.e., , . : ; ! ?)

S -- Are all the words spelled correctly?

Students read a composition four times; each time for the purpose of checking the specific aspect of the piece as represented by letters **C O P S**.

Editing Rules**

The following editing rules could be used as the passage is being **"COPS"** ed:

Misspelled words;
Incorrect punctuation and capitalization;
Parts that don't sound right;
Insert either a word, phrase or sentence;
Reorder sentences or paragraphs.

Suggested Application

1. For proofreading students' own writing after completion of a rough draft.
2. For students checking of each others work before handing in assignment.
3. For checking group work after each draft.

4. For proofreading essay exam questions.

---

*An adaptation of KU-IRLD strategy
**Written Language Project, University of Arizona, Department of Special Education

C - Capitalization

O - Overall Appearance

P - Punctuation

S - Spelling

Teaching Example

1. After students have written a rough draft of a paragraph or essay, have them exchange work in order to **"COPS"** each other's compositions.
2. Rather than you, the teacher, correcting work, hand it back uncorrected for the students to **"COPS"**. This activity could be used as an initial teaching approach in order to illustrate to the students the effectiveness of the **"COPS"** strategy.
3. A modification of the previous procedure would be to mark a paragraph or composition before returning it to the students to **"COPS"**. Mark the work again after the students have used the **"COPS"** strategy of self correction. They then can compare their marks to easily see the usefulness of the strategy.

Modification/Extension Strategy

THE IDEA DIAGRAM

The **"Idea Diagram"** is particularly suited for use before writing, as a brainstorming technique. Encourage students to write down all their ideas in any order.

A framework in which to organize attributes will guide student's observations and provide the basis of an outline from which to write.

An attribute guide for describing an object*

Objects to be described _____

Color:

Shape:

Size:

Height, breadth

Weight:

Texture:

Temperature:

State of motion:

Speed, evenness, relationship to other things

Aroma:

Taste:

*Alley, G., & Deshler, D., 1979

Suggested Application

This strategy could be used for report writing using multiple sources; for note-taking, for the writing of compositions, or for providing a framework for studying.

A similar framework could be provided to organize the students information, thoughts and actions, in social settings, as an aid for anticipating the different behaviours required in a variety of social contexts. (See following page).

Teaching Example

Have the students fill out an outline for a report on a famous person. They can then be shown how to write <u>two</u> reports from the same outline; one in chronological order; one in the order of 'most important contribution of person' to 'least important contribution'.

Social Application

Just as the 'Idea Diagram' is suited for brainstorming before writing, so can it be used to structure the brainstorming for ideas before a new social situation arises, or to aid analysis of a social situation after the fact. <u>Before</u> use relates to issues such as thinking about and preparing for new situations, sequencing behaviour, discussion of possible outcomes of behaviour, etc. <u>After</u> use aids social analysis in order to formulate future other options/behaviour

leading to new and better consequence. The "Idea Diagram" could also help to sequence the priority order of dealing with social problems listed.

IDEA DIAGRAM

Name: _____

Date: _____

TOPIC:

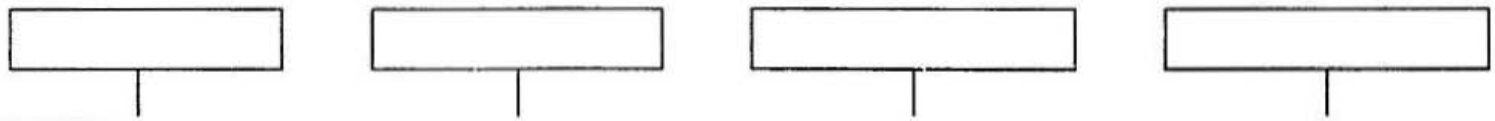
INTRODUCTION:

_____

_____

_____

SUBTOPICS:



DETAILS:

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

_____ _____ _____ _____

CONCLUSION:

_____

_____