IMPROVING MILDLY AND MODERATELY INTELLECTUALLY HANDICAPPED SECONDARY STUDENTS' REVISING SKILLS: WORD PROCESSORS AND THE WRITING MILIEU

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Research of the past decade has gradually moved from a reliance on a technocentric perspective to a view informed by the interaction of technology with the culture in which it exists. The current research examines the development of a supportive "writing milieu" which harnesses the motivation generated by the use of word processors while incorporating complementary instructional techniques including process-oriented writing, peer proofreading and elements of the data-based instruction approach. A multiple-baseline across subjects time-series design was chosen for the study of two intact secondary classes for students with mild intellectual handicap in separate rural centres. Pilot and main study results have shown that exceptional students can decrease error rates in stories and letters produced on the word processor as a first step toward more qualitative improvements while exhibiting positive attitudes toward writing with computers.

Identification of the Problem

In recent years computers and computer applications have become common in almost every aspect of life in Australia as in most other parts of the world. The state and territory educational systems have also participated in the widespread introduction of computers at all levels and have benefited from the application of computer technology to various needs within the context of Australian education. The word processing capability of microcomputer software received early recognition and has been increasingly applied, in recent years, in an attempt to address the diverse problems of groups within the educational system having difficulty with the writing task. Results of investigations centering on the learning disabled, mildly and moderately intellectually handicapped, and young novice writers in the mainstream have been largely inconclusive concerning the improvement of written products resulting from word processing. However, increases in writer motivation and the length of word processed compositions have been tentatively supported by the research literature. Although there seems some justification for a degree of optimism concerning word processing and its potential for addressing the writing problems of special need populations, the use of word processing alone, despite recent hardware and software advances, has not met many earlier expectations.

In recent decades, educational research concerning the writer's

task has identified effective instructional interventions which offer significant assistance towards addressing the problems of exceptional students. The process-oriented approach to writing encompasses many elements which act to nurture the development of competency in this area.

Data-based instructional methods, which highlight specific elements of the teaching and learning process, have also proven effective in modifying academic and behavioural outcomes for exceptional students and may provide an additional avenue for the treatment of their needs as novice writers.

Investigations into supportive contexts for writing have identified other related and salient elements concerning mainstream and special need populations and the composing process including the importance of peer collaboration, student ownership of the writing process, the significant relationship between time allocation, the writing task and the product, and the importance of rereading during the composition process itself. Additional instructional recommendations for teaching writing to exceptional students, which can be used in conjunction with word processing, concern allocation of ample writing opportunities, the assignment of practical writing tasks serving real purposes, and the provision of authentic audiences for written products (Graham, 1982).

The process-oriented approach, data-based instruction, and results stemming from investigations into the general domain of literacy and exceptional students, have been applied, individually and in a variety of combinations, with some success, to the problem of generally enhancing the writing of such students. However, the problem continues to remain one of significantly reducing a massive number of mechanical errors as a fundamental first step towards a more qualitative improvement of the written product. Without an effective means of reducing such errors, the cyclical process of rereading and

revision cannot be effectively commenced and the resulting teacher-dependency will continue to disenfranchise the writer concerning ownership, defeating motivation, limiting the time and effort devoted to the writing process by the student, and severely curtailing the individual attainment of literacy and the ability to communicate with fellow students and other members of society.

The current research aimed at investigating the effect of word processor use within a supportive writing milieu on the written products of secondary students with mild intellectual handicap.

The present investigation stems from an early call by Bridwell, Nancarrow and Ross (1984) for systematic study of the ways in which word processors can be used to meet the needs of writers. The initial call for the "principled use" of the power of word processors has been followed by others (Lieber & Semmel, 1985; MacArthur, 1988; Rieth, Bahr, Polsgrove,

Okolo & Eckert, 1987). Hawisher, following her review of 42 related studies, noted that the research base for investigations into word processing applications had gradually moved from one centering on a technocentric perspective "to a view informed by the interaction of technology with the culture in which it exists" (1989: 63-64).

The main problems examined within the investigative premise as outlined above, were related to the effects of intelligence, learning, and setting on the subject's ability to reduce the number of mechanical-level errors in written products.

Review of the Literature

Microcomputer and associated software technology has become an important feature of modern society in recent decades and has provided a new challenge to education in the preparation of children for a place in that society.

If children with moderate to mild learning difficulties, by far the largest group with special educational needs, are to take their place as adults in an increasingly computerised society, it is essential that they become more familiar with this new technology (Clark, 1986). This need has been variously addressed by the introduction of a wide range of computer hardware and associated software into special schools, segregated support classes and integrated resource withdrawal schemes giving special needs students access to this new technology. One of the major uses of the microcomputer in these services has been associated with word processing. In recent years many claims have been made for word processing and the gains made in the writing ability of students using such software.

Much of the research concerning writing and word processing has centred on young children in the normal mainstream (Fler, 1987; Ollila, 1987; Porter, 1986, 1987; Zurn, 1988), the learning disabled (Arms, 1984; Cassady, 1985; Graham & MacArthur, 1988; Kerchner & Kistinger, 1984; Neuman & Morocco, 1985; Poteet, 1980) or university level subjects (Rodrigues, 1985; Sommers, 1980). The current research will focus on the mildly and moderately handicapped as well as the related groups of young, novice writers in the mainstream and the learning disabled.

Relevant studies of learning disabled and mainstream students show that, despite the many advantages claimed for the word processor and the resulting positive effects on childrens' writing, little definitive evidence is available to support such conclusions. Murray (1987) in his study of reluctant writers, was able to report only subjective and survey-based claims for word processors and benefits to students' writing including increased output, pride in work, concern for content, enthusiasm, confidence, revision of text and collaboration. Zurn (1988) found clear differences in handwritten and word processed writing

samples taken from three kindergarten classes. The word processed samples had more words used, more different words used, and contained more complete thoughts or T-Units than the handwritten samples. At the same time, however, no differences were found between samples on a holistic rating that evaluated the child's overall writing stage development. In her evaluation of a programme in computing for the severely learning disabled Collis (1988) found very few instances of differences in writing. No particular pattern of computer work was found to be mechanically better than paper and pencil work, nor were there any differences reported in the complexity and length of comparison texts, or revision strategies employed in the sample compositions.

There are many other theories of writing concerning younger subjects which may relate to students with mild handicaps at the centre of the present study. Rodrigues (1985) theorises that word

processing and programmes that deal with the the whole writing process may help to develop recursive strategies of more proficient writers but doubts that younger writers are sufficiently able to independently shift attention readily between writing and revising. Others offer suggestions regarding the thinking process involved in the revision of text, and the absence of qualitative revision when it is attempted (Collins & Gentner, 1980; Sommers, 1980; Bridwell, 1980). The inability of the child to put aside privileged knowledge, or that which is only available to the writer, is highlighted by Barlett (1982). Even when sensitised to this recurring problem in writing, children seem unable to correct it successfully. As in the case of novice mainstream writers, older exceptional students may also be unable to put aside privileged knowledge and independently shift attention readily between writing and revising tasks.

Word processing, like typing, can become a routine skill for some, but for young children, and possibly older students of limited intellectual ability operating near capacity, the 'additional burden' of managing the commands and environment of word processing, may lead to a decrement in performance (Parr, 1987). The apparent physical help afforded by the use of word processing in the writing process may not, then, necessarily aid the writing process with some populations. On the other hand, work by Scardamalia, Bereiter and Goelman (1983) suggests that the mechanical demands of word processing and the physical act of writing have only a weak effect, if any, on the higher level processes of writing. It is also suggested that memory loss during these various 'demands' is not a predominant factor influencing the content of children's writing. The difference of the findings may be due to potentially confounding variables concerning the effects of computers in the writing classroom (Parr, 1987).

To date, research findings concerning the younger child and the use of word processing for writing improvement, indicate that there are a number of areas requiring further investigation as they relate to the older

exceptional student. The revision process of detection, identification and correction used by middle primary school children in research by Bartlett (1982), global text changes beyond quantitative text revisions (Parr, 1987), consideration of audience perspective and the presentation of privileged knowledge in writing samples (Crowhurst & Piche, 1979; Kroll, 1978), and the findings relating to the demands word processing environments make on young writers, may all have direct implications concerning the design of intervention strategies to enhance the written products of older students with mild intellectual handicap as a first step towards more qualitative changes.

In contrast to the research on word processing and mainstream novice and learning disabled writers, there has been some limited recent research concerning the use of word processors with students having mild intellectual handicap (Doyle & Race, 1987; Philhouser, 1985; Rieth et al., 1987; Vacc, 1987). One study found that adolescent exceptional students did spend significantly more time, made more revisions, and produced longer letters when writing on a microcomputer (Vacc, 1987). Holistic evaluations of letter quality, however, did not differ significantly between the handwritten and microcomputer production modes. Vacc (1987) also found that the mean number of words written per unit of time spent completing a letter was substantially higher for subjects' handwritten letters.

In the Doyle and Race (1987) study focusing on students in a special school setting, earlier research claims for increased production, interest and motivation were supported, however, text revision had not been shown to be a 'realistic possibility'. Touch typing instruction had been a feature of this study and it was found that this skill was not generally transferred to the word processor. Definitive statements about the effects of word processing on the quality of students' written work were not offered due to an expressed need for further analysis. In their review of effective instruction with microcomputers, Ellis and Sabornie (1986) concluded that the promise of word processors in relation to improving writing ability was compelling but yet to be fulfilled and that, although preliminary studies in the area suggested that the use of this latest writing tool did not necessarily improve writing skills, specific instruction in the skills broadly associated with making maximum use of word processors is clearly needed with exceptional students.

Studies of mainstream population samples and the few concerning special populations have highlighted the inconclusive nature of the research to date. While affective benefits to students and quantitative product increases have been shown to result from the use of word processors within writing environments, contradictory findings do not allow similar conclusions to be made concerning improved quality of written products. Assumptions about the educational benefits of microcomputers need to be examined further and more precise research is needed for the efficient application of microcomputers in the classroom (Vacc, 1987). Graham & MacArthur (1988) indicated the appropriateness of further research to

investigate a possible link between increased quantity and improved quality of the written

product in their study of students with learning disabilities. Their research also indicated that some form of strategy training concerning text revision is an essential component of programmes implemented to improve the written products of exceptional students.

A review of the literature devoted to, both word processing and strategy instruction, leading to improvements in revision techniques and ultimately the written product, comes much closer to the focus of the proposed research. Information and recommendations concerning the process-oriented approach to writing, and related information concerning a wide variety of strategies to improve the revision process for more effective writing, are abundantly available in the literature (Bos, 1988; Clark, 1985; Silverman, Zigmond, Zimmerman & Vallecorsa, 1981; Snyder, 1987). Although empirical support for the process-oriented approach is limited, such an approach may be especially suitable for students with handicaps since use of this approach may help reduce cognitive strain by taking complex problems in the writing process and breaking them down into smaller sub-problems (Graham, 1982). Addressing the revision process may be one missing element which, when combined with word processors and other interventions, lays the foundation for sustained writing improvements. The critical importance of the revision process in effective writing has, in fact, been noted in the literature and attributed to Hayes and Flower (1980) and demonstrated by Schumaker et al. (1982) using strategy instruction as a means of improving the detection and correction of mechanical errors during text revision.

Although early research mainly looked at the writing products of proficient writers, later studies examined the actual process of writing and are worth noting in relation to older exceptional students. The processes used by younger children while they were engaged in writing were investigated by Graves (1973), while stages in the development of writing and spelling abilities were noted in later studies (Calkins, 1983; Gentry, 1981; Graves, 1982). Three components of the revision process, detection, identification, and correction were identified by Bartlett (1982) in his study of primary level students. Such studies would seem to bear more directly on investigations into improving the writing process and product of exceptional students.

Research concerning the process writing approach, the writing processes and characteristics of young mainstream students, the learning disabled and older exceptional students, and the relationship between the use of word processors and increases in both student motivation and the volume of written work (Gardner, 1986; Murray, 1987; Outhred, 1987; Vacc, 1987), indicates the likelihood of qualitatively improving written products

if the above mentioned elements can be combined into an effective whole. Investigations into, and informed comment upon, instructional milieus where word processors are combined with other essential elements or interventions to actualise the inherent potential of the situation, are evident in the literature (Graham & MacArthur,1988; MacArthur & Graham, 1987). The conclusion reached would seem to indicate that microcomputer use is but one aspect of an ecology that includes teachers, students and the general learning environment (Lieber & Semmel, 1985; Snyder, 1987). Porter (1987) and Chu (1988) have called for further research is in this general area.

An additional essential element of effective instructional milieus which enhance the writing process for exceptional students may include the establishment of a 'writing community' where the introduction of the computer helps to create an environment in which mistakes or failures are expected as an initial step in the learning process and where peer discussion, tutoring and collaboration interactions focus on the learning process in a student-centred, rather than teacher-directed, way (Bork, 1986; Sandery, 1986; Sherwood, 1988).

The complementary advantages of word processors and writing strategies to improve revision practices may be organised into an effective programme using data-based instruction and assessment procedures and guidelines provided by Blankenship and Lilly (1981) to foster initial, qualitative writing changes. Instructional procedures or interventions are based on results from frequent assessment practices which provide exceptional students with a constant flow of information on the level of their performance in relation to a predetermined goal (Deno, 1985; Fuchs & Fuchs, 1986; Jones & Krouse, 1988). The importance of this type of instructional feedback is highlighted by the role that it plays in convincing exceptional students, not only of the necessity of active participation in the individual learning process, but also the necessity of assuming control of the learning situation (Brown, 1980; Reid & Hresko, 1981). It has been shown that feedback on the positive aspects of a student's composition can have a facilitative effect on writing performance (Beaven, 1977; Jones & Krouse, 1988).

Use of the data-based approach may provide a sequential and graduated approach to the attainment of early qualitative improvements in the writing products of older students with mild intellectual handicap as a first step toward later and more complex qualitative changes.
5.

Method

Design

The multiple-baseline across subjects time-series design as discussed by Vasta (1979) and Tawney and Gast (1984), and as utilised by Graham and MacArthur (1988) in their study of self-instructional strategy training and the learning disabled, was employed in the current study and can be seen in Figure 1. The subjects of the study were randomly ordered

concerning their entry into the experimental condition or intervention phase of the study. Each Ss served as his/her own control, entering the treatment phase at staggered intervals to help control for possible confounding external effects. Results from continuous assessment measures, outlined in the procedures section of the proposal, during the baseline and intervention phases were used as a basis for drawing inferences about the effectiveness of the intervention treatment package. Recommendations as set forth by Blankenship and Lilly (1981) were used as a guide concerning the application of the continuous assessment measures.

O1 O2 O3 O4 O5 X O6 O7 O8 O9 O10

O1 O2 O3 O4 O5 X O6 O7 O8 O9 O10

Figure 1. Multiple-baseline across subjects time-series design.

The multiple-baseline design is a time-series technique which is often employed when treatment interventions result in 'nonreversible effects' or when the researcher is moved, by educational and ethical considerations, to continue desirable improvements in student behaviour and not to reverse the experimental variable, even temporarily, as in the ABAB design (Vasta, 1979). The rationale behind this research approach involves the staggered introduction of the treatment variable, rather than the presention and removal of the same variable, as a demonstration of a functional relationship between the independent and dependent variables. A functional relationship may be demonstrated using such designs if changes in student writing behaviour repeatedly correspond with the presentation of the experimental 'package' during the intervention phase of the design. Finally such designs are particularly helpful to researchers vitally concerned with upholding the ethical standards for research with children as developed by The Society for Research in Child Development (Vasta, 1979).

The independent variables are the experimental and control conditions defined as:

(exp) Use of word processors and the process-oriented writing approach, within a framework of additional specific instructional interventions, including peer-proofreading and the provision of student feedback resulting from frequent assessment of written products, based on individual student goals as a support for the writing process

(control) Use of word processors alone during the writing process

The dependent variables were identified as the individual and group mechanical error levels as shown by results of continuous assessment measures described in the procedures section.

Subjects and Setting

The study was conducted in two intact I.M. classes located in two state secondary schools in separate regional centres within the Central Western region of New South Wales. Twenty students with ages ranging from 12.9 to 16.4 years at the outset of the study took part in the research programme. The sample was comprised of thirteen males and seven females including fourteen students identified as having mild intellectual disabilities, four students having moderate intellectual needs and two special placement students with other learning disabilities. IQ scores for the sample were based on the WISC-R and fell within the ranges stipulated for special class placement. The sample included five students of aboriginal extraction. The research subjects predominately belonged to the mid-to-low SES group.

A written pupil survey revealed that all students had had some experience with word processors and microcomputers ranging from a few months experience to five years or more. Four students stated that the computer was available to them at home with games and word processing noted as the most popular uses. The surveys indicated that all students felt they could word process to some extent.

All core subjects were taught by the teacher with the assistance of a teacher's aide at both settings. The English, reading, spelling, language and writing programmes were examined and found to be similar. Most composition work focused on isolated skill remediation with some creative writing assigned occasionally. Writing task feedback was given to students in the form of grades and errors were commonly noted by the teacher for student attention. Neither class used word processors as a part of the writing programme. It was concluded that the within-class instructional content would act as a control variable in the study in relation to the experimental writing programme.

Special class students attended practical subjects such as woodworking and home science on an integrated basis. Although integration was extended to half-days for four students at one setting approximately half-way through the current study, this did not significantly affect the conditions as set forth for the study.

Experimental Procedures, Instrumentation and Data Collection

At the commencement of the 1991 school year all members of the I.M. support classes participated in the study as a normal part of their educational programmes.

Ss participating in the study were randomly assigned a commencement date for their introduction to the intervention phase of the research design following the baseline phase. During the baseline phase, students were initially familiarised with word processing procedures and then asked to write stories on subjects of interest to them during set periods of the cyclical school timetable. Instructions were standardised for all students. Stories were collected upon completion and evaluated using an adaptation of the Goodman, Casciato and Price (1987) Error Analysis Worksheet to determine, not only word and error totals, but also an-error-per word or error rate (ER) total. An emphasis on mechanical error detection and correction may be warranted when considering the magnitude of the problem for students with mild handicaps (Bridwell, 1980; Sedlack & Cartwright, 1972).

A list of decisions made during a pilot study in 1990, as advised by the GCP analysis authors, was compiled to ensure marking consistency when filling in the GCP Error Analysis Worksheet. This list of decisions included decision-making rules and other guides to further ensure consistency. A standardised set of simple proofreader marks devised by Tompkins and Friend (1988) were adapted and used when marking written products. Credentials for using such an assessment device were established by Moran (1987) in her review of the options for written language assessment. A more comprehensive written language assessment inventory of errors was rejected in favour of the more limited Goodman, Casciato and Price analysis worksheet, due to the major drawbacks associated with lengthly pre-printed inventories, including the increased time taken to analyse each written product and assumptions of levels of sophistication in writing skills that do not exist for many students with mild handicaps. In addition, most errors occurring in the writing samples of this group fell within relatively few categories as compared with the numerous possibilities presented in the pre-printed inventories (Goodman, Casciato & Price, 1987).

No student feedback relating to the content of student written products was forthcoming from the researcher, teachers or teachers' aides for any of the Ss during the baseline period. Teachers did not provide assistance with the writing of individual stories and this policy was adhered to throughout the intervention phase of the study. Appeals for help were routinely redirected back to the individual student during the baseline phase or towards peers during the intervention phase. Teachers recognised appropriate on-task behaviour and redirected inappropriate behaviour according to standard school rules and welfare policies. During both phases of the study the data collected on individual story error-per-word totals was graphed for each student. Students received copies of their graphed data only during the intevention phase. Graduated individual ER goals were assigned following the production of at least five baseline written products however these goals only became known to the participating Ss during the intervention phase. Such goals were established during the baseline phase by assessing the error-per-word totals of story samples from

mainstream classes.

Mainstream classes were chosen by the head of the school English department as the most likely placement for integration candidates from the I.M. class, and therefore provided the source for the compilation of information leading to the discovery of the necessary criteria for success in the 'next environment' - the English mainstream - for I.M. student hopefuls. Using standardised procedures, students of the nominated mainstream classes were asked, by their teacher, to write an essay on an issue of personal concern or interest. The students were allowed to write for as long as they chose and were not interrupted by the teacher during the writing session of approximately fifty minutes. Access to the school computer room word processors was not provided for the exercise since mainstream classes normally do not have continuous access to school computers for daily class assignments. The absense of a word processing component was also in keeping with the concept of a valid 'next environment' concerning the provision of student writing goals. I.M. students integrated full-time into the mainstream would be expected to complete the majority of their daily work without the use of word processors. The procedures outlined above, followed those appropriate to the data-based instruction approach (Blankenship & Lilly, 1981).

Subjects entering the intervention phase received standardised group instructions on peer-proofreading techniques using the same simplified set of mechanical error marks as employed by the researcher when analysing student written products and as set forth by Tompkins and Friend (1988). Students were also given an individual story organiser which outlined the composing and proofreading process of the treatment programme and acted as an essential motivational element within the intervention.

Student organiser worksheets directed individual students to write a story or letter on the word processor after an individual planning period. Upon completing the first draft students selected a peer for the proofreading process initially focussing on revision for meaning. Subsequent proofreading sessions on later drafts focused on mechanical errors including spelling, certain forms of punctuation, and word choice. Before each proofreading session, both writer and proofreader were reminded to look for certain categories of mechanical errors based on the needs demonstrated by the draft at hand as assessed by the researcher. Upon completion of the third draft students were asked to quietly reread the story to locate any further errors in order to optimise the chances of meeting the individual ER goal previously established for the individual student. Each step, listed on the story organiser, was signed by a teacher upon completion enabling the student to keep track of the process over often extended writing periods. The final draft was then handed in for analysis and determination of the student's ER total for the story. This total was then entered on the student's graph by either the student or the

teacher. The story was then returned to the student for final corrections before publication. Students were allowed to negotiate with the teacher concerning the number of corrections to be made at this stage consistent with the student-centred nature of the intervention programme and supportive writing milieus. A list of words, derived from misspelled story words, was also given to the student for study and later testing.

Verbal recognition was given to writers and their proofreaders who were collectively successful in meeting the individual's ER goals. Stamp and "writing expert" charts were used for recognition and organisational purposes while story sharing sessions and individual publishing books were also added later to further develop the writing milieu. A journal and quick reference sheet were also kept by the researcher during the course of the study to record necessary organisational and developmental details as a further check on the experimental processes and procedures.

Pre and post-intervention student surveys, based on those used in a 1990 pilot study, were administered to document affective research results and provide material which may be important concerning the control of history. A record documenting individual choices of proofreader peers was also kept in addition to the administration of two sociograms at the beginning and at the end of the writing programme to provide further data on peer proofreader choices in order to highlight an important element in the total process of mechanical error reduction within the supportive writing context.

Analysis

There were 20 subjects represented in the final analyses of the data. Table 1 shows the means and standard deviations for each testing occasion on the dependent variable. The dependent variable was the ability to revise written work at the mechanical error level as expressed by error rate. The first five baseline or pre-intervention measures and first five post intervention measures for each subject were used to determine means. The table shows the means of the dependent variable by site and for the whole group.

Table 1

MEANS AND STANDARD DEVIATIONS FOR SCORES OF ALL SUBJECTS ON THE DEPENDENT VARIABLE

Variable	Site	X	o	N
Baseline 1	1	2.700	.857	9
	2	2.600	.884	11
For entire sample		2.645	.851	20

Baseline 2	1	2.456	.903	9
	2	2.691	.622	11
For entire sample		2.585	.749	20
Baseline 3	1	2.656	1.068	9
	2	2.873	.794	11
For entire sample		2.775	.908	20
Baseline 4	1	2.456	.795	9
	2	2.791	.565	11
For entire sample		2.640	.681	20
Baseline 5	1	3.189	1.658	9
	2	2.682	.708	11
For entire sample		2.910	1.220	20
Intervention 1	1	7.700	4.806	9
	2	5.164	2.615	11
For entire sample		6.305	3.873	20
Intervention 2	1	6.344	2.152	9
	2	5.045	2.412	11
For entire sample		5.630	2.335	20
Intervention 3	1	8.389	6.358	9
	2	8.182	6.392	11
For entire sample		8.275	6.208	20
Intervention 4	1	8.489	4.579	9
	2	9.764	10.391	11
For entire sample		9.190	8.129	20
Intervention 5	1	10.300	4.523	9
	2	5.982	1.993	11
For entire sample		7.925	3.945	20

The data were investigated in four distinct phases. At the initial

level, the sample data were analysed using stem and leafplot, Skewness, Kurtosis, and boxplot procedures. These were conducted to determine if the dependent variables were multivariately normally distributed. Two of the post intervention variables contained suspicious outliers which were further investigated using the extensive test procedures available in the SPSS MANOVA procedure. These included the Bartlett and Cochran homogeneity of variance tests. The intial suspicions were confirmed regarding the two post intervention variables which were subsequently excluded from all further analyses. All other dependent variables met the criteria for entry into the MANOVA.

At the second level of analysis, data from the two settings were examined to determine differences using IQ as the covariate for both a before effect using the baseline data on all five occasions, and an after effect using data from the three measures taken during the intervention. The

rationale for this level of analysis was based on the hypothesis that IQ might be a factor important to the modification of the dependent variable scores. IQ was initially investigated to reveal if there was a difference between the sites. The summary of the analysis of variance for IQ by site is shown in
Table 2.

TABLE 2

SUMMARY OF ANALYSIS OF VARIANCE FOR IQ BY SITE

Source of Variation	SS	DF	MS	F	Sig of F
Main Effects	766.578	1	766.578	4.596	.046
Site	766.578	1	766.578	4.596	.046
Explained	766.578	1	766.578	4.596	.046
Residual	3002.222	18	166.790		
Total	3768.800	19	198.358		

The summary of the analysis of variance reveals that IQ had a marginal effect ($p < .046$). A MANCOVA was then conducted using the baseline measures with IQ as the covariate to determine the differences made by intelligence on the dependent variable by site. The details appear in Table

3. No significant differences by site were found for the baseline measures with IQ as the covariate. The procedure was repeated subsituting post intervention for baseline measures. The results for the analysis appear in Table 3. Again no differences were found between sites for the dependent variable with IQ as the covariate.

TABLE 3

SUMMARY OF MANCOVA FOR IQ BY SITE

Source of Variation	SS	DF	MS	F	Sig of F	p
Baseline						
Within Subjects						
Within Cells	19.29	72	.27			
Before	1.65	4	.41	1.54	.199	n.s.
Site by Before	2.35	4	.59	2.20	.078	n.s.
Post Intervention						
Within Subjects						
Within Cells	1004.36	36	27.90			
Post	75.26	2	37.63	1.35	.272	n.s.
Site by post	36.54	2	18.27	.65	.526	n.s.

The summary of the multivariate analysis of variance for IQ by site reveals no significant differences between the two settings on the pre-intervention or the post intervention measures using IQ as the covariate. As a result the variable of site was dropped for the third level of analysis.

The analysis at the next level examined the combined data from the two settings to ascertain the learning effect for the baseline phase with IQ as the covariate (MANCOVA) using polynomial contrast. The details appear in Table 4. The findings showed that there was no significant learning effect during the baseline phase of the study.

The analysis then examined the combined data from the two settings to ascertain the learning effect for the post intervention phase with IQ as the covariate (MANCOVA) using polynomial contrast. The details appear in Table 4. The findings showed that there was no significant learning effect, linear or quadratic, during the post intervention phase of the study.

TABLE 4

SUMMARY OF MANCOVA FOR LEARNING EFFECTS WITH IQ

Source of Variation	SS	DF	MS	F	Sig of F	p
Baseline						
Within Subjects						
Within Cells	21.65	76	.28			
Diff	1.38	4	.34	1.21	.313	n.s.
Post Intervention						
Within Subjects						
Within Cells	1040.90	38	27.39			
Post	86.94	2	43.47	1.59	.218	n.s.

At the final level of analysis, a MANOVA was applied to the baseline and post intervention means with IQ for the combined settings. A summary of the analysis at this level appears in Table 5. This summary reveals a highly significant main effect ($p < .001$).

TABLE 5

MANOVA FOR PRE-INTERVENTION AND POST INTERVENTION MEANS WITH IQ

Source of Variation	SS	DF	MS	F	Sig of F
Within Subjects					
Within Cells		1278.86	19	67.31	
Post	1043.46	1	1043.46	15.50	.001

Discussion

The mean error rate scores of subjects were divided on the basis of pre-intervention and post intervention measures of written work on self-selected topics. Written products were composed during a programme of intervention which incorporated the use of word processors within an environment containing specific elements supportive of the writing process. Significant differences were found between word processed compositions produced during the baseline conditions and those resulting from the intervention programme. This finding suggests the introduction of word processing alone will not adequately cater for the composition needs of students with mild intellectual handicap. Although increases may reasonably be expected to occur in a quantitative sense as well as improvements in student attitudes, teachers may fail to optimise learning unless the motivational power of word processors is focused within an enviroment which also recognises the importance of recognition, contingent and frequent feedback, student-mediation of the learning task, authentic purposes for writing, and learning processes involving peers in collaborative and cooperative efforts. The establishment of such conditions may reasonably be expected to stimulate task engagement and increase student productivity thereby laying the groundwork for writing improvements of a more qualitative nature.

The importance of motivation for secondary "eleventh hour" students with mild intellectual handicap cannot be overstated. The significant findings of the study relating to the ability of students to reduce mechanical error rate levels may be attributed to a large extent to the motivation of participants, yet the lack of significant differences between the two settings points to further implications for special education teachers. The behaviour programme, instituted at the smaller of the two settings on the basis of its perceived success at the larger of the two settings during the initial phase of the study, enabled the researcher to establish baseline conditions at both settings. The significance of

this action lies in the fact that the pre-intervention conditions did not offer the participating students any of the essential elements of the supportive writing community including student-mediated learning, frequent and contingent feedback, and authentic purposes for writing. Many of the subjects of the current study had behavioural difficulties in addition to their intellectual needs, and their persistence through the largely unrewarding baseline phase may be due in large part to a programme which focused on rewarding appropriate behaviour while providing purposeful consequences for more inappropriate behaviour.

The significant findings stemming from the current investigation also highlight the importance of addressing the mechanical error level as an initial step towards more qualitative writing improvements. One finding during the intervention programme revealed the absence of a distinct demarcation between mechanical error correction and more qualitative improvements. Contingent instruction which attempted to address punctuation

concerns also addressed qualitative aspects of sentence writing, while attention to spelling invariably led to an examination of vocabulary choice. In this way, it might also be said that higher order thinking skills such as memory perception, logic, problem solving and cognitive monitoring were being developed through word processing and the process of composition within the intervention writing programme.

Higher level revision through recognition of audience was also made possible during the latter sessions of the workshops with the introduction of letter writing. The re-enactment of student expository-type compositions during contingent instruction lessons and story sharing sessions also provided vehicles for establishing a sense of audience in the writers of the present investigation.

Written product assessment which is diagnostic and aimed at providing specific information to students to enable them to meet proximal and distal goals requires the establishment of valid goals. Such goals are determined by a comprehensive evaluation of the "next environment" for students with special needs. A review of the literature highlighted the importance of establishing goals and providing diagnostic feedback on a contingent basis for students about to terminate their formal education at the secondary level.

An additional advantage of an approach to microcomputers which moves away from a technocentric perspective to one which places the computer in the role of the moderator or dependent variable, may be the eventual realisation of many expectations raised in the early and mid 1980s concerning the advantages word processing could offer hetereogeneous groups within the educational system.

The current findings may also help address the need expressed in the literature for appropriate research into the process writing approach. Two main points of interest resulted from the investigation in this respect. Firstly, the delimitation of the complex task of composition for students with mild intellectual handicaps stemming from the use of the process approach, should offer encouragement to special education practitioners contemplating the task of intiating composition instruction with exceptional students. Secondly, as a result of the present study, the process writing approach and the recursive nature of the revision process, may also be seen to be complementary rather than mutually exclusive, addressing concerns expressed by Rodrigues (1985) relating to the inability of young writers, and possibly those with mild intellectual handicap, to independently and readily shift attention between writing and revising.

The findings of the present study may help to dispel practitioner concerns that the quality of childrens' compositions will be adversely affected by the demands made on them especially as they attempt to cope with the word processing application (Philhower, 1985). The participating students in the research study, seemed to have had little difficulty with software commands and hardware functions and when problems were

encountered, peers were able to lend assistance reinforcing task engagement and cooperation within the writing community.

An important implication of the current research for teachers investigating the advantages of introducing word processors into writing classrooms is related to the screen and hard copy text clarity which closely approximates the font styles and standard formats of print material within the normal range of reading and instructional textbooks. Observations recorded during the writing programme revealed that students were beginning to question their spelling approximations on the computer monitor screen. Students perceiving "dissonance" may have experienced a mismatch with an internalised model developed over years of exposure to text in books, on television, and through other forms of print media.

The finding that intelligence did not significantly affect the learning outcomes experienced by students participating in the current study implies that the successful introduction of a supportive writing environment which incorporates the use of word processors is not contingent upon the intelligence of the intended group members. Students assigned to the lower and medium functioning groups as well as high functioning pupils made significant gains during the course of the programme intervention.

A related finding, that of the nonsignificant effect of learning over time during the intervention phase, is cause for concern. Although the findings were very significant concerning the change in student revising behaviour, the absence of progressive learning over time may be due to the brief nature of the intervention. An implication of this aspect of the study relates to the length of the writing programmes introduced into secondary classes for students with mild intellectual handicap. It may be necessary to extend the programme and the diagnostic monitoring of written products, well beyond the five occasions reported for the current study. Such an extension may reveal patterns of behaviour more characteristic of individual students and groups, including indications of learning over time beyond the immediate effects of the intervention writing programme.

The nonsignificant differences between the settings may imply that the differences originally thought to distinguish between the two research groups, were less important than the conditions subsequently established for the creation of a supportive writing community. Placement of computer networks within special needs classes, while offering more flexibility in lesson programming and providing a variety of motivational advantages, is not necessary when establishing milieus for writing as long as students continue to have access to the materials and techniques empowering them to become engaged in their own learning process wherever the location of the network. Similarly, the scheduling of workshop sessions may take many forms including single sessions on a daily basis or multiple block sessions on fewer days per week. The essential concept is the importance of frequent student exposure to the purposeful activity of contexts for writing where

requests for help are redirected back to the abundant resources of the individual and the collaborative group in a student-centered way.

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