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EFFECT OF COMPUTER ASSISTED INSTRUCTION
ON WRITTEN EXPRESSIVE LANGUAGE OF MILDLY
MENTALLY RETARDED STUDENTS

by
Vicki R. Newman

A Thesis
Submitted in partial fulfillment of the
requirements of the Master of Arts Degree in the
Graduate Division of Rowan College
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Approved by

Date Approved April 24, 1995

Effect on Written Expression

ABSTRACT

The effects of computer assisted instruction on the written expressive language of mildly mentally retarded students was investigated. The quality of written work samples produced using paper and pencil was determined and compared to the quality of the expressive language samples produced on the computer after computer assisted instruction was implemented. Attitude toward writing with both modes of expression was measured. The results indicated that computer assisted instruction improved the quality of written expressive language in the areas of product length, legibility and mechanical construction. It did not significantly improve the content, complexity or thematic maturity of ideas produced on the computer after instruction. The findings are not congruent with the general theory that computer assisted instruction broadly improves written expressive products of mildly mentally retarded youngsters. However, teacher research does support the position that computer assisted instruction improves composition length, legibility and mechanical construction.

MINI-ABSTRACT

Vicki R. Newman

Effect of Computer Assisted Instruction
on the Written Expressive Language of
Mildly Mentally Retarded Students

1995

Thesis Advisor: Dr. Stanley Urban
Learning Disabilities

When the writing samples of Mildly Mentally Retarded students were compared before and after computer assisted instruction, some positive changes were seen in the areas of length of composition; mechanical skill levels [capitalization and punctuation] and legibility. No consistent data supported growth in the areas of composition quality, defined as composition content, organizational structure/vocabulary or thematic maturity. Careful acknowledgement of the limitation of the research project must be considered.

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CHAPTER 1

The Problem

Among the factors contributing to the lack of academic success of students with mild mental retardation [MMR] is delayed language development. Oral and written expressive language development is closely associated with intellectual development. This reflects the higher occurrence of delayed oral language development {Dunn, 1973}, restricted vocabulary, and incorrect grammatical usage {Spradlin, 1968} exhibited by Educable Mentally Retarded {EMR} children. Deficits in expressive language skills may be one of the greatest barriers MMR youngsters need to overcome if they are to become integrated into society.

The current movement toward inclusion of classified students into regular education classes highlights the need for MMR children to become more independent and attain higher functioning in their written expressive abilities. The focus on technology has allowed new avenues for educating all students. These factors impact on the need to effectively use a broad range of methods of educating MMR students and addressing their special educational needs.

The literature supports the use of computers in elementary education programs in fostering the development of written language expression. Learning disabled students who spend five

to seven hours per week in tutorial or resource room settings working on writing are reluctant to write. They believe that they lack the skills needed for writing or feel they have nothing to say (Poplin, 1980; Lerner, 1976). Value of the study will be useful to regular education and special education teachers in facilitating instruction in written language expression and increasing the written expressive abilities in MMR youngsters so that they can become productive adults integrated within a gainful society.

The Purpose

Throughout this research paper the children classified as EMR {Educable Mentally Retarded} or MMR {Mild Mental Retardation} will refer to the same population. The purpose of this study is to compare the written expressive language of EMR children before and after instruction in personal computer keyboarding skills. In other words, a traditional method of teaching written expression will be contrasted with a computer assisted approach in order to examine, document and compare the process of teaching writing, pupil attitudes about writing, and the quality of the products of writing before and after instruction in computer keyboarding.

Research Questions

1. Will special needs students who are classified EMR produce superior written language products after being instructed in the use of a personal computer?

2. What benefit, if any, will be shown by using a personal computer as a tool in written language instruction, rather than traditional paper and pencil written language instruction?

3. Will attitudes toward writing change?

This hypothesis will be restated in testable form in Chapter 3.

Overview

The study describes the role of the computer in teaching written communication skills to EMR youngsters as compared to teaching expressive language skills through a traditional paper and pencil writing process methodology.

Relevant literature will be reviewed in Chapter 2 in order to present the current status of Computer Assisted Instruction (CAI) when used as a tool to improve written communication for special needs children.

The design of the research study will be presented in Chapter 3 describing the test measures used, testable hypotheses, and analysis of the findings. Attitudinal variables that emerge as critical used during the project will be discussed as to how they impacted on the child's writing process.

Chapter 4 presents analysis of the research findings which emerge through the gathering and analyzing of the data. Both negative and positive evidence will be presented and discussed, along with interpretation of the results. The

summary and conclusions will comprise the fifth chapter integrating the findings of the study with the hypothesis stated in Chapter 1. Implications for future research will be considered in this final section.

The paper presents the results of a 6 month study of a sample population consisting of 12 classified EMR students in a self-contained suburban New Jersey public school. The whole class will be exposed to the training on the computer and will use the same computer software tutorial to learn writing process skills. Writing performance will be assessed before and after the computer software program is taught.

Limitations

There were few studies found that provided information on the use of computer instruction used to improve the writing ability of children classified as mildly mentally handicapped {EMR/MMR}. Therefore, limitations of this study include: lack of published research in this area; the size of the sample included in this study; limited demographic diversity; the significance of cognitive deficits that interfere with learning; the relatively short time frame of six months during which writing samples were collected and the common concern with the effect of subjectivity when scoring writing samples.

CHAPTER 2

Review of the Literature

Background

The most widely accepted definition of mental retardation developed by the Association on Mental Retardation {AAMR} was incorporated into PL 94-142, becoming the accepted legal definition at the federal level. Mental retardation is viewed in terms of three factors which include the following:

1. Intellectual functioning or conglomerated learning abilities, operationally determined by performance on an intelligence test, must yield a score below 70-75 on a standardized IQ test.

2. Adaptive behavior, the degree to and efficiency with which the individual meets standards of maturation and personal independence must be below expected standards for his age level.

3. Age of onset must occur during the developmental period between conception and 18 years of age.

Below-average intellectual functioning must occur concurrently with below level adaptive behavior in order to be classified as MMR\EMR. Clinical judgement is necessary to classify a child with an IQ score above 70-75 as MMR if there is concurrent below level adaptive behavior, {Haring & McCormick, 1990}. This addition to the MMR\EMR classification

criteria has effected the number and severity of students currently being classified in this categorical grouping {McLoughlin & Lewis, 1990}.

One of the areas of academic function impacted by mild mental retardation is written language. Writing draws upon many skills and cognitive processes {Scardamalia & Bereiter, 1986}. Learning Disabled students score significantly lower than normally achieving students on a variety of written language tasks {Graham & MacArthur, 1987}. The written products of Learning Disabled students show deficits in low-level skills such as handwriting, spelling, grammar and punctuation as well as more substantive areas of content generation, organization of text and quality of revision.

Research reporting results of MMR\EMR students using computers to enhance their written expression is limited. This may be a reflection of the variety of functional deficits that are exhibited by MMR\EMR youngsters. Mildly handicapped students including students with MMR\EMR may have deficits in one or more of the following areas:

- . Attention including hyperactivity and distractibility.
- . Memory including memory search, short-term and long-term use of efficient memory strategies.
- . Intellectual abilities: general deficits in intellectual functioning for MMR\EMR students.
- . Metacognitive and cognitive processing difficulties are cited as difficult areas for MMR children, {Case, Harris

& Graham, 1992}.

- . Language including receptive and expressive language problems frequently are experienced.
- . Social behavioral characteristics including disruptive behavior, social withdrawal, social aggression and poor interpersonal skills.
- . Affective or motivational factors related to achievement.
- . Basic academic skills including basic reading, writing, spelling and math skills.
- . Study/organizational skills, {Case et al.,1992}.

The most critical area for EMR students is communication. The components of language are: semantics, phonology, morphology, syntax and pragmatics.

Semantics relates to content problems. Meaning of words that are categorized according to function. Children may have problems with conceptualization and formulating ideas about objects, actions, events or relationships. A child with this problem may take longer to respond and may have trouble retrieving or recalling a word. He may be able to participate in classroom discussion, but have no response when called upon.

Phonology refers to form. One may have difficulty learning the language code and linking it to the environment. Phonology relates sounds and sound combinations to letters in various positions within words. If phonics is used as the main teaching strategy the child may be inhibited in his

progress because he is unable to make the sound/symbol match needed to understand and process vocabulary words in context or in isolation.

Morphology relates to word meaning and is a problem of language form. A morpheme is the smallest unit of language that has meaning. A child may not understand the rules for word formation or the language code as it is tied to his known environment.

Syntax refers to the framework or structure of the language. If the basic subject, verb, object pattern of language is not understood, the child may have difficulty understanding the meaning of written words. Students with problems processing syntactical structure may use only simple sentences and show less creativity in written expression.

Pragmatics is another component, falling under the subgroup of problems in use of language. It refers to using language correctly in social situations. The student who has a problem in this area may not be able to adapt his speech or written performance to the listener or reader's needs. He does not stay on the topic and has difficulty interpreting oral or written language cues. These mild to profound deficits in language usage, structure, meaning and pragmatics interfere with their already impaired intellectual functioning.

Therefore, developing receptive and expressive language skills is the foremost educational concern in meeting curriculum criteria and stated Individual Education Plan goals

for classified youngsters. The language of the MMR\EMR child may be non-coherent or exhibit pervasive broken thought patterns; show inappropriate responses; omit prefixes and suffixes, exhibit difficulty with retelling stories or sentences and show little generalization when transferring learned tasks to other situations. His failure to use prior experiences to learn in new situations impacts on his ability to use written expressive language.

Research Findings

When reviewing the literature, findings were restricted by the limited availability of studies designating MMR\EMR students as the sample population included when teaching or enhancing written language with the use of computers. Research reveals a general consensus that using computers for word processing greatly benefits learning disabled students [Fuchs & Fuchs, 1989; MacArthur & Shneiderman 1988; Morocco & Neuman, 1985].

Larter {1987} stated the lack of facility in expressing ideas through writing is probably the most common disability of the language skills. Writing requires many related abilities, such as the ability to read, spell, write legibly, and knowledge of the rules of written usage. Learning disabled students have significant problems in communication through writing {Englehert et al., 1988}.

Studies suggest that word processing makes it easier to correct, revise and rewrite a text. For many learning-disabled

students, word processing creates an opportunity to write without worrying about handwriting and to revise easily. The writer can add, correct, delete, revise and freely experiment {Lerner, 1988}.

Vacc {1987} found letters of adolescent mildly mentally handicapped {MMH} students composed on a microcomputer were longer than those written by hand. Students spent more time engaged in writing when using a computer than writing letters by hand. The mean number of words written per unit of time spent completing a letter was substantially higher for subjects handwritten letters; However, judges' holistic evaluations of letter quality did not differ significantly between the production modes.

One study on word processing and reading found improvement in the quantity as well as quality of writing and improvement in reading {Rust, 1986}. There is evidence that when students use computers, they write longer language experience stories and make more revisions {Dudley-Maring, 1985; Grabe and Grabe, 1985; Anderson-Inman, 1986}.

Informal review of their writing with paper and pencil revealed less spontaneity in producing writing samples {MacArthur and Schneiderman, 1988}. Kane {1983} found that students composed more text using a word processor than with pencil and paper. They also revised their writing more, both to change the organization and to modify individual words, phrases and sentences. Daiute and her colleagues {Daiute et

al., 1983} conducted a study with junior high students working with a word processor that provided prompts and suggestions for revision. She reported that it led to more frequent and varied revisions. Students who have severe problems in handwriting, or who write very slowly may find the microcomputer more effective as a means for written communication {Lerner, 1988}. Performance in reading, and instruction in reading can also improve performance in writing {Stotsky, 1983}. Word processing or the use of the computer in writing is proving to be one of the most widely used applications of the microcomputer as an effective tool for teaching writing.

Larter {1987} indicated that elementary school children particularly those in the primary grades, increased and improved their writing by using microcomputers and that such results could be obtained in a classroom in a six-month period with only a few computers. This study of elementary students in the Ontario Ministry of Education and the Language Study Center of the Toronto Board of Education examined and compared how the products of writing instruction with a computer differed from the products of traditionally taught writing. The study indicated that the process of writing with microcomputers differed from the process of writing with traditional tools, and that it differed by grade level. {Larter, 1987}. In grade 1 during the prephase of the study, all the pupils wrote with traditional tools. After a

microcomputer was placed in the experimental classroom the pupils were writing much more on the computers, and when assessed holistically, they were writing better, in terms of ideas, organization, syntax and spelling. The students in the experimental group also felt their writing was better if produced on computers. At the grade 1 level the process of writing with computer and writing with traditional tools had outstanding differences. Children using computers did more composing; dictated to the teacher more often and did less copying from other sources. The 3rd graders participating in the study were more interested/motivated; engaged in more on-task behavior; did more revisions, and more composing than children who wrote with traditional tools. Drawings were used in the same manner by both 1st and 3rd grade students as examples of expressive writing {Larter, 1987}.

A study using three approaches to teaching writing using word processing suggests that an effective brainstorming strategy was made even more successful by reflecting the child's ideas back to him in print so that he was able to clearly read his own writing productions. The accessibility of the child's print made it easier for the teacher to intervene when the child's writing process broke down {Morocco and Neuman, 1985}. It is suggested that the collaboration of the teacher and pupil when keyboarding skills are elementary, allows the teacher to type the words expressed orally by the child. This provides a connection between the spoken and

written forms of language. It also helps the child to perceive ownership for his writing sample produced on the computer since it is his words that are typed by the teacher {Morocco and Neuman, 1985}. These researchers cautioned against analyzing the impact of word processing independent of the method of instruction {Morocco and Newman,1985}.

In a discussion of curriculum-based measurement and the effects of teacher feedback systems, it is suggested that students using computer software that provided corrective and instructive enhanced feedback, showed greater achievement over controlled groups where such feedback was not provided {L. Fuchs, D. Fuchs and Hamlett, 1989}.

Kerchner and Kistinger {1984} studied Learning Disabled students who used word processors with instruction based on a process approach to writing. This approach stresses meaningful communication and included prewriting activities, composition and conferencing with teachers {Graves, 1983; Calkins, 1980}. The students made significant gains compared to students that received no special intervention.

EMR students serviced in self contained classes reflect similar profiles of classified LD students in the area of language processing. Much of the information tested with LD classified students could be applied to developmentally delayed students {Schwartz and MacArthur, 1990}. The Computers and Writing Instruction Project {CWIP} has developed an instructional program for teaching writing to LD students.

The program consists of three components: a process approach to writing instruction, word processing and strategy instruction. Students were taught writing as a complex cognitive task involving planning, drafting, revising and editing with an emphasis on writing as a meaningful act of communication with some audience {Schwartz and MacArthur 1990}. From infancy, children's language learning is guided by the principle of communicative usefulness. The ability to produce a neat, printed copy can increase motivation and encourage writing. The editing power makes revision possible without tedious recopying {Schwartz and MacArthur, 1990}. Computers enhance instructional interactions between students and teachers and gives the instructor a window onto the writing processes of individual students [MacArthur, 1988]. However, students do not acquire keyboarding and word processing skills without instruction {MacArthur & Schneiderman, 1986}. A crucial element of effective strategy instruction is frequent guided practice interspersed with direct instruction {Schwartz & MacArthur, 1990}. A preliminary analysis of data collected indicates that students in the CWIP project have shown improvement in the quantity of writing and overall quality, mechanics and attitudes toward writing {Schwartz & MacArthur, 1990}.

Research on word processing in school settings, especially with exceptional students is still limited. Research is needed that examines the use of word processing

with specific instructional techniques such as instruction in revision and with specific exceptional populations.

Interaction among word processing, instructional methods and the social context for writing also need further exploration {MacArthur, 1988}. Computers can be exceptional tools for writing instruction. Word processors change the physical process of writing by replacing handwriting with typing and by making revision convenient and quick. Word processors can change the social context for writing by supporting publishing for a variety of audiences and enhancing instructional interactions between teachers and students by providing teachers with a window into the writing processes of individual students. If computers are to contribute to better writing they must be integrated with an effective instructional program. Special educators must develop sound instructional methods and computer-assisted composition tools that meet the needs of exceptional children. Further research is needed to determine how computers can be used to effect writing instruction {MacArthur, 1988}.

In reviewing the research, Majsterek {1990} suggests that computer technology appears well suited to address writing difficulties in classified Learning Communication Disabled {LCD} students. Kerchner and Kistinger {1984} experimented with a process approach to writing using school-age LCD students. Students posttested with the Test of Written Language {TOWL} {Hammill & Larsen, 1983} scored higher on

subtest areas. They note, however, that it is unclear if improvement was due to the word processing program or the process orientated writing instruction. Using "Applewriter" {MacArthur & Graham, 1987} suggested that when mechanical and conventional demands are reduced, writing performance improved.

Computer assisted composing {CAC} Montague {1993}, can provide an alternative to traditional writing instruction actively engaging students in the writing process. Computers facilitate the development of compositions over time by simplifying the revision process. More time is spent on the draft process because of easy ability to add, delete or change text. CAC improves student-teacher interactive and improves student attitude toward writing {Montague & Fonseca, 1993; Storeygard, Simmons, Stumpf & Pavoglou, 1993}.

Summary and Discussion

Classification as Mildly Mentally Handicapped requires the presence of various characteristics including decreased intellectual functioning {50-75 range IQ} occurring between conception and 18 years of age, along with significantly delayed adaptive behavior. Impaired ability to communicate and process receptive and/or expressive language often accompanies these two criteria for classification.

It is suggested that the computer may function as an educational aid to MMR youngsters in the following ways: to assist memory and operate as a sequencing tool; to ease

receptive language difficulties and to minimize sensory stimulation. Computer enhancements such as verbal cues, animation, directive arrows, and high-lighting can assist students in determining where to focus their attention. {Leming, Levie, & McLesky, 1980}. Lack of evidence exists for accessing the use of word processing along with writing skills instruction to enhance expressive language of MMR\EMR children. Studies reveal that learning disabled students have found success with word processing. However, their improved writing performance may be a factor of the method of instruction used and/or the keyboarding instruction received during the duration of the study. It is not clear if the difference in writing performance has occurred from decreasing manual handwriting tasks; the easing of the physical aspect of editing and revising writing products; immediate teacher intervention because of clear writing samples or immediate feedback provided by the chosen word processing software.

This study will provide additional research as to the effectiveness in improving the expressive writing skills of youngsters classified as mildly mentally handicapped {EMR/MMR} through the use of computers used for written expressive language composition. Traditional process orientated writing instruction will be provided to the sample study group, followed by instruction in basic keyboarding functions. Then computer word processing software will be used for written composition. A standardized assessment tool The Test of Early

Written Language {TEWL} and teacher made questionnaires assessing prior computer knowledge will be used as preassessment measures. A PREPHASE and POSTPHASE attitudinal survey will be used to assess students attitudes toward writing. Holistic evaluation of writing samples will be conducted to evaluate improvement in student composition.

Cain {1984} provides an editorial comment taking a strong position on the basic reasons for including computers in the special education curriculum. He argues that knowledge of computers and how to interact with them will be an essential skill for coping with one's world in the near future. Computers, he suggests, have tremendous potential for compensating for communication deficits and linguistic problems.

The computer can allow for continuous feedback and repetition to encourage academic progress. Instruction delivered in small steps with frequent responses and immediate feedback can help give students feedback for mastery of concepts. Sound, motion and color cues can serve as memory aids that can help students make initial associations needed to learn. Specific error feedback has potential for higher mastery of curricular tasks and achievement of goals. The computer can become a self-monitoring device that enhances the adaptive behavior ability of the mildly mentally handicapped student. The computer can also be motivational providing challenge, fantasy and curiosity {Malone, 1984}.

Using the criterion for classification of MMR children along with their difficulty with written language, this study will discuss and provide additional data in assessing the effectiveness of CAI in providing an alternative method of instruction and its impact on the writing samples of EMR students.

CHAPTER 3

Design of the Study

A group of 12 youngsters identified as Educable Mentally Retarded was selected. These children attended the Kingston School in a suburban New Jersey school district. The sample population included students from low-middle to upper-middle class families residing within Camden County. Black, Caucasian, and Hispanic children were included in the sample population. These students were between the ages of 9 years, 7 months and 14 years, 1 month and ranged in grade placement from the 4th through 6th grade. The sample was composed of ten females and 2 males, with IQ function ranging from 49-69 as measured on the WISC-R, Peabody Picture Vocabulary or The Detroit Test of Learning Aptitude. With the exception of two ESL {English as a Second Language} students, reading levels measured with standardized tests were reported as grade levels, ranging from Readiness- K to 6.0.

Method of Data Collection

Classified EMR students exhibit deficits in verbal expression and receptive language resulting in non-coherent or broken thought patterns, along with inappropriate responses and difficulty with retelling a story. Therefore, the criteria chosen for assessing the written expression of the group of students included in this sample reflects these

areas, for they most often interfere with expressive writing in children classified as EMR. In order to measure early written language development in children participating in the study, several evaluation instruments were considered of value. The Test of Early Written Language {TEWL} was used to determine the following:

1. To identify individual strengths and weaknesses.
2. To identify children who had early achievement problems.
3. To document students' progress in written language as a consequence of special intervention programs.
4. To serve as a measurement device in research studies pertaining to the academic achievement of these children.

Both the Brigance and Vineland Adaptive Behavior Scales were devices reported in individual IEP documents used to determine the Adaptive Behavior level of the sample group. The TEWL evaluation instrument is suggested for use with children between the ages of 3-7. However, this device was chosen for this study as a valid measure with which to determine the written language ability of children classified EMR, since the mental age of the sample group fell within this developmental age range. The examiner began testing at the entry level of item 1 for each student and discontinued the testing when the child missed 5 consecutive items. Results of this evaluation appears in Appendix A.

Procedures

The sample group was given the TEWL assessment device in October, 1994. Instruction in the writing process was given by traditional means from September 15th through November 15th, 1994. Writing samples were collected from each student and evaluated according to the following criteria:

- A. Ideas, content and development
- B. Organization and unity
- C. Vocabulary, sentence structure and variety
- D. Grammar and usage
- E. Capitalization and punctuation
- F. Handwriting legibility

Writing samples were collected and evaluated after traditional writing process instruction. Then keyboarding instruction using the "PAWS" Keyboarding Program and "The Picture a Story" story construction software was implemented. Additional writing samples were collected and evaluated. The latter samples were created on an Apple IIe computer located within the classroom and shared by the 12 students participating in the study.

The students' papers were read by two evaluators for an overall holistic impression of the writing. The student's writing was then rated by comparing his writing sample performance with an informal teacher-constructed 0-2 point rating scale based on criteria established as indicators of criterion-referenced goals relating to the various above

mentioned skill areas {Appendix B}, Drawings and illustrations were included in the samples evaluated.

Throughout this report of the study, reference is made to three phases. The phases were not only based on time, but also on the types of writing samples collected.

A. PREPHASE: Paper Writing

This phase of the study ran from the middle of September, 1994 through the middle of November, 1994. During this phase, all children in the group wrote with traditional tools. The teacher created individual file folders for each selected pupil. During this phase tests measuring written expression were administered. The evaluators interviewed the children and obtained answers to various surveys and questionnaires noted in Appendix C of this paper. At the very end of this phase, the computer was used to have the pupils learn and practice keyboarding skills using the "PAWS" and the "Picture a Story" programs.

Each participant in the study was treated as its own control. Between 3-9 writing samples were collected for each student during the PREPHASE segment of the study. During mid September through December, 1994 traditional journal writing activities were conducted. Assignments included the following activities:

1. Listening to a story tape.
2. Listening to a story about Christopher Columbus.
3. Basal reader story selection from Merrill Linguistic

Reading Program.

4. "Frog and Toad" - selected stories.
5. Getting to Know You Facts Sheet with individual responses.
6. Discussion of violence based on series-"Power Rangers".
7. Science walking tour experience.
8. Individual description of; How to grow a pumpkin.
9. Story webs on a variety of readings.

Each child's writing sample was rated on a three point scale {0-2} according to the following criteria:

1. Content
2. Vocabulary/Structure
3. Mechanics
4. Handwriting legibility

The results of the PREPHASE rating of writing samples can be found in Appendix B of this research paper. All subjects received a rating of 0 {poor} or 1 {moderately well} in all areas considered as critical for successful writing production. The following exceptions can be noted: one subject received a rating of 2 {almost always} on the Content area on one writing sample; 1 subject received a rating of 2 on the Vocabulary/Structure segment of one writing sample and 1 subject received a score of 2 on the handwriting component of one writing sample.

B. TRANSITION PHASE: November, 1994 through December, 1994

During this time period the subjects were instructed in keyboarding skills using an Apple IIe computer, which was in the classroom during the entire period during which the research was conducted. Direct instruction on the computer was given to the entire group. Printed diagrams were distributed showing system components and key placement on the keyboard. "Computers", a Watts First Library publication, was read aloud to the entire class. This was followed by a daily 5 minute individual teaching/practice session with a teacher aid who was skilled in computer keyboarding. The programs chosen for the study were PAWS- a step by step keyboarding program and CommuniKeys - a keyboarding program that introduces keyboarding techniques in lessons consisting of real words and sentences. It reinforced keyboarding in activities that emphasized language skills. Writing on the computer consisted of looking at the keyboard and pressing a variety of keys designated by the instructor. Phrases and/or sentences were copied in order to practice familiarity with the keyboard symbols.

The investigator must note here that problems in software selection were affected by the following factors:

1. Software availability.
2. Limited step-by-step software with minimum language abilities needed for success.
3. Improperly formatted discs.

Time on computer tasks was also affected by daily schedule limitations. The benefit of a full time aid cannot be overlooked in attempting this study. The aid was able to work with all the subjects several times a week on a one to one basis while the regular classroom instructional program was on going.

C. POSTPHASE: January through March - Comparison of paper writing with computer writing.

The children in the sample group still did writing on the computers and did traditional writing on paper. Both products created on the computer and traditional handwritten samples were placed in each student's writing folder. The teacher, and other evaluator then analyzed this data and included it in the data analyses. The details of all these holistic and statistical evaluations are provided in Appendix D.

The literature on writing with the aid of computers shows significant concern for student attitudes toward writing. It is often emphasized that students respond more positively when writing with the assistance of computers than with traditional tools {Schwartz and MacArthur 1990; MacArthur and Shneiderman, 1990; MacArthur, 1988; Lerner, 1988; Schwartz, 1982; Hennings, 1981}. Therefore, an attitude questionnaire was developed and administered twice during the research project. This measure was administered at the PREPHASE portion of the study in October and at the POSTPHASE segment in March. The instrument consisted of 18 items with four response alternatives [always;

sometimes; never or don't know] and was administered orally to the children on a one-to one basis. The statistical analyses is described in Chapter 4 and documented in Appendices C and E.

A brief questionnaire was administered during the PREPHASE of the research to determine which children used a computer at home {Appendix C}. Frequency and type of usage was considered in the responses. A summary of the results of this survey revealed that 3 students owned a home computer; 1 student used it rarely; 1 student used it one time per week and 1 student used the computer several times a week to play games and to complete academic tasks.

Computer literacy and keyboarding skills were assessed during the PREPHASE of the study and then taught just prior to the introduction of the word processing software. The students were taught various keyboard functions such as: return; space bar; moving arrow keys; moving print; saving; deletions character by character; insertion character by character; saving document; and printing {Appendix C}.

In early childhood education it is important to recognize the strong relationship between each developmental area, rather than its isolated importance {McConnell-Falk and Celesia, 1985}. A chart designed by the Camden City Public Schools was used as a reference during computer skill instruction. The following visual motor skills were noted:

1. Use of a pincer grasp when handling disk software, {e.g. take diskette with thumb on the label; place into diskette drive and close the door on the diskette drive}.
2. Manipulate small push button switches, use eye hand coordination, e.g. stop/start computer, turn off and on power.
3. Press individual keys with index finger.
4. Look at and focus on monitor.
5. Switch visual orientation back and forth from a plane on the keyboard to a plane on the monitor.
6. Visually scan areas from left to right and top to bottom manner; look at display on monitor.

Cognitive developmental skills considered were:

1. Understand the spoken language [receptive language].
2. Verbally communicate information [expressive language].
3. Associate written words on the monitor with the spoken word.
4. Show an interest in the symbol keys on the keyboard and the written display appearing on the monitor.
5. Identify written symbols on the monitor and keyboard.
6. Follow directions for using the computer.

There are many anecdotal reports in the educational literature that support the hypothesis that students write more words when using microcomputers, than they do when using traditional tools {Piper, 1983; Kleiman and Humphrey, 1982}.

Students appear more motivated to write more and they become, through practice, better writers. The question then is "When EMR children write with the aid of computers, do they write more and produce better quality compositions"? Between 3-9 writing samples placed in the writing sample folders were analyzed during the pre and post phases in order to better to answer this question.

For the purposes of evaluation, the following grand averages were then determined for comparison.

1. Average number of words per piece of paper writing per student {PREPHASE}.
2. Average number of words per piece of paper writing per student {POSTPHASE}.
3. Average number of words per piece of computer writing for each student {POSTPHASE}.

The average number of words per piece of writing was than calculated for each child during each phase of the study. Comparison of paper and computer composition quantity can be found in Appendix E.

The data analysis will be discussed in Chapter 4 of this research paper. The results discovered will be summarized using each participant in the study as its own control.

CHAPTER 4

Analysis of Data

Few, if any researchers have attempted to compare the written expressive performance of MMR students before and after computer assisted instruction. In this study I attempted to identify the qualitative differences between the performance samples gathered before and after instruction on computer keyboarding and the subsequent usage of computer assisted software in the production of written language samples.

The Test of Early Written Language {TEWL} was administered to 12 subjects, classified mildly mentally retarded [MMR] between October 14 and October 21, 1994. The TEWL measures a broad spectrum of writing language abilities. It was designed to be administered to youngsters between the ages of 3.0-7.11 years of age. This instrument was chosen by the investigator as a valid measuring tool because it coincided with the mental age of the students included as the sample population studied in this research project. The TEWL provides a tool for investigation of critical aspects of early writing abilities as well as the problems of young children with potential or determined written language disorders.

The results of the study can be found in Appendix A of this paper. The students ranged in age from 9.07 to 14.1

years. The average mental age, according to prior testing included in their most recent individual evaluation plan, was six years. The twelve subjects tested scored between the 1-91 percentile. Two student scored in the 1 percentile {very-poor}; 3 at the 2 percentile {poor}; 5 at the 15-18 percentile {below average}; 1 at the 37 percentile {average} and 1 at the 91 percentile {above average}. The test results indicate severe writing language difficulties encompassing a broad range of skills with significant weakness in written language abilities.

The student's expressive language ability includes the child's understanding and expression of symbolic auditory and visual stimuli. The form, content and usage of language are reflected in the students understanding and expression of language phonology, morphology, syntax, semantics and pragmatics. The TEWL and the WIAT were used to establish criteria and set benchmarks for authentic assessment of performance on the written products of the MMR students.

1. Will special needs students who are classified MMR produce superior written language products after being instructed in the use of a personal computer? Appendix E exhibits differences shown in the areas of: number of words used per composition; legibility of composition; punctuation and capitalization [mechanics] and thematic maturity [sentence complexity, idea sequence, fluency of composition].

2. What benefit, if any will be shown by using a

personal computer as a tool to improve written expression? From October, 1994 to March, 1995 eleven children showed improved writing content and vocabulary/structure in paper and pencil writing samples. Six children showed improved skills in punctuation and capitalization and seven samples were more legible when evaluated by the readers. Paper and pencil samples and computer writings were compared in March following CAI instruction. The following findings were recorded for each criterion selected:

- . Content: Six children improved and six children showed no improvement.
- . Vocabulary/structure: Five children showed improvement; Six remained the same and one showed decreased ability.
- . Mechanics: Six samples showed improved abilities; Four stayed the same and two exhibited decreased skills.
- . Legibility: Eight students showed improved legibility in computer produced samples and two remained the same. An equal amount showed decreased legibility.

3. Will attitudes toward writing change after instruction in computer keyboarding and software usage?

The literature on writing with personal computers has a great deal to say about attitudes, emphasizing repeatedly that students are more positively disposed to writing with personal computers than with traditional tools (Hennings, 1981;

Schwartz, 1982}. Consequently an attitude questionnaire was developed and administered twice- once in October, 1994 and once in March, 1995. The results are shown in chart form in Appendix C & E.

Each student participating in the study was asked questions to determine various attitudes presently held about writing. Areas of interest were the following:

1. Enjoyment of writing.
2. Pride in written materials.
3. Difficulty with writing.
4. Recognition of good writing.
5. Usefulness of writing.
6. Attitude toward reading.
7. Collaboration when writing.

The questionnaire consisted of 18 items with four response alternatives (always, sometimes, never or don't know). The investigator chose four items as most significant determinants in attitude toward writing. They are listed as follows:

1. Do you like to write?
2. Do you have difficulty with writing?
3. Do you recognize when you write well or make a mistake?
4. Do you like to read?

Results of the PREPHASE questionnaire showed that all 12 of the children surveyed like to write always or sometimes. There was no correlation between experiencing difficulty with

writing and liking to write-{scores were evenly spread between three responses- always, sometimes and never}. Seven children out of 12 said they never recognized their own mistakes or were aware of product quality. All but one child said they liked to read always and one said he liked to read sometimes. The sample group generally had positive attitudes toward writing and reading. This attitude seemed to have no relationship to their difficulty with writing or ability to recognize good writing products.

Six questions from the PREPHASE questionnaire were selected and re-administered during the POSTPHASE the study. The following items relating to writing with the aid of a computer were chosen from the original survey as a comparison sample:

1. I like to write things.
2. My writing looks good on paper. [compared to computer]
3. Writing is hard.
4. Writing makes my hand tired.
5. I like to read.
6. I like to write with the computer better than with a pencil and paper.

Results revealed the following:

. Enjoyment of Writing: Six students showed no change in attitude toward writing. Four of these students already expressed a positive attitude toward writing during the PREPHASE, while two said they enjoyed writing sometimes. Five

additional students stated they had a more positive attitude toward writing after computer training. Two youngsters exhibited a negative attitude toward writing after computer instruction.

. **Pride in Written Materials:** 40% of the students expressed they had more pride in their writing samples after computer instruction. One showed a negative change in this area.

. **Difficulty with Writing:** Nine students stated they experience less difficulty writing after keyboarding instruction, while three stated they experienced no change in difficulty level.

. **Recognition of Good Writing:** Nine students exhibited no change in recognition of good writing production. Three stated they recognized their mistakes more easily.

. **Attitude Toward Reading:** Eight students showed no change in reading attitude. Four students showed a negative change in attitude toward reading.

. **Choice of Computer or Paper-Pencil mode of production:** The survey revealed that children that appeared to exhibit less expressive language impairment in daily classroom performance liked to write more on the computer than on paper. Those with more extensive expressive language deficits chose paper and pencil options over computer assistance for writing production. However, one child with severely impaired expressive language performance, but more developed receptive language ability, also chose computer writing as a mode of

expression over paper and pencil tools. Additional discussion follows in Chapter 5.

A survey administered to the sample group during the PREPHASE of the research project enabled the investigator to learn if the child used a computer at home. The respondents were asked to indicate the following:

1. If they used the computer at home?
2. The purpose for which they used it.
3. How often they used their computer?

Results indicated that 9 out of 12 students did not own a computer. The three students who used a computer at home indicated they used it for games, reading or math homework and one indicated he used it to complete writing assignments. Results of this survey are listed in Appendix C. Subjects 2, 6, and 12 had used computers at home for games and homework. Subjects 2 and 6 were able to use both hands to push the keys. Of the children who used a computer at home, Subject 12 appeared to be the only child that used the keyboard easily and showed little frustration. Subject 11 had no computer at home and also showed ease of use with the keyboard and was able to follow the screen prompts.

There was no significant relationship between written language samples of students using computers at home and the written language samples of classmates without home computers. Generalization of learning did not appear to be present. Further investigation would be needed to form conclusions.

Comparative samples gathered before and after computer assisted instruction indicated benefits in the areas of:

- . Numbers of words used per composition
- . Legibility
- . Mechanics

Consistency of results established no differences in composition thematic maturity or idea sequence. This is concordant with the position that computer assisted instruction improves some areas of written language production, but does not address the broad spectrum of deficits that were assessed on the TEWL indicating student levels of performance in written expression. A discussion of specific benefits in relation to individual subjects will be examined in Chapter 5 of this research paper.

CHAPTER FIVE

Summary and Conclusion

The effects of computer assisted instruction on the written expressive language of mildly mentally retarded youngsters was investigated by this researcher in order to answer the following research questions.

1. Will MMR students who receive instruction in computer keyboarding produce better written expressive samples using the computer as an aid to written production?
2. After establishing criterion, what, if any, areas will show improvement?
3. What attitudinal changes toward writing will occur?

Twelve classified EMR [mildly mentally retarded] students ranging in age from 9.7 years to 14.1 years presently receiving their education in a self-contained special education setting were identified for this research project. During the PREPHASE the children were taught the traditional writing process and required to complete varied assignments that were gathered over a two month period between October, 1994 and November, 1994. Attitude toward writing and knowledge of keyboarding skill surveys were administered. During the TRANSITION PHASE throughout December, 1995, the

students were taught keyboarding skills using an Apple IIe located in their classroom. They were given the opportunity to practice keyboarding and develop their own stories on the computer between January and February of 1995. Practice time varied; However, each student received instruction and worked for approximately two 15 minute sessions per week.

During March, 1995, the POSTPHASE, five computer produced samples were collected from each student. Paper and pencil written productions collected in the PREPHASE were compared to paper and pencil products gathered in the POSTPHASE. Computer produced writing samples were then compared to the paper and pencil productions gathered during the POSTPHASE.

The number of words used in paper and pencil samples revealed that two children showed increased word production using the computer as a writing tool; Five students produced samples that contained an equal amount of words [within a range of five words] using either mode of production and five student samples showed a decrease in the number of words produced on computer samples compared to paper and pencil products.

Discussion

Research studies discussed in Chapter 2 of this teacher research project established a position that learning disabled students benefited from computer keyboarding instruction in reporting better written expressive language production after

keyboarding instruction. They cited that production quality and length were improved, along with exhibited positive attitudinal change toward writing in general.

This teacher research project was implemented in order to confirm or reject this hypothesis by introducing computer keyboarding instruction into a self-contained classroom of 12 EMR [mildly mentally retarded] students.

Gains in quantity of words exhibited in computer produced writing samples were varied. This finding does not support Larter (1987) indicating computer usage fostered increases in the number of words produced in a composition. Students that had stronger expressive language skills as measured on the Test of Written Language Development produced more lengthy compositions using either mode of production.

Two students with limited English speaking backgrounds scored in the 2% on the TEWL in October, 1994. Both of these students showed increased mechanical skill levels [capitalization and punctuation] using the computer. Two other students scoring poor or very poor [1%-2%] on the TEWL showed no difference in all critical areas. Two students scoring in the Average and Above Average range on the TEWL showed improvement in computer produced samples in the areas of content, legibility and vocabulary.

One student of 5 who scored in the Below Average range showed improvement in all criterion areas and showed strengths in expressive language that may be beneficial in transitioning

into a career goal opportunity. Legibility severely impeded the production of this student's paper writing samples. The computer was a definite aid to expressive language production for this youngster.

The production of more aesthetic compositions may allow future employers to perceive the EMR individual as more capable of functioning in a work setting. The EMR student may perceive the computer as a self-monitoring device that enhances his self-esteem and consequently his adaptive behavior.

In this study general problems with spacing, shift key usage for capitalization and deletion errors inhibited the quality of computer productions. It is the opinion of this researcher that further instruction in keyboarding and continued practice over another six month period with improved keyboarding acuity would improve legibility of computer productions. Specific problems are noted in Appendix D.

Kerchner and Kistinger (1984) suggested when mechanical demands were reduced, writing performance was improved. The "Picture A Story" and "Paws" software programs offer immediate feedback, decreasing the need for sequencing of ideas with visual and mechanical prompts to aid construction of sentences. The computer may have functioned as an assist to memory and operated as a sequencing tool to ease receptive language difficulties. Animation and high-lighting embedded in the software programs may have helped to focus attention

during composition sessions.

The POSTPHASE Attitude Survey { Appendix E} reveals that students that exhibit less expressive language impairment, as measured by teacher evaluation, their TEWL written language scores and functional assessment, perceived their computer produced writing samples less difficult to create. Those youngsters chose computer production mode over paper and pencil tools. Seven of the twelve children said they liked to use computers more often to assist production than paper and pencil tools. When correlating attitude toward reading, and the use of computers, eight students expressed no change in their attitude toward reading. Four students expressed a negative change in their attitude toward reading. This researcher would need to determine the impact of a new reading series used during this study. The highly scripted, direct instruction series may have impacted on the reading attitude and the resulting responses gathered in this survey.

Further teacher research would verify if continued instruction in computer keyboarding would over-ride cognitive, auditory and expressive or receptive language deficits exhibited by EMR classified children. Perhaps over-practice in keyboarding skills would compensate for the above deficits and provide opportunity for data entry or computer system software programs that require little cognitive interaction. Increased emphasis on transitioning programs for special needs students may drive further research in this area.

APPENDICES

APPENDIX A
TEST OF EARLY WRITTEN LANGUAGE

Subject #	Age	Percentile	Descriptor
1 [YA]	9.10	2	Poor
2 [NF]	14.03	91	Above Avg.
3 [AF]	10.11	2	Poor
4 [SK]	11.09	15	Below Avg.
5 [MR]	10.02	16	Below Avg.
6 [BR]	12.00	16	Below Avg.
7 {LS}	9.07	2	Poor
8 [CS]	12.05	18	Below Avg.
9 [JT]	10.01	1	Very Poor
10 [HT]	9.10	1	Very Poor
11 [DV]	11.00	16	Below Avg.
12 [CW]	12.04	37	Average

APPENDIX B

PREPHASE WRITING SAMPLE RATINGS

Subject #	#Samples	Content	Voc/Str.	Mechanics	Handwriting
1	5	2	3	4	4
2	7	5	6	3	7
3	4	2	0	0	3
4	3	0	0	0	1
5	6	1	0	0	5
6	4	1	2	2	1
7	6	4	4	0	4
8	5	1	1	1	5
9	3	0	0	0	2
10	4	3	1	2	3
11	5	3	4	1	5
12	5	5	4	1	4

APPENDIX C
COMPUTER SURVEY

Subject #	Own	Purpose/Usage	Frequency
1	no		
2	yes	games/homework	5 x week
3	no		
4	no		
5	no		
6	yes	games/homework	1x week
7	no		
8	no		
9	no		
10	no		
11	no		
12	yes	games	less than 1 x week

APPENDIX C

ATTITUDE QUESTIONNAIRE

Enjoyment of Writing always sometimes never don't know

I like to write things.

Writing makes me feel happy.

Writing makes me feel nervous.

I like to write things even

when my teacher doesn't make me.

Pride in Written Materials

I like to keep things I write.

I like to show my family the

things I write.

My writing looks good on paper.

I like my writing put up on the wall.

I am a good writer.

Difficulty with Writing

Writing is hard.

Writing makes my hand tired.

_____ always _____ sometimes _____ never... dk

Recognition of Good Writing

When I write, I can tell
where my mistakes are.

Writing is Useful

Writing helps me tell people my ideas.

Collaboration When Writing

I like to have my friends help me
when I write.

Attitude toward Reading

I am a good reader.
I like to read.

APPENDIX C

Name _____ Computer Questionnaire

Date _____

I have a computer at home.

I use my computer to: play games do school work
 write things learn reading or math

I use my computer:

 everyday one time a week
 a lot not much

Name _____ Date _____

Keyboarding skills and functions used:

Deletion character by character:

Insertion character by character:

Save:

Print:

Move letters, words or sentences:

Return:

Spacebar:

Project: 1 2 3 4 5 6 7

APPENDIX C
ATTITUDES TOWARD WRITING QUESTIONNAIRE

Subject #	response	PREPHASE			
		Always	Sometimes	Never	DK
1	{YA}	16	0	0	0
2	{NF}	10	2	4	0
3	{AY}	11	0	5	0
4	{SK}	5	10	0	1
5	{MR}	1	11	4	0
6	{BR}	11	3	2	0
7	{LS}	11	2	3	0
8	{CS}	6	5	4	1
9	{JT}	3	10	2	1
10	{HT}	6	2	8	0
11	{DV}	12	0	4	0
12	{CW}	3	11	2	0
		—	—	—	—
Total		74	56	38	3

Note: See Questionnaire sheet Appendix C for sample questions.

Each subject is its own control.

APPENDIX D

The Transition Phase revealed a number of difficulties with teaching computer keyboarding skills to MMR classified youngsters. A log was kept documenting individual problems with computer usage. The following descriptions evidence a variety of difficulties.

Subject # Problems

- 1
- a. difficulty remembering Space Bar location
 - b. forgets to use Shift Key to capitalize
 - c. doesn't space between words or use periods
 - d. was able to copy her own sentences dictated to the teacher/aid onto the computer

Subject # Problems

- 2
- a. had difficulty with placing hands on keys-
{physical handicap impedes fine motor
coordination}
 - b. forgets to use Delete Key instead of arrow key
 - c. forgets to use Shift Key to capitalize
 - d. presses Esc Key instead of Return Key
 - e. can use left index finger for left side of
keyboard and right index finger for right side
of keyboard

Subject # Problems

- 3
- a. types with index finger
 - b. easily frustrated

Subject # Problems

- 4
- a. good ability to use all fingers on home keys
 - b. confident working with computer
 - c. typed first name incorrectly
 - d. did not remember to use Shift Key to capitalize
 - e. did not remember how to use Return Key
 - f. easily frustrated when unable to find keys to write her name

Subject # Problems

- 5
- a. used arrow keys instead of Space Bar
 - b. unable to reply to prompt on screen - {unable to read words}
 - c. uses index finger only to find keys

Subject # Problems

- 6
- a. does not use both left and right index fingers
 - b. grew tired- {physical handicap impedes energy level}
 - c. good legibility- {physical handicap impedes legibility for paper and pencil tasks}

Subject # Problems

- 7
- a. trouble typing his name
 - b. did not remember to capitalize using Shift Key
 - c. did not use Space Bar to space between words

- d. able to type sentences dictated to aid
- e. held down Delete Key and erased product
- f. confused "I" and "L" on keyboard

Subject # Problems

- 8
- a. does not remember to use Space Bar
 - b. does not remember to use Shift Key to capitalize
 - c. uses index finger to type
 - d. was able to follow screen prompts with help

Subject # Problems

- 9
- a. hesitant to type, yet said she liked computers
 - b. difficulty remembering instructions Shift Key; Space Bar;
 - c. does not know how to sound out or try to make words

Subject # Problems

- 10
- a. could not find Return Key or Space Bar
 - b. hesitant to touch keys
 - c. difficulty finding keys on keyboard
 - d. confused over "a" key-conflicts with printed "a" in reading text used

Subject # Problems

- 11
- a. quick response time
 - b. able to use all fingers
 - c. able to follow screen prompts well

Subject # Problems

- 12 a. found keys easily
- b. tried using all fingers to type but reverted
 back to two fingers
- c. increased speed from 4 to 6 word/per/min.

A summarization of the findings reveals difficulties in keyboard usage that impede the legibility, punctuation and capitalization and number of words produced during composition production. Further group and one-to-one instruction was designed and implemented to improve computer keyboarding skills during both the TRANSITION and POSTPHASE portion of the research project.

APPENDIX E

A rating scale ranging from 0-2 points was developed by the researcher based on criteria from the Wechsler Individual Achievement Test and the Test of Early Written Development. Four areas were identified and rated. They are as follows: content; vocabulary/structure; mechanics and legibility. Five samples were used for each control allowing a possible 2 points to be scored in each area for each writing sample.

Subject #	PREPHASE-paper	POSTPHASE-paper	POSTPHASE-computer	
1 ya	content	2	5	10
	voc/structure	3	5	10
	mechanics	3	5	10
	legibility	4	5	10
2 nf	content	3	5	10
	voc/structure	4	5	10
	mechanics	2	5	5
	legibility	5	5	10
3 af	content	2	3	5
	voc/structure	0	3	5
	mechanics	0	1	0
	legibility	3	2	0

4 sk	content	0	5	5
	voc/structure	0	5	5
	mechanics	0	0	0
	legibility	1	3	0
5 mx	content	1	5	10
	voc/structure	1	5	10
	mechanics	0	0	5
	legibility	5	5	10
6 br	content	3	5	5
	voc/structure	3	5	5
	mechanics	4	0	5
	legibility	1	0	10
7 ls	content	4	5	5
	voc/structure	4	5	5
	mechanics	0	0	5
	legibility	4	5	5
8 cs	content	1	5	5
	voc/structure	1	5	5
	mechanics	1	7	10
	legibility	5	7	10
9 jt	content	0	5	5
	voc/structure	0	5	5
	mechanics	0	0	0
	legibility	2	5	10

10 ht	content	4	3	3
	voc/structure	2	3	3
	mechanics	3	5	0
	legibility	4	5	5
11 dv	content	3	7	10
	voc/structure	4	5	10
	mechanics	1	0	5
	legibility	5	0	10
12 cw	content	5	7	10
	voc/structure	4	7	5
	mechanics	1	5	5
	legibility	4	3	10

APPENDIX E

SUBJECT #	AVERAGE NUMBER OF WORDS	PAPER	COMPUTER
1		22	19
2		32	31
3		15	23
4		36	25
5		47	29
6		30	25
7		22	44
8		25	27
9		26	22
10		14	17
11		16	39
12		52	35

APPENDIX E

POSTPHASE ATTITUDE QUESTIONNAIRE

Enjoyment of Writing:

Description	Number of Students
No Change	6
More Positive	4
Negative Change	2

Pride in Written Materials:

No Change	6
More Positive	5
Negative Change	1

Difficulty with Writing:

No Change	3
Less Difficulty	9

Recognition of Good Writing:

No Change	9
Better Recognition	3

Reading Attitude:

No Change	8
Negative Change	4

I would choose to write on a computer rather than with paper and pencil. [after instruction]

Computer	7
Paper/Pencil	5

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