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ABSTRACT

This program was developed and implemented to promote higher-level thinking skills and problem-solving skills and to strengthen the understanding of mathematical concepts in second grade students through the use of the Logo programming language. The objectives for this study were that 70 percent of the target students should demonstrate the basic Logo turtle commands; construct geometrical shapes; solve problems through discovery; and write a simple program. The target group of second graders participated in a 12-week period to learn Logo through pre-lab activities; hands-on experience in the computer lab; and follow-up activities. All the program objectives were met with the target group improving dramatically in the specific areas. Included in the appendices are the curriculum essentials framework; the pre-study survey and questionnaire; and the phase exams for each step of the program. (Contains 11 references.) (Author/JLB)

INTEGRATING MANDATED LOGO COMPUTER INSTRUCTION INTO THE SECOND GRADE CURRICULUM

by

Monica Borer

A Practicum Report

Submitted to the Faculty of the Abraham S. Fischler Center for the Advancement of Education of Nova University in partial fulfillment of the requirements for the degree of Master of Science.

The abstract of this report may be placed in a National Database System for Reference

August, 1993

Abstract

Integrating Mandated Logo Computer Instruction Into The Second Grade Curriculum.
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This program was developed and implemented to help promote students with higher-level thinking skills, problem-solving skills, and strengthening understanding of mathematical concepts. The objectives for this study were that 70 percent of the target students to demonstrate the basic turtle commands, construct geometrical shapes, solve problems through discovery, and write a simple program. The target group of second graders participated in a twelve-week period to learn the Logo program. Pre-lab activities introduced concepts. Hands-on experiences were initiated in the computer lab and follow-up activities were given for reinforcement. All the program objectives were met with the target group improving dramatically in specific areas. Appendices include the Phase exam for each phase of the program.

Authorship Statement/Document Release

Authorship Statement

I hereby testify that this paper and the work it reports are entirely my own. Where it has been necessary to draw from the work of others, published or unpublished, I have acknowledged such work in accordance with accepted scholarly and editorial practice. I give this testimony freely, out of respect for the scholarship of other workers in the field and in the hope that my work, presented here, will earn similar respect.

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Appendix N

Practicum Observer Verification Form

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Practicum Title Integrating Mandated Logo Computer Instruction Into The Second Grade Curriculum

Student's Name Monica Borer

Program Site P.L. Diskin Date July 29, 1993

Observer's Name Jean Schaefer Jean Schaefer
(please print---sign)

Observer's position Educator Phone # 702-799-5936

Observer's comment on impact of the project (handwritten):

Students have experienced and are more knowledgeable of logo and mathematics skills in the curriculum plan.

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Chapter I

Purpose

Background

The setting for this practicum was a rapidly growing school district in the southwestern part of the United States. The district covered an area of 7,910 square miles and included rural and city areas. This district's student population of 136,188 ranked it as the 14th largest among the nation's public school systems. The city in which this practicum took place was the largest metropolitan area in the district. One-hundred-seventy public schools were within the school district. Of the 170 schools, 120 were elementary schools, 24 were junior high schools, 21 were senior high schools, and five were special schools. Several additional schools were scheduled to open within the next year. Although the total student enrollment was 136,188 as of January, 1992, the district was in a growth mode and was expected to exceed that figure by between eight and ten percent per year.

The target school in which this study was conducted was an 18-year-old, year-round elementary

school located in a residential area surrounded by lower-middle class homes. Sixty percent of the children who attended the target school lived in nearby homes and 36 percent were bussed in from lower and lower-middle class areas of the city.

The students who attended the target school represented diverse ethnic backgrounds. Approximately 23 percent of the student population was either Black or Hispanic. Another 5 percent came from Asian or other ethnic backgrounds. Many students came from single parent homes. Thirty percent of the families participated in the free and reduced school lunch program. Some of these families received welfare assistance. Other families worked various shifts in the casino industry and were often not home or sleeping when the children were at home.

Total student enrollment of the target school was approximately 735 kindergarten through fifth grade students. For these students, the school provided an English as a Second Language (ESL) program, Gifted and Talented Education (GATE) program, Reading Improvement Program (RIP), and two special education resource room programs. The primary resource room provided remediation for first to third grade students, while

the intermediate resource room serviced fourth and fifth graders. The school had 39 full-time certified teachers, a principal, a part-time vice principal, and part-time instructional specialists which included a school psychologist, nurse, and speech therapist. Classified support personnel included a secretary, office clerk, media clerk, and one teacher's aide.

The author of this practicum has a bachelor's degree in elementary education and has been a certified teacher for three years. The writer maintained a second grade, full-time position in the designated school district and was in a team-teaching program. In the past three years, the author has taught first grade, second grade, and a third-fourth combination class, all at the target school.

The target classroom was one of five second grade classrooms. Out of the five classrooms, three were participating in a team-teaching program, including the target classroom. Each teacher had a class enrollment of not more than 17 students. The two teachers that shared the target classroom had a total class enrollment of twenty-nine. The target class consisted of 12 females and 17 males. Twenty-one were Caucasian, two African American, four Hispanic, and

two Asian. Two students were in the Gifted and Talented Education program and one student was in resource room. Of the 29 students, 10 received free lunch, 10 students brought their lunch from home, and nine students purchased school lunch.

The target school had two computers rooms, one for the primary grades and one for the intermediate grades. Each computer lab had 12 Apple IIe computers and two printers. The rooms were available for teachers on a time-share basis. Most of the teachers used the computer lab at least once a week for a total of 40 minutes. An assortment of Minnesota Educational Computing Consortium (MECC) computer programs were available teacher resources provided by the school district.

Problem Statement

The district had a set, mandated curriculum for each grade to ensure that all students receive appropriate computer education. This curriculum included teaching the Logo Programming Language in all grades, kindergarten through fifth (Appendix A:33). However, the problem was that students were not receiving education in Logo due to lack of teacher knowledge of the subject. A pre-study survey and

questionnaire for another study proved that 92 percent of the teachers did not teach Logo and 88 percent of the teachers in the target school were not knowledgeable about Logo (Scheffelman, 1993). A copy of those documents are included in this report (Appendix B:35).

The district had expressed concern about the education of students in mathematics. According to researchers Maddux (1984) and Keller (1990), Logo is an important tool that contributes much to student understanding of mathematical principles. Turtle Geometry, one aspect of Logo, provides opportunity for students to manipulate spatial concepts. The district had mandated use of the Logo program and Turtle Geometry to contribute to student understanding.

After attending recent Logo inservices at the target school, this author realized that, ideally, students, specifically the author's second grade students, should be proficient in Logo to meet the district's mandates and to better equip these students with mathematical concepts and problem-solving skills.

Outcome Objectives

The objectives for this study were as follows:

1. After Phase One of Logo instruction, 70

percent of the target second grade should be able to demonstrate the basic turtle commands as measured by the successful manipulation of the turtle through four mazes and a successful grade of 70 percent or higher on a Phase One unit exam (Appendix C:38).

2. After Phase Two of Logo instruction, 70 percent of students in the target second grade should be able to construct geometrical shapes such as squares, rectangles, and triangles using Logo. This objective will be considered a success by evaluation of completed activities under specific criteria and guidelines, and a successful grade of 70 percent or higher on a Phase Two unit exam (Appendix D:40)

3. After Phase Three of Logo instruction, 70 percent of the target second grade should be able to solve problems through guided discovery and exploration as measured by completion of scheduled activities under specific criteria and guidelines, and a

successful grade of 70 percent or higher on a Phase Three unit exam (Appendix E:43).

4. After Phase Four of Logo instruction, 70 percent of the target second grade should be able to write a simple program using the TO command. The success of this objective will be determined by the completion of scheduled activities under specific criteria and guidelines, and a successful grade of 70 percent or higher on a Phase Four unit exam.

CHAPTER II

Research and Solution Strategy

During the past several years, the public had become concerned about problems within the educational system in the United States. Reports such as the National Assessment of Educational Progress (1991) indicated that student competency, particularly in mathematics, had seriously deteriorated. In its present state, the educational system was not meeting a satisfactory level of education for its students.

Authorities agree that our educational system needs reorganizing and revitalizing. Many recommendations to remedy the problems have been presented. The mandated use of computer technology in learning and teaching environments is one that school districts have deemed a partial solution. Computer education that focuses on problem solving, integrated curriculum, mathematics, and creativity are judged by many experts to be important tools to improve the quality of the educational system (Ryan, 1991).

Logo

Logo is an interactive computer programming

language easily used by young students. It was developed by Dr. Seymour Papert at the Massachusetts Institute of Technology in the late 1970's. Papert is a computer scientist who has studied child development for many years. His work is based on the studies of his colleague, Jean Piaget, noted child-development expert. Papert combined his scientific skills with Piaget's theories on how children think and learn to create a software program that enables children to use programming language (Torgerson, 1984).

Maddux (1984) pointed out that Logo is different than other programming languages because it can be used with very little knowledge of computer language. The geometrical component of Logo is known as Turtle Geometry. The turtle is the cursor by which the user points and moves within Logo. Only a five or ten-minute presentation is required to introduce the four basic commands for turtle movement. The commands are used to create and manipulate graphics, geometrical shapes, and designs, which are carried out by a triangular shaped cursor called the turtle. The turtle's distance and angle are determined by the numerical inputs placed after the direction commands. In the immediate mode, children learn to create

designs, drawings, and geometric figures instantly. Children type the command and press the **ENTER** key which moves the turtle. Once the student has mastered the immediate mode, the student can advance to the next level, the program mode. In the program mode, the commands are no longer carried out individually. A series of commands are written, then the **ENTER** key is pressed and the command program is executed on the monitor. In addition, Maddux pointed out that Logo provides immediate feedback, which allows students to correct and learn from their errors, and to exercise their self-correcting and problem-solving skills. Students with short attention spans can benefit from Logo because they can work at their own pace.

Logo provides students with a variety of learning strategies. According to research done by Emihovich and Miller (1988), this can be important in educating minority children. Minority students find success because they control the program which, in turn, allows them to master their environment. This study showed that minority students often have different learning styles based on a language socialization style that is relational rather than analytical. These two styles are opposites of each other in many

ways. The analytical style is learned through spoken and written language whereas the relational style is learned through people versus things. Many minorities perceive the whole not the parts, use inferential reasoning rather than deductive or inductive reasoning, accuracy versus approximation, and nonverbal versus verbal communication. Another discovery by Emihovich and Miller was that students, especially minority students, can also acquire metacognitive skills which are rarely met in the regular classroom. Planning the turtle's movements provides students with experience in how they think and learn. This higher-level thought process applied to a concrete object teaches them content, thinking styles, and behaviors needed for academic success. In this study comparing minorities to others using computer-aided instruction and Logo, minorities did not do as well in the CAI conditions but did out-perform others when using Logo.

Mathematical Understanding

Researchers Kull and Carter (1990) found that Logo enhances children's mathematical understanding. Students can explore numbers and number relationships by using the wrapping component of Logo. Wrapping in

Logo occurs when a large number is entered into the computer, moving the turtle off the screen and back again as many times as commanded to produce a screen wrap. Young students are unable to appropriately associate numbers with their value. Students discover number relations by finding that if a larger number is entered into the computer, the turtle wraps longer and fills up the screen more than if a smaller number is entered. The children construct these wraps and determine that numbers represent a relational amount of some thing. After discovering number relation, students began to predict what will happen on the screen with numbers they choose to input.

Using mathematics with Logo leads to geometry. Students practice and simulate spatial relations, learning to repeat and rotate geometric figures on the screen. Battista and Clements (1991) suggested that illustrating spatial imagery is important in geometric problem solving because it involves thinking about properties of figures. Determining how to recognize geometrical figures in their tilted forms develops students spatial imagery and visual reasoning.

Torgerson (1984) noted that Piaget's research stressed the necessity of student involvement in

physical manipulation of objects to build intellectual structures. Children need to interact with their environment to understand spatial relations. This is accomplished when students act out the turtle's movements physically. The creating of geometrical shapes and designs provides practice in left, right, forward, and backward directions once they have developed the concepts of spatial relations.

Researchers Clements and Battista (1990) investigated the changes in children's mathematical knowledge that result from learning Logo. They concluded that understanding of geometric shapes was enhanced. They also concluded that children's ideas about mathematics became more sophisticated. After 40 sessions of Logo, children's comprehension of angles, angle size, rotation, and properties of shapes were superior to that of the comparison group.

Creativity

Silvern (1988) points out that problem-solving strategies and play facilitate creative thinking. Through play, children transform objects into real-world ideas. Constructive play is defined as using ordinary objects and imagination to create a new product. Painting, drawing, and building blocks are

all forms of constructive play, but a child does not have to think about creating with them. Using Logo, the child must think creatively because a set of instructions must be followed or created. Through constructing and transforming original instruction sets, children can develop and express creative thinking.

Clements (1991) corroborated these findings when his Logo group significantly outperformed other groups in creativity training studies. Third-grade children were able to create complex projects by combining an entire page of shapes into one drawing. Their drawings were more complete, more original, more sophisticated graphic representations than the control groups. According to his study, Clements determined that this was probably because they learned procedural thinking when using Logo.

Teaching Strategies

Keller (1990) states that the proper Logo environment is critical for student learning. Her review of current studies has shown that structure must be present in the Logo computer lab. However, the amount of structure for optimal learning has not been determined. For example, if the environment is

too loosely or too tightly structured, teaching becomes ineffective. When teaching Logo, it has been proved that the teacher plays an important role. Mediated Logo instruction has been the most successful in teaching students. Such teaching involves thinking processes rather than the product. Keller uses a four-step sequence to guide students: query, coaching, reflection, and recording. In the query approach, the teacher will ask questions to lead students to locate and identify the bug, or problem, (What did you tell the turtle to do?). In the coaching approach, the teacher prompts the student by asking (What did the turtle do?). In the reflective stage, the teacher will ask questions that remind the student to locate the cause of the problem and to solve it using past experience from similar situations (What did you want it to do? How could you change your procedure?). In the recording approach, students write down different types of errors found and formulate rules to correct them. This instruction allows the student to reflect, think, and solve problems, then apply them to new situations. This transfer of learning is a higher-level thinking skill that carries abstractions from one context to another.

Since most computer labs have limited resources, educators are often forced to pair students on the computers. In the Logo environment, this is beneficial for students and teachers. Studies show that as students confront and resolve conflicts with each other, they develop higher forms of reasoning and enhance their cognitive development. It has been observed that students who acquire the concepts quickly will peer tutor a partner. Even though one student may actively teach the other, at the end of Keller's (1990) study, both students manipulated the turtle better when working cooperatively and exchanging ideas equally. With peer tutoring, the teacher became an observer and the students communicated with each other and fed off of each other's creativity. Both active and passive students built self-confidence. The high-ability students reinforced their own learning and helped the lower-ability students accomplish a task which may not have been possible when working alone. When given a choice to work alone or with a partner, students chose to work in pairs (Keller 1990).

Solution Strategy

After evaluation of the research and the

guidelines presented at the Logo inservices, the author prepared weekly lesson plans based on the inservice materials. The author taught the Logo computer program to the target second grade class so that the students would become proficient in Logo and increase their awareness of mathematical concepts.

Specifically, in a 12-week period, the class attended computer lab at least 40 minutes per week as advised by the district. Using Keller's four-step teaching strategy, the author used pre-lab activities in the classroom to introduce Logo concepts, followed up with hands-on experience in the computer lab. Mediated instruction was provided by the teacher to stimulate higher-thinking skills and increase student's problem-solving abilities. Methods included exploration and discovery, guided practice, peer teaching, and cooperative learning. District mandates were followed and the Curriculum Essentials Framework objectives (Appendix A:33) for second grade were met.

CHAPTER III

Method

The following implementation method based on the solution strategy was used to develop student understanding of Logo over a 12-week period. The target group attended the school's computer lab two hours per week during which time all students had access to the computers and Apple Logo II. Students worked on projects both individually and cooperatively.

Phase One (3 weeks)

The initial introduction of the program functions was in the classroom. During this time, students were introduced to the basic Logo commands through games and kinesthetic activities such as treasure hunts, human mazes, and Follow the Leader. Each student was expected to have full knowledge of the basic turtle movements and was expected to kinesthetically act them out in class.

When students understood the turtle commands, they operated the turtle on the computer. First, students experimented with the turtle, discovering the

effect of each command on the turtle's movement. Next, the students practiced the commands by moving the turtle through mazes placed on the computer screen. Students had to employ problem-solving and estimating skills to accomplish this task. Students explored with Logo and made a simple line design. Each student had an opportunity to operate and experiment with each introduced function or functions on the computer. Students worked alone at the computer during this time. Students were required to complete four mazes that were progressively more difficult and were given a Phase One unit exam (Appendix C:38).

Phase Two (3 weeks)

Students were introduced to Turtle Geometry. The initial introduction was in the classroom where the definitions of geometrical shapes (square, rectangle, and triangle) were explained. Students were introduced to four more commands to aid them in manipulation of the turtle.

In the computer lab, students constructed a square, rectangle, and triangle in various sizes and constructed each from different starting points. They continued exploring and creating various designs, patterns, and roads with geometrical shapes. Students

began to record their commands, keeping a written record for future use. The students worked in pairs during this phase. Students were required to create a face on the screen using squares, rectangles, and triangles, and to create a scene including a house and tree using only the three shapes taught in this phase. Students were given a written unit exam on Phase Two objectives (Appendix D:40).

Phase Three (4 weeks)

Students were introduced to problem-solving activities. Students wrote a sequence of commands to construct a given figure. Students were required to discover and correct an error in logic when given a list of commands. Students were expected to read a list of commands and visualize what the turtle would do. The initial instruction was in the computer-lab. Students were given an opportunity to solve problems with logo by trial and error, peer interaction, and discovery. Students worked in pairs most of the time. Written records of their commands continued to be part of the lesson.

Color commands were introduced during this phase. The color commands were explored as children discovered different effects on designs and pictures.

Students continued to explore, experiment and record on their own. Students were required to complete three task sheets in the computer lab and were given a unit exam over Phase Three (Appendix E:43).

Phase Four (2 weeks)

Students were introduced to the program mode and the Logo TO command. The initial introduction was in the classroom with preparatory activities. The concepts were then explained in the computer lab using Logo. The students wrote a simple program using the TO command to create a geometrical shape. The students wrote a simple program using the TO command to create a line design. Students continued to explore, experiment, and record during this time. The unit exam for Phase Four consisted of a hardcopy of a final student-created, computer programmed picture.

CHAPTER IV

Results

The level of success in the Logo program was examined through student use of Logo on a weekly basis and testing at the end of implementation of each phase. Student achievement of the project objectives was determined by the following methods of evaluation and results were tabulated.

Phase One

Students were able to demonstrate understanding of basic turtle movement by kinesthetically following student-directed turtle commands in the classroom and by successfully completing a treasure hunt which required the students to follow written turtle commands. In the computer lab, 76 percent of the students were able to successfully maneuver the turtle through the four progressively-difficult mazes. The non-English speaking students had difficulty as they confused directions, such as forward with up, as did special education students. More time would be needed to meet their special needs.

Students were given a written exam at the end of

the phase. The scores were as follows: nine students received 90 percent, seven students received 80 percent, six students received 70 percent, five students received 60 percent, and two students received 50 percent.

On Question One of the Phase One unit exam (Appendix C:38), 90 percent of the students were able to successfully match Logo commands to turtle movement. Ninety-seven percent answered Question Two correctly, indicating that most students knew which command was needed to turn the turtle the correct direction. Ninety-three percent answered Question Three correctly, indicating that most students knew which commands were needed to move the turtle forward and backward. The maze on Question Four was the most difficult for students to answer. Accordingly, points were lost on this question by students who were unable to write complete directions to guide turtle through the maze.

This Phase was considered to be a success because 75 percent of the students scored 70 percent or higher on the Phase One unit exam (Appendix C:38).

Phase Two

Student's abilities to successfully construct

geometrical shapes such as squares, rectangles, and triangles were evaluated by observation in the computer lab. Ninety-three percent of the students could construct squares of varying sizes, 97 percent could construct a right triangle (using the HOME command), and 83 percent could construct rectangles. These shapes were constructed from various starting points on the computer screen.

Students were given a written exam at the end of this phase. The scores were as follows: eight students received 90 percent or higher, ten students received 80 percent, seven students received 70 percent, and four students received 60 percent.

On the Phase Two unit exam (Appendix D:40), only 65 percent of the students matched all commands with turtle movements correctly. Students had been introduced to new commands. Some students had not yet mastered these commands. One-hundred percent of the students correctly identified the geometric shapes on Question Two, and on Question Three, 100 percent identified the correct commands to construct a square. On Question Four, 90 percent of the students identified the commands to construct a triangle. On Question Six, 72 percent of the students answered

correctly indicating mastery of the pen up command. Question Seven was answered correctly by only 28 percent of the students. No explanation can be given for this result, since it involved the show turtle command which students frequently used in the computer lab. Students may have misunderstood the question. Eighty-three percent of the students answered Question Eight correctly, indicating mastery of the clear screen command.

This Phase was considered a success because 86 percent of the students scored 70 percent or higher on the Phase Two unit exam (Appendix D:40).

Phase Three

Eighty-six percent of the students were able to successfully identify errors in written computer programs in the classroom. When given programs containing errors in the computer lab, 83 percent of the students were able to use problem-solving ability to correct their assigned computer programs.

Students were given the exam at the end of the phase. The scores were as follows: eight students received 90 percent or higher, six students received 80 percent, seven students received 70 percent, eight students received 60 percent or below.

On the Phase Three unit exam (Appendix E:43) Question One, which was a cumulative review of the commands from each phase, was answered correctly by 100 percent of the students. Questions two through four indicated that 72 percent of the students understood problem solving skills related to problems in Turtle Geometry.

This phase was considered a success because 72 percent of the students scored 70 percent or higher on the Phase Three unit exam (Appendix E:43).

Phase Four

Eighty-three percent of the students successfully wrote a simple program using the TO command in the computer lab. A variety of geometric shapes were constructed. The geometrical shapes, which were defined by the TO command, were rotated to create a design. Students were required to supply a hardcopy of a student-created programmed picture using the TO command for their unit exam at the end of the phase. Sixty-six percent of the students were able to satisfactorily complete their picture.

This phase was not quite considered to be a success because 66, rather than 70, percent of the students completed the exam satisfactorily. Since

these students had no previous knowledge of Logo from their first grade classrooms, the percentage of students completing the assignments successfully is expected to increase next year with the introduction of E-Z Logo in first grade. All four ESL students were among those who scored lower than 70 percent on the unit exams. This was probably because the ESL students did not always attend computer lab and often missed the in-class instruction due to the pull-out nature of that program.

CHAPTER V

Recommendations

It was recommended to the principal that implementation of this program be continued in the target second grade the following school year. This author further developed lesson plans and activities to coordinate with math lessons and other cross-curriculum objectives. The writer also plans further training in and investigation of other Logo materials and other aspects of the Logo program.

This study was made available to other teachers and administrators throughout the district. It is also available to any educator or administrator who requests it.

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Appendices

Appendix A

Curriculum Essentials Framework

SCOPE AND SEQUENCE COMPUTERS K-8

STRAND ONE: Learning About the Computer (Keyboard, Computer Operation, Terminology)
EXPERIENCES

It is essential for students to:	K	1	2	3	4	5	6	7	8
1.1 locate specific keys on the keyboard.	I	I	D	T	T	T	T	T	T
1.2 identify the cursor location on the monitor.	I	I	D	T	T	T	T	T	T
1.3 touch any identified key using fingers of correct hand on appropriate side of keyboard.	I	I	D	T	T	T	T	T	T
1.4 demonstrate correct finger placement on home row of the keyboard.		I	I	D	D	T	T	T	T
1.5 demonstrate keyboarding skills using a typing program.			I	I	D	D	D	T	T
1.6 identify parts of a computer system.	I	I	D	T	T	T	T	T	T
1.7 follow instructions to run a program.	I	I	D	T	T	T	T	T	T
1.8 describe proper care of computer-based equipment.	I	I	D	D	D	D	T	T	T
1.9 describe proper care of handling disks.	I	I	D	T	T	T	T	T	T
1.10 follow correct sequence to load program when system is turned off (cold boot).	I	I	D	T	T	T	T	T	T
1.11 follow correct sequence to load program when system is on (warm boot).	I	I	D	T	T	T	T	T	T
1.12 define computer operation terms.	I	I	I	D	T	T	T	T	T
1.13 define word processing terms.			I	D	D	T	T	T	T
1.14 define Logo terms.	I	I	I	I	D	D	T	T	T

STRAND TWO: Using the Computer as a Tool (Applications, Problem Solving)
EXPERIENCES

It is essential for students to:	K	1	2	3	4	5	6	7	8
2.1 give precise multistep oral directions for a task that has been analyzed.			I	I	D	D	T	T	T
2.2 give precise multistep written directions for a task that has been analyzed.				I	I	D	T	T	T
2.3 solve problems by demonstrating the basic turtle movement Logo commands.	I	I	D	D	T	T	T	T	T
2.4 solve problems by writing the Logo commands to draw a geometric figure.		I	D	D	T	T	T	T	T
2.5 solve problems by creating a Logo design using the REPEAT command (Total Turtle Trip).				I	I	D	D	T	T
2.6 solve problems by creating a Logo procedure.				I	I	D	D	T	T
2.7 solve problems by revising a Logo procedure.					I	D	D	T	T
2.8 save text that has been entered using a word processing program.	I	I	D	T	T	T	T	T	T
2.9 load text that has been saved using a word processing program		I	I	D	T	T	T	T	T
2.10 print a hard copy of text using a word processing program.		I	I	D	T	T	T	T	T
2.11 edit text using a word processing program.			I	I	D	T	T	T	T
2.12 use computer-based technologies to collect data.			I	I	I	D	D	T	T
2.13 use computer-based technologies to analyze data.				I	I	D	D	T	T
2.14 use computer-based technologies to create an end product.			I	I	D	D	T	T	T

Key: I = initial experiences, D = developmental experiences, T = transfer experiences.

Appendix B

Pre-Study Survey and Questionnaire

PRE-STUDY SURVEY Grade Level _____

What would you like to see change/improve in computer education in our school? Please check your preferences.

_____Inservices on how to use the computer lab and software

_____A curriculum to teach keyboarding (all grade levels)

_____A curriculum to teach logo (all grade levels)

_____Training films for students on how to use software

_____Training films for teachers on how to use software

_____More social studies software for your grade level

_____More science software for your grade level

_____Software to help ESL students learn English

Questionnaire:
Please circle your response.

1. I currently use the computer lab an average of:

1/week 2/week 3/week 4/week 5/week

2. My students mainly use the lab to practice:

math skills keyboarding word processing logo

language arts programming data base other

3. I teach keyboarding: yes no

4. I teach logo: yes no

5. I use and create data bases yes no

6. I use and create spreadsheets yes no

7. I use a word-processing program yes no

8. I use a publishing program yes no

9. Rate your "comfort level" with computing, (5 highest)

0 1 2 3 4 5

10. Rate your "comfort level" with teaching logo.

0 1 2 3 4 5

11. I think teaching logo will benefit my students.

0 1 2 3 4 5

Appendix C

Phase One Exam

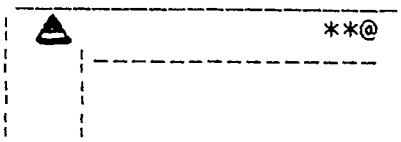
Phase One Exam Name_____

1. Match the command letters to the commands.

FD	Left
BK	Forward
RT	Clear screen
LT	Show turtle
CS	Right
ST	Back

2. What command would turn the turtle toward the bug?

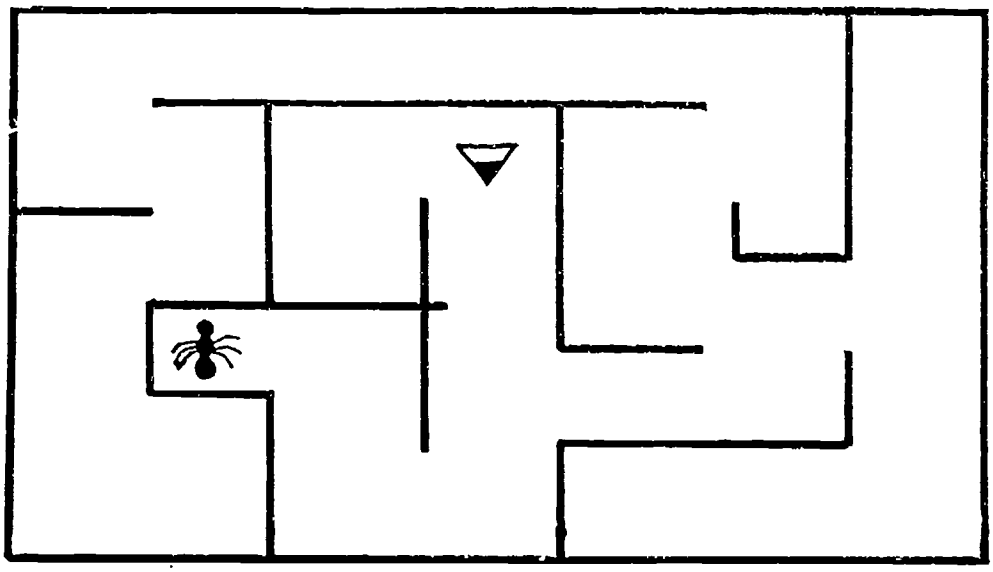
RT 90 or LT 90



3. What command would you use to move the turtle?

_____

4. Write the commands to get turtle through the maze?



Appendix D

Phase Two Exam

Phase Two Exam Name _____

1. Match the command letters to the commands.

PU	Center turtle
PD	Hide turtle
HT	Show turtle
HOME	Pen up
ST	Clear screen
CS	Pen down

2. Write down the name of each shape.

_____ _____ _____

4. Circle the Logo commands that make a square.

FD 30 RT 90 FD 30 RT 90 FD 30 RT 90 FD 30 RT 90	or	FD 30 RT 90 FD 60 RT 90 FD 30 RT 90 FD 60 RT 90

5. Circle the commands that make a triangle.

FD 30 RT 90 FD 60 RT 90 FD 30 RT 90 FD 60 RT 90	or	FD 60 RT 90 FD 60 HOME

6. If you wanted to move the turtle without drawing a line, what command would you use? _____

7. If the turtle was hidden, what command would you use to get it back? _____

8. If you wanted to erase the screen and start over, what command would you use? _____

Appendix E

Phase Three Exam

Phase Three Exam Name _____

1. Match the letter commands with the commands.

SETBG	Hide turtle
SETPC	Pen up
PD	Background color
BK	Left
RT	Pen down
HT	Pen color
PU	Right
LT	Back

2. Write the commands for a square that is 50 turtle steps.

3. Read the commands and picture it. Find the mistake cross it out and write the correct command.

Square

```
RT 90
FD 50
RT 90
FD 50
RT 90
FD 50
LT 90
FD 50
RT 90 _____
```

Triangle

```
FD 70
RT 90
FD 50
LT 90
_____
```

4. Using your pencil and ruler, follow the commands to make a design.

```
FD 05
BK 05
LT 90
FD 05
RT 90
FD 05
END
```

Attachments

PAT A. DISKIN ELEMENTARY SCHOOL
4220 RAVENWOOD DRIVE LAS VEGAS, NEVADA 89117 799-5930
CHUCK SANTELMAN, Principal 799-5925 FAX

To Whom It May Concern:

This letter is to inform you and the NOVA administration that there is a need at Pat Diskin Elementary School to have students in-serviced on the "Logo Computer program".

As requied in the Clark County School Districts' Curriculum Essential Framework, computer technology and the teaching of logo is required for students in grades K-5. Monica Borer, as part of her master's program, will address this need along with developing programs for students. If you have any questions please feel free to call us at (702) 799-5910.

Sincerely,

Chuck Santelman
Diane Reitz

June 1, 1993

To Whom It May Concern:

Monica Borer is a second grade class-size reduction teacher a Pat A. Diskin Elementary School. I am aware that Mrs. Borer has participated in the Logo inservices and has received the materials necessary to instruct her students in the Logo Programming Language. Since the Clark County School District mandates the Logo Programming Language Program to be taught in grade levels kindergarten through fifth, the implementation of the Logo Programming Language in the classroom is a much needed project.

Sincerely,

Cindy Buterbaugh

Cindy Buterbaugh
Second Grade Teacher