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Two Instructional Approaches - The Electric Maze And The Direct Instructional Model-For Teaching At- Risk Kindergarten Students Alphabet Letter Names

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TWO INSTRUCTIONAL APPROACHES – THE ELECTRIC MAZE AND THE DIRECT INSTRUCTIONAL MODEL – FOR TEACHING AT- RISK KINDERGARTEN STUDENTS ALPHABET LETTER NAMES

An Abstract of a Thesis

Submitted

In Partial Fulfillment

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ABSTRACT

This paper compares the effectiveness of two instructional approaches for teaching the names of alphabet letters to 5 and 6 year-old elementary students who were at risk for academic failure. The literature review examines investigations which had previously addressed the direct instructional model and parameters of active learning. In this context, a variety of perspectives regarding active learning are reviewed followed by a finer examination of self-corrective materials which was a unique component of the active learning paradigm used in this investigation.

Nine ($\underline{N} = 9$) elementary children were taught the names of five randomly chosen letters (upper and lower case) via the direct instructional technique and five randomly chosen letters (upper and lower case) incorporating an active learning approach, utilizing an electronically designed maze. The Electric Maze (six feet by eight feet) was composed of 24 one foot by one foot squares each of which could be programmed to beep if stepped upon. A single subject counter balanced repeated measures research design was used to determine the effectiveness of the two differing interventions in teaching alphabet letter names to each child in 10 minute daily sessions. Additionally, a nonparametric statistical test, the Wilcoxin Matched-Pairs Signed-Ranks Test (Siegel, 1956), was implemented to see if the direct instructional approach was statistically more effective in teaching alphabet letter names (alpha .05 level) than the active learning approach which incorporated the Electric Maze to provide immediate feedback to the learners regarding the correctness of their responses.

Results from the Wilcoxin Matched-Pairs Signed-Ranks Test indicated that the direct instructional technique was significantly more effective than the electric maze ($\underline{T}$ = 7) at the alpha .05 level. Data compiled and charted for each student demonstrated that for seven of the nine students, the direct instructional technique was more effective in teaching them to recall alphabet letter names. In contrast, two of the nine students appeared to learn more alphabet letter names when the active learning Electric Maze was incorporated. These findings support the value and importance of teachers providing diverse instructional paradigms so students have the opportunity to learn under the conditions which are most conducive for their optimal learning. Further, the importance of students identifying the conditions which best promote learning for themselves is an important skill if they are to become self-determined learners. Strengths and limitations of this investigation, as well as recommendations for further research, have been included.

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has been approved as meeting the thesis requirement for the

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CHAPTER 1

INTRODUCTION

Determining the effectiveness of differing instructional strategies with diverse learners is a challenge to educators. A perusal of any methodology textbook in a particular content area provides a vast array of recommended strategies and techniques for teaching new information to students. For example, the frequently used textbook Teaching Elementary Reading by Robert Karlin (1975), identifies a vast array of basal reading programs, multimedia aids or individualized programs to name just a few of the methods that teachers might incorporate into their curriculum for teaching reading. In Approaches to Beginning Reading, Aukerman (1971) describes over one hundred differing ways to teach the reading process to children. The techniques use a diverse array of techniques from a letter/color paired association orientation to a rebus letter combination. Clearly, the vast array of choices and options can create a dilemma for the teacher in determining which approach or orientation to the reading process is most likely to be effective for each child with differing learning strengths and limitations.

One important prerequisite of the reading process is that the children must be able to identify the individual letters composing the words they read. This particular research project focuses on one single aspect of the reading and spelling process: that of letter name recognition. In this investigation, the effectiveness of two approaches for teaching children how to recall the names of alphabet letters was compared.

Statement of the Research Question

Will young children who are at risk for academic failure learn the names of the alphabet letters more quickly when instructed by the direct instruction method or when instructed by incorporating a self-correcting Electric Maze which requires the learner to hop from one letter to another letter as directed by the teacher or a spinner wheel?

Definitions

For the purposes of this paper, active learning is defined as a kinesthetic approach to learning where students are moving around within the learning environment (Barbe & Swassing, 1979). Related to this definition, is a tactual or multisensory approach to learning where students are encouraged to have hands-on experiences with objects or ideas (Barbe & Swassing, 1979). For this particular investigation, the author defined the active learning technique when contrasted to the direct instructional paradigm as a learning technique which required a greater expenditure of calories by each individual during engagement of the instructional lesson. A point-by-point analogical comparison of the two differing instructional techniques that were compared in this investigation is available on Table 1.

Direct instruction is a systematic method for presenting material in small incremental steps of difficulty, pausing to check for students' understanding, and achieving active and successful participation from all students. According to Rosenshine (1986), the following seven steps compose the direct instructional sequence:

1. Direct the student's attention to the present task.
2. Review relevant past learning.

3. Identify the goal of the lesson by referring to what is being learned, why it is important, and how it relates to other learning.

4. Clearly and articulately model and describe the skill that is to be learned (direct teach is applied here, ask questions to verify student's understanding, may need to repeat this step several times).

5. Guided practice is used to prompt for correct responses and prevent incorrect responses (repeat until student demonstrates high level of proficiency).

6. This is followed by independent practice and evaluation, which are utilized to check for skill mastery (monitor and provide feedback for each response).

7. Closure, the final step, may be obtained by reviewing what was covered, discussing future lessons, or providing independent work or homework assignments.

The Electric Maze is a piece of portable electronic equipment comprised of a three by eight foot flexible carpet grid with pressure sensitive switches on 24 squares (each containing an upper or lower case letter) which had been programmed to beep when stepped on by a student. Each student was asked to hop to the square that contained the designated letter and then state the letter on which he had hopped (see Appendix A).

This paper incorporates a technique which verifies or reinforces a correct response by providing immediate feedback where the student can correct himself immediately and practice only the correct responses without reinforcing an incorrect answer (Mercer, Mercer, & Bott, 1984). In this particular investigation, the Electric Maze was utilized as a self-corrective material that provided immediate feedback to the student.

Definition of Variables

The independent variable in this investigation was the specific technique used to teach the names of the alphabet letters (viz., the direct instruction procedure or the self-correcting Electric Maze procedure). The dependent variable was the number of letters the students were able to identify daily after a ten-minute instructional session.

Purpose

The purpose of this project was to compare two instructional strategies regarding their effectiveness to teach elementary students who are at risk for academic failure the alphabet letter names. The two instructional strategies compared were direct instruction and a self-correcting Electric Maze. This project analyzed the results from two differing approaches. First, a single subject counter-balanced repeated measures design was incorporated to determine the effectiveness of two differing interventions for each child. The Wilcoxin Matched-Pairs Signed-Ranks Test was also applied to determine if differences across the two instructional techniques were significant in helping children master the names of alphabet letters, both upper and lower case.

CHAPTER 2

LITERATURE REVIEW

Introduction to the Literature Review

The focus of this study was to compare the effectiveness of two instructional strategies for teaching the names of alphabet letter names to elementary students who were at risk for academic failure. The two approaches investigated were direct instruction and active learning. Therefore, an examination of the literature regarding the direct instructional model has been provided. Active learning is a broad area, therefore, a variety of perspectives were addressed, in addition to the description of active learning applied throughout the investigation. Because self-correcting materials were utilized in the active learning technique, the literature review addressed the importance of immediate feedback. Immediate feedback is also applied during the direct instructional model, but at a lesser degree.

Direct Instruction

Direct instruction is a systematic method for presenting material in small incremental steps of difficulty, pausing to check for students' understanding, and achieving active and successful participation from all students. This method is most effective when teaching concepts that are well structured and build on specific cumulative increments of learning. Consequently, Rosenshine (1986) has targeted this method as most applicable when teaching learning associations frequently required in mathematical activities, reading decoding procedures, or repetitive rote sequences (e.g., setting a table, learning to spell a word, etc.). For example, reading decoding activities or writing activities such as

forming manuscript letters tend to yield themselves well to the direct instructional model while reading comprehension or developing the skills to discuss social issues would not be viable content for using this method (Spiro & Meyers, 1984).

The direct instructional model utilizes effective teaching through a systematic approach of teacher directed instruction involving three major components: direct teach, guided practice, and evaluation. Direct teach occurs when the teacher directly models the skill that is to be learned. Guided practice involves a guided or controlled environment where the students receive guidance or assistance until the students have achieved a desired level of proficiency. Evaluation is accomplished when the teacher carefully monitors the students' performance. Seven sequential components have been delineated and are referred to in the literature as composing elements included in the direct instructional model and are described below (Rosenshine, 1986).

First of all, gaining learners' attention is critical for influencing student achievement. The teacher must direct the students' attention to the present task (Rosenshine, 1986). This can be done through vocal intonation, facial expression, or using interesting instructional material. Incorporating an element of surprise, mystery, or intrigue can further enhance learner attention to the activity (Becker, Engleman, & Thomas, 1971). Bringing materials out of an attractively decorated bag or giving clues to the learners and having them guess what the lesson might be about are examples of ways to entice the attention of the learners.

The second step is to review relevant past learning. When new information is linked to previous knowledge, students can achieve an optimal level of learning. It can help to

place learning in a context that is meaningful to the learners. Review can occur in many forms. For example, teachers may guide the student to think about past assignments or systematically review prerequisite skills (Rosenshine, 1986).

Identifying the goal of the lesson is the third step. When the teacher refers to what is being learned, why it is important and how it relates to other learning, lower-achieving students learn best (Rosenshine, 1986). The goal should be clearly and briefly stated followed with abundant examples of ways the skill is relevant in daily activities (Rosenshine, 1986).

The fourth step in the direct instructional model sequence requires the teacher to directly model the skill that is to be learned. This, in itself, is direct teaching. Effective teachers demonstrate the skill and verbalize how to perform the task several times prior to requiring the students to perform the task. Frequently, teachers exaggerate the response to be learned in the direct teach demonstration and provide mnemonics or other additional cueing systems to enhance the probability that the learners will be able to perform the skill. For example, in teaching students to print the number "5," the teacher might say "Mr. 5 with his round fat tummy. . ." as she makes the first part (ƽ) of the numeral, and continues, ". . . put his hat on and he looks so funny!" as she completes the numeral "5" (viz., adds the vertical line to the numeral stem). Classrooms utilizing instruction in small steps show higher student success rates (Rosenshine, 1986). Additionally, sometimes teachers have students think aloud or talk to themselves throughout the performance of the tasks. When the teacher models the task, it should be very clear, yet exaggerated to encourage or require the students to pay attention to critical

features of the task. When teaching difficult concepts, teachers are encouraged to ask questions to verify students' understanding and increase students' attention to the task. During the direct instruction component, the most important component of the sequence, it may be necessary to repeat the modeling or demonstration several times (Rosenshine, 1986). Success for students in the next step, guided practice, is dependent on the effectiveness of the direct teach component.

The fifth step encourages the teacher to practice the skill under guided and controlled conditions to ensure success on the part of the learners. Preventing students' incorrect responses and eliciting multiple correct responses creates the optimal learning environment (Rosenshine, 1986). During this step of the direct instruction sequence, the teacher continues to prompt the correct response by providing the appropriate guidance and assistance until the students are able to demonstrate the desired level of proficiency. Additional guidance can be provided by the teacher if needed to the extent that the teacher and students do the task together (Rosenshine, 1986). For example, the teacher may actually place her hand over the students' to guide the response when the students are learning to form manuscript or cursive letters. The teacher begins to fade the physical assistance as the students become more and more successful.

During the next sequence in the model, two components, independent practice and evaluation, are utilized to check for skill mastery. Once the students have demonstrated a desired level of skill performance, the students must repeat the tasks or activity without supervision or prompts from the teacher. At this time, the teacher carefully monitors the students' performance. At first, each response given by the students is followed with

feedback provided by the teacher until the students are consistently responding correctly. The students are then provided with a number of successful repetitions they can perform on their own (Rosenshine, 1986).

Closure is the final step of the direct instructional model. Closure is accomplished by reviewing with the students what has previously been addressed in the lesson. Additionally, the teacher may discuss what the next lesson will cover and again provide the context of how this skill is important in daily activities. Providing independent work or homework assignments also can provide effective forms of repeated practice and closure (Rosenshine, 1986).

Direct Instructional Research

Even though the literature supports the effectiveness of direct instruction, particularly in the achievement of lower-ability students, questions about this method have been raised. Leinhardt, Bickel, and Pallay (1982) argued that students must spend time reading orally and silently if they are to learn to read rather than breaking the reading process down into such minute units. Students must spend time discussing or writing about the content that they read about if they are to make the reading process meaningful.

Peterson (1979a; 1979b) also questioned the effectiveness of direct instruction. While he concurs that direct instruction may be effective for promoting achievement on standardized tests in reading and math, these tests primarily assess lower-level skills in these areas and are not valid indicators of complex, higher order learning. In short,

Peterson (1979a; 1979b), suggests that direct instruction is not the most effective method for promoting students' achievement of higher-cognitive skills in reading and math.

Direct instruction may be necessary, but not sufficient for reading or math achievement for students developing higher-level skills. Higher-order thinking in reading and math may require a less direct instructional approach that transfers some of the burden of teaching and learning from the teacher to the student. Concomitantly, as a result, this method can promote greater student autonomy and independence in the teaching-learning process (Peterson, 1986).

Although the effect sizes were small, Peterson (1979b) found that with more direct approaches of teaching (like direct instruction) students were more likely to perform slightly better on achievement tests. However, they did worse on tests of abstract thinking (viz., creativity and problem solving). Conversely, when less direct, more open approaches were used, students performed slightly worse on achievement tests, but tended to do better on creativity and problem solving (Peterson, 1979b).

Doyle (1983) argued that a certain degree of "unstructuredness" might be necessary even when teachers incorporate the direct instructional approach to determine whether students really understand how and when to apply their knowledge and skills. Doyle suggests that in some cases it may be necessary to allow students to experience the content for themselves. In this model of learning, students can invent procedures and construct knowledge structures of their own (Doyle, 1983).

It was concluded by Snow and Lohman (1984) that a more structured treatment might help less intelligent students. A structured approach may help students overcome

their lack of aptitude by reducing the complexity of the task being learned or by direct training of component assemblies required for performance of the task. They also discovered that structured treatments may either depress or nourish learning in higher ability students, or it may not affect learning at all (Snow & Lohman, 1984).

Similar conclusions were reported by Veenman and Elshout (1995) regarding the effectiveness of structured teaching for lower ability students. They concluded that a structured learning environment enhanced learning performance in students with low intelligence and a lower level of metacognitive skillfulness. Conversely, the structured environment interfered with learning of low intelligence students with a higher level of metacognitive skillfulness. The level of learning in higher intelligence students was not affected by a structured environment regardless of their level of metacognitive skillfulness (Veenman & Elshout, 1995).

A synthesis of intervention literature by Swanson (1999) focused on studies that included measures of word recognition and reading comprehension. Studies were selected when participants met two criteria. The first criteria required that the samples of "nonidentified" students with learning disabilities had a mean intelligence quotient (IQ) above 84 (or a reported average range based on standardized scores). In addition, the mean standardized reading score of the sample was reported to be at or below the 25th percentile. From these studies, it was determined from the meta-analysis that the performance of reading comprehension was positively influenced when a combined instructional model was used incorporating components of both strategy and direct instruction techniques (Effect size (ES) estimates (M = 1.15) exceeded Cohen .80 criteria

for substantive finding). Furthermore, the direct instruction-only model appears robust for word recognition strategies (ES estimates (M = 1.06) exceeding Cohen .80 criteria). It can be concluded from these results that the components of the combination model and the direct instruction-only model indicate that the "segmentation" component positively influenced the magnitude of treatment outcomes (Swanson, 1999).

The results of an additional meta-analysis indicated that when direct instruction and strategy instruction were applied to children and adolescents with learning disabilities, higher effect sizes emerged when compared to other approaches (Swanson & Sachse-Lee, 2000). Mean effect size scores were .91 for direct instruction, 1.07 for strategy instruction, .68 for remedial instruction (e.g., one-to-one-tutoring), and .59 for eclectic approaches (viz., using Cohen's (1988) threshold of .80 for a "large" effect). In addition, the most important variance (15% of the variance) related to high effect sizes came from studies incorporating instructional components of drill-repetition-practice-review (viz., foundation of the direct instruction model), segmentation, small interactive groups, and the use of strategy cues (Swanson & Sachse-Lee, 2000).

Active Learning

Many definitions and perceptions of the components of active learning are addressed in the literature. Some of these perspectives include kinesthetic styles and tactual or multisensory approaches of learning. Other perspectives focus more on active learning as students who are actively engaged in their environment. An additional type of active learning permits students to be involved in activities that require physical movement (i.e.,

utilization of increased caloric output). In contrast to active learning, passive learning is conceptualized as a child being a tabula rosa into which information can be poured.

Kinesthetic learners were identified by Barbe and Swassing (1979) as the students who are most likely to be successful if they do it first and read about it later. Kinesthetic (or active) learners are more likely to excel in sports as they would rather be active and moving around versus sitting and reading a book (Flaherty, 1992). Because kinesthetic learners prefer to be active and experience more success in active environments, they struggle to listen attentively and achieve when environments (viz., lectures) fail to provide movement or activity (Barbe & Swassing, 1979).

Related to the kinesthetic learners are the tactual learners or those who prefer a multisensory approach. Tactual learners often fidget with objects or ideas by trying them out, touching, feeling, or manipulating them. The tactual learners also lose interest quickly in lecture-type environments, which cater to the visual and auditory learners, as the tactual learners are not permitted to have hands-on experiences (Barbe & Swassing, 1979).

Several problems arise when teachers choose to lecture. Johnson, Johnson, and Smith (1991) speculated that with each minute that passes, student attention decreases. Lectures are geared towards auditory learning which promotes lower level learning of factual information. Additionally, lecturing assumes that all students learn the information at the same pace. Finally, it was reported that lectures were unappealing to most students (Johnson, et al., 1991).

Information was learned more successfully during lectures when a multisensory approach was incorporated. Pike (1989) reported that when teachers added visual materials to their lectures, student retention increased from 14 to 38%. This indicates that as more sensory stimulation is applied, learning and retention are likely to improve.

Materials designed for learners who prefer kinesthetic, tactual, or multisensory approaches are usually game-like and naturally motivating (Dunn & Dunn, 1978). These materials are designed to be attractive to students with the intention that they will persistently use the materials until they have achieved their outlined objectives. The materials may also be self-corrective with little structure (Dunn & Dunn, 1978).

Active learners are also characterized as students who are intellectually and actively engaged in their environment. Silberman (1996) defines active learners as students who use their brain to study, solve, and apply what they learn in a fast-paced, fun, supportive and personally engaging environment. In contrast, the direct instruction model does not necessarily support the incorporation of the active learning paradigm. The major emphasis in the direct instruction model is on the modeling and demonstration of a skill, and the provision of differential reinforcement to shape the targeted behavior to acceptable levels. The active type of environment usually involves moving around out of the seat and thinking aloud. In order to learn well, it helps when students are able to hear, see, ask questions, discuss, and most importantly "do it" by figuring things out for themselves (Silberman, 1996).

Because of the diverse perceptions of what active learning is and the conditions which constitute active learning, it is difficult to identify a concurrent view as to what

consists of active learning or what constitutes an example or non-example of active learning. For the purposes of this study, active learning, in contrast to direct instructional learning, is defined as a technique that requires a greater expenditure of calories for engagement in instructional activities on the part of the learner. An example of active learning in this investigation is when students hop from square to square on the programmed Electric Maze which clearly burns more calories in contrast to students sitting in a chair interacting with materials as portrayed in the direct instructional model.

Self-Correcting Materials

The Electric Maze is a device that emphasizes and utilizes active learning. With this piece of equipment, students can hop from one letter to another. In addition to active learning, the Electric Maze offers a unique feature of being self-corrective. The Electric Maze has been designed to be easily programmed by a teacher to buzz when a certain square is landed on by the students. This feedback immediately tells the students if they are correct or incorrect.

Feedback is an important component of the learning process. In most typical classrooms, students are given an assignment to complete, and the assignment is returned to the students the next day with the mistakes circled. According to Mercer, et al. (1984), this type of feedback does not promote optimal learning. First of all, the time lapse between completion of the assignment and feedback is too slow to be effective. Because a time lapse exists, students are not likely to utilize the feedback given to them several hours or days later to practice the correct responses. The correct answers are not immediately revealed to the student, and memory traces of incorrect responses go from

short term to long-term storage. If feedback is to promote optimal learning, it should be immediate (Mercer, et al., 1984). The feedback should also model the desired behavior. Finally, the feedback should be followed by students practicing the correct response to allow for maximum improvement (Mercer, et al., 1984).

Repeated practice in making errors is also reduced or eliminated when self-corrective materials are used. When immediate feedback is not provided, the students will continue to practice making the mistakes until the teacher corrects them at a later time. When immediate feedback is given, or self-corrective materials are used, the students correct themselves immediately and practice only the correct responses (Mercer & Mercer, 1978). Through the immediate feedback, the students are quickly able to see (or hear) which items need more practice. As a result, changes can be made immediately and the students can try again to get a correct response without reinforcing an incorrect answer (Mercer, et al., 1984).

In this study, the Electric Maze was an effective use of self-corrective materials as it provided immediate feedback. Because immediate feedback was provided, students were prohibited from repeated practice of incorrect responses. The correct responses could be modeled by the teacher, or the students may make another attempt at the correct response. Additionally, the correct response could be practiced repeatedly by the students for maximum improvement.

CHAPTER 3

METHODOLOGY

Applied Techniques for Teaching Alphabet Letter Names

Direct Instruction

This method for teaching the alphabet letter names incorporated seven steps from the direct instruction model. The direct instruction model is a systematic method for presenting material in small steps, pausing to check for student understanding, and achieving active and successful participation from the student (Rosenshine, 1986). Following are seven elements delineated by Rosenshine (1986) as the sequential components of teacher-directed lessons:

1. Direct the student's attention to the present task.
2. Review relevant past learning.
3. Identify the goal of the lesson by referring to what is being learned, why it is important, and how it relates to other learning.
4. Clearly and articulately model and describe the skill that is to be learned (direct teach is applied here, ask questions to verify student's understanding, may need to repeat this step several times).
5. Guided practice is used to prompt for correct responses and prevent incorrect responses (repeat until student demonstrates high level of proficiency).
6. Independent practice and evaluation are utilized to check for skill mastery (monitor and provide feedback for each response).

7. Closure, the final step, may be obtained by reviewing what was covered, discussing future lessons, or providing independent work or homework assignments.

When incorporating this technique, the teacher-selected materials may vary from a variety of manipulatives including but not limited to foam or magnetic letters, puzzles, flash cards, or stickers. For a list of available materials used during the direct instruction technique, see Appendix B. These materials may be embedded in a variety of games such as Go Fish, Treasure Hunt, Concentration, etc. The criteria for game selection were based on the criteria of repetitive practice (viz., the task of naming upper and lower case letters). Instruction was administered for each lesson following the direct instruction guidelines previously described. The student sat facing the teacher with the manipulative items between them.

Electric Maze

The other method for teaching alphabet letter names involved using the Electric Maze, which is an electronically programmable innovation of the classic maze. The Electric Maze is a piece of portable electronic equipment which is comprised of a six by eight foot flexible carpet grid with 48 squares that can be programmed to beep when stepped on, and a battery-powered programmable control with alarm module (see Appendix A). Pressure sensitive switches imbedded in the grid are programmed to activate or deactivate individual squares enabling the creation of innumerable configurations for various learning activities. The maze was designed for indoor use with 1 to 24 participants. Historically, the maze has been used predominantly in business and

industry focusing on problem-solving skills, interpersonal relationships, and team building exercises.

The Electric Maze was renamed the Magic Carpet by the author in order to increase its appeal to young children. It was believed by the investigator that the full six by eight foot carpet was too large an area for a five or six year old youngster to navigate. Therefore, the carpet was broken down into two separate three by eight-foot pieces, and only one eight feet piece of the equipment was used. Additionally, the carpet was modified for the current investigation by attaching strips of Velcro at the top of each carpet square so that laminated alphabet letters, which also had a Velcro strip attached to the back side of the letter card, could be attached to each square. In order to prevent "location" memorization of a letter, the letters were randomly moved around the carpet for each differing activity. Each laminated letter was made from a piece of poster board and cut to match the size of the squares on the carpet (viz., 10 inches by 10 inches). When playing a game, every square on the carpet could have a letter attached to it, or a square could be left without a letter if a reduction in stimuli was desired. Obviously, the fewer letters attached to the maze required fewer discriminations on the part of the participant. The same laminated letter squares were used over and over so the actual size of each upper and lower case letter remained constant. The Velcro attached to the back of each alphabet letter card enabled the teacher to easily rotate their position on the Electric Maze.

During the investigation incorporating the Electric Maze, students were told by the teacher to "jump" to a designated letter. If the child jumped (or stood on) the correct

letter a buzzing sound would occur informing the child he was correct. However, if the child jumped on the incorrect letter, no buzzing sound would be emitted from the carpet. The teacher would say "No, that's not a ___." (Name of alphabet letter previously delineated). The teacher would point to the correct square where the letter was depicted and the child would hop to it. The teacher would ask, "Now what letter is that?" The child would respond, the carpet would buzz, and the teacher would say, "That's right! That's a ___." Next, the teacher would either instruct the student to hop to a different letter on the carpet or to another square with the same letter. To prevent monotony, the teacher also used individually three by five by one inch brightly colored beanbag animals. The student could toss the beanbag animal to a letter, state the letter name on the square on which the animal landed (i.e., "little h") and then hop to the square to see if he was correct (viz., did the square buzz when stepped on). Another variation included a spinner incorporating the same colors as the animals. The teacher would pre-place an animal on individual letters. Next, the student would spin the spinner, identify the letter on the square where the animal with the corresponding color was, and then would jump to the letter to see if the square buzzed indicating the correctness of the response.

A Point by Point Analogical Systematic Comparison of Differences in the Two Methods

Because this investigation addressed the effectiveness of two distinct procedures to teach alphabet letter names, a point-by-point analogical comparison of the two techniques is provided in Table 1. This comparison makes it patently clear that each procedure consisted of distinctly different instructional procedures. If it is determined that one

Table 1

Comparison of Methodological Differences

Learning parameters	Teaching procedures	
Comparisons regarding	Direct instruction	Electric Maze
Space requirements	Small area with a table and 2 chairs	10 X 12 foot area on which to lay carpet
Physical movement required	Fine motor movement: roll dice or spin spinner	Gross motor movement: hop from a 1 X 1 foot square to another
Physiological involvement	Body generally positioned in chair with activities generally requiring hand and finger movement	Body in motion hopping from one square to another evolving in vestibular stimulation and increased pulse rate
Lesson sequence	Ideally consists of 7 well-delineated specific steps	Consists of practicing letter names by hopping from square to square
Corrective feedback	4 step correction procedure implemented 1. say "no" 2. repeat verbal cue 3. give enough assistance to enable student success 4. mild social praise	If an incorrect square is stepped on, the buzzer sound remains quiet, the student is told "no" by the teacher who then tells the student the correct square to step on
Degree of teacher involvement	Teacher structures lesson, provides "direct teach," and modifies number of practice trials based on student's success	Teacher programs instructional maze and determines number of practice trials with each letter

(table continues)

Comparisons regarding	Direct instruction	Electric Maze
Verbalizations by teacher	Many; conducts direct teach and provides learning supports as needed	Used to direct students to hop to letter; a "buzzer" provides correctness of feedback to student
Reinforcement	Teacher always provides differential feedback to student's response and praises response if correct (Yes, that's the letter __)	Teacher says, "You must have it right because it buzzed" or "What does it mean when the buzzer is quiet?"
Corrective feedback	Teacher provides corrective feedback and gives enough assistance to student to ensure he knows the correct response	The carpet provides corrective feedback; if response is incorrect, teacher directs student to hop to correct letter square
Manipulatives/Materials used	Varied daily with a wide variety of manipulatives depicting alphabet letter names	Used carpet daily, but varied manipulatives used to target differing letters (e.g., spinner, beanbag animals)
Attractiveness of materials	Very appealing: colorful and game-like with a variety of objects	Carpet: neutral gray, Letters: black and white, Beanbag animals and spinners: bright colors
Durability of materials	Wide range of durability depending on the item	Very durable and could be used indefinitely
Cost	Varies depending on type of manipulative (0 to $25)	$3,015 plus cost of added manipulatives
Storage	Varies depending on number and size of manipulative	2 X 2 X 4.5 feet space
Ease in obtaining materials	Easy: school supply store, discount store, or design own	Difficult: locate company, place order, wait for arrival

approach is superior to the other, all the collective components of that approach as delineated for each intervention will contribute to that difference.

Participants

UNI Faculty

A variety of professionals involved in this project. Dr. Donna Raschke, Department of Special Education at the University of Northern Iowa (UNI), five undergraduate students, and a graduate student submitted a proposal describing this investigation to the Undergraduate Research/Experiential Learning Program (at UNI). The proposal requested funding to implement the project and conduct the research. Funding was awarded for the purchase of books and literature addressing the two approaches, transportation costs, materials, supplies, compensation for undergraduate participation, storage containers, reward incentives, and encouragers and treats for meetings with teaching faculty. The Electric Maze had previously been purchased with resources on a differing project.

Project Coordinator

Sherry Jack, graduate student in School Psychology at UNI, was the project coordinator. Duties included, but were not limited to the following: meeting with the principal and four elementary teachers from Edison School, coordinating schedules, training the undergraduate students, purchasing supplies, and overseeing implementation of the project. Trouble shooting as needed was provided to ensure the project ran smoothly. Reliability checks were conducted with the assistance of Margaret Cahill, graduate student in Early Childhood Special Education. The project coordinator also

tabulated the results, charted learner progress, and did the calculations required by the non-parametric statistical procedures.

Experimenters

Five undergraduate Early Childhood Special Education majors (mean age = 22 years, 4 months) had taken a course entitled Including Young Children with Special Needs Into the General Education Programs at UNI during the 1998 fall semester. Throughout the duration of this course, the Direct Instruction model was described, modeled, and demonstrated. The students were required to implement this model into the concomitant required practicum. The practicum consisted of 3 hours per day, 4 days per week for 8 weeks. When the possibility of participating in the present project was described in this required methodological course, five undergraduate students indicated an interest in participating in the project. Several meetings were held to describe the project and train the students for implementing the two differing teaching orientations applied throughout the investigation (see pre-experimental phase).

Edison Elementary School Faculty

Bruce Potter, the principal at Edison Elementary School (located in a mid-western community of 100,000 people), gave permission for the investigators to meet with the teachers to determine the feasibility of the study. The following Kindergarten and first grade teachers identified potential students from their classroom for participation in the study: Mrs. Linda Whitmore, Mrs. Sherry Robb, Mrs. Carrie White, and Ms. Elaine Eggers.

Criteria for Subject Selection in Investigation

Participants were selected from one of the four classrooms averaging 18 students per room at Edison Elementary School. During the pre-experimental assessment phase, children were selected for participation based on the assessment data, which indicated that they did not know the names of at least 10 pair of alphabet letters (pair = both upper and lower case of the same letter). None of the children had been formally identified as having an educational disability, but all were struggling in various academic areas within the classroom. From this group of twelve, 10 children (6 males and 4 females, with a mean age of 6 years 1 month) were randomly selected to participate in the investigation that began during the month of January. One of the participants contracted chicken pox during the implementation of this investigation, was absent a great deal, and was eventually dropped from the study ($n = 9$).

Experimental Design

Pre-Experimental Phase

The pre-experimental process is described depicting the activity and the time it was conducted. Subsequently, a description of the experimental design that was implemented is described. The Undergraduate Research/Experiential Learning Committee approved funding for the proposed project in October. A Human Subjects formed was submitted to the Graduate College in late November, and approval was granted in early January.

Two training sessions were held in December with the five Experimenters who had indicated an interest in participating in this project. The first session was held on December 11th to introduce and describe the proposed project. The second session held on December 16th involved a review of the direct instruction model, and a demonstration of using the Electric Maze. During this demonstration, the Experimenters were taught how to set up the carpet and program it. Then they practiced their speed and accuracy of programming the carpet by taking turns being the teacher and the student while using the alphabet letters, which were attached to the carpet. Finally, they were taught the correct procedures for storing the carpet.

Dr. Raschke and Sherry Jack met at a school supply store on December 21st to purchase the alphabet manipulatives that were to be utilized during the application of the direct instruction model. Additional supplies were ordered though various school supply and toy catalogs. All of the purchased materials displayed alphabet letters in various forms, or could easily be modified to depict upper and lower case letters.

On January 10th another training session was held. The Experimenters reviewed their skills for using the Electric Maze. They also practiced using the beanbag frogs and color-coded spinners with the carpet. As in the previous training session, the Experimenters took turns being the teacher and the student. In addition to the maze, they practiced their direct instruction teaching skills using the manipulatives that were purchased. Data forms were also introduced at this time (see appendix C). A demonstration depicting how to use the forms was given followed by the opportunity to practice completing them.

A meeting was held at Edison Elementary School on January 12th. During this meeting, Sherry and Dr. Raschke met with the principal at Edison School to further describe the project in depth. Formal permission was granted to carry out the study at this school. A potential list of teachers interested in having children in their classrooms participate in this investigation was given to the coordinator. Subsequently, the Project Coordinator contacted the teachers about students in their classrooms that might be potential participants. A meeting was held to contact teachers and provide them with a brief description of the project including specific requirements for the participants. The teachers were asked to bring a list of their students who were informally identified as being unable to name at least 10 pairs of alphabet letters to the next scheduled meeting on January 19th at Edison School. At the January 19th meeting, teachers asked questions about the project and provided a list of at-risk students that would potentially qualify as participants for this study (i.e., students who did not know at least 10 pairs of letters by name). Schedules for each individual student were given to the Coordinator to identify times that would be convenient for the student to participate in this study. A parental permission form granting the child's participation was composed and sent home with each child that had been targeted (see Appendix D). The children then returned the signed forms to their teachers.

An additional meeting was held on January 19th with the Experimenters. Each Experimenter was randomly assigned to work with two elementary students individually in two 15-minute blocks. Schedules from both the elementary students and

Experimenters were carefully studied in order to identify blocks of time that were compatible.

The Project Director and Coordinator designed a script for the experimenters to use. Training was held on January 21st to teach and practice the script that was to be used during the two interventions. This script delineated what was to be said or done when various situations occurred (see Appendix E). A major purpose of this meeting was to strive for consistency and reliability across Experimenters during all phases of the experiment.

On January 22nd the Project Coordinator and Experimenters took the supplies and data collection sheets to Edison School in order to determine where the materials could best be stored and to become familiar with the school. The locations available for carrying out the interventions were determined to ensure consistency across Experimenters. Additionally, the Experimenters were introduced to the teachers and provided the opportunity to dialogue about preferred procedures for picking up and returning students to the classroom. Experimenters were encouraged to contact the Project Coordinator at any time if they had any questions or concerns. The teachers, principal, and Experimenters were provided with information regarding how to reach and communicate with the Project Director and Project Coordinator.

Single Subject Counter Balanced Measures Design

A single subject counterbalanced repeated measures design (see Table 2) was implemented. Five children were randomly selected to begin participation in sequence number one, and five children were randomly selected to begin participation in sequence

number two. Note the intervention order is transposed across the two sequences to control for the "order effect." The teaching instructional time of 10 minutes was fixed across both interventions. It was anticipated that the experiment would require 18 teaching days. The pre-experimental phase (2 days) identified 10 children who did not know the names of 10 upper and lower case alphabet letters. The remaining days are broken down as follows: baseline 1 = 2 days, intervention 1 = 5 days, baseline 2 = 2 days, intervention 2 = 5 days, (break for 5 school days), and baseline 3 = 2 days (to assess for long term recall of all 10 pair of letters).

Table 2

Single Subject Counter Balanced Measures Design

	Baseline 1 (2 Days)	Intervention 1 10 minutes daily (5 Days)	Baseline 2 (2 Days)	Intervention 2 10 minutes daily (5 Days)	Baseline 3 (2 Days)
Sequence #1 (N = 5)	I	Direct Instruction with 5 unknown alphabet letters	II	Electric Maze with 5 unknown alphabet letters	III
Sequence #2 (N = 4)	I	Electric Maze with 5 unknown alphabet letters	II	Direct Instruction with 5 unknown alphabet letters	III

Pre-Experimental Baseline

The pre-experimental baseline began on January 25th and lasted for 2 days. On the first day, each child was individually assessed using flashcards to identify which

letters he was unable to name. The letters were not given in sequential order and upper and lower case were tested separately. This procedure was repeated on day two. A minimum of 10 unknown pair of letters (1 pair = upper and lower case of the same letter) was needed for the student to participate in the investigation. Ten children met this criterion and were included in the investigation.

Baseline 1

On the first day of this phase, five pairs of letters were randomly selected from the pre-experimental baseline pairs. These letters were tested once again using flashcards to ensure that they were unknown. If the child could name any of the letters, that pair was removed from the pool, and the teacher immediately selected another pair of letters to assess. This process was repeated until five pairs of letters (viz., total of 10 letters, 5 sets of letters which included the upper and lower case letters were identified as unknown to the student. These five pairs of letters were reassessed on the second day of this phase to document that indeed, the letter names had not been mastered.

Intervention 1

Five students were randomly assigned to the direct instruction intervention, and the other five were assigned to the intervention with the Electric Maze. During the intervention, children received 10 minutes of one on one instruction with their assigned intervention. After 10 minutes of instruction with the five pair of letters, each child was tested each day using the flash cards to identify which letters had been learned. This information was recorded on the data sheets that were affixed to clipboards for each Experimenter. The first intervention phase lasted 5 days, one instruction session per day.

Training and Reliability Checks

On February 1st a meeting was held with the Experimenters to answer any questions or concerns regarding the experimental phase and application of the intervention and script. Reliability checks were administered during intervention one on February 4th to verify that procedures remained constant among the five Experimenters. Observing each of the Experimenter's performance during the implementation of the intervention did this. Data was taken during the testing portion and compared with the data obtained by the experimenter. Margaret Cahill, Early Childhood Special Education graduate student, assisted with the reliability checks. An additional meeting was held on February 5th to address any questions or concerns held by the Experimenters. At this session, the Experimenters also rehearsed the script and implementation of the intervention that they would be using next.

Baseline 2

Following the 5 days of the intervention, baseline two was conducted. This baseline assessed another five pair of unknown letters to be used in the next intervention. The same instructions were applied as they were in baseline one, across the 2 days of assessment.

Intervention 2

Children previously assigned to the Electric Maze were now assigned to the direct instruction intervention, and children previously assigned to the direct instruction technique were now placed in the Electric Maze intervention. The five pair of letters identified in baseline two were incorporated for instruction during this intervention.

Once again, each child received 10 minutes of one on one instruction. After 10 minutes of instruction with the five pair of letters, each child was tested each day using the flash cards to identify which letter names, if any, had been mastered and which letter names had not been mastered. This information was recorded in the column labeled "Intervention 2" on the data sheets. The second intervention phase lasted for 5 days.

Baseline 3

After completion of the second intervention, 5 school days passed in which the student received no activity or intervention. Subsequently, baseline three was conducted. Each student was tested on each of the 10 letters using the flashcards. The purpose for the delay in this baseline was to assess the student's long-term recall of the alphabet letter names.

CHAPTER 4

RESULTS

Analyses of Results

In order to test the hypothesis that the direct instruction approach would be more effective than the Electric Maze technique for teaching at-risk students the names of alphabet letters, the results of this investigation have been analyzed in two ways. The first method of analysis applied a non-parametric statistical analysis, the Wilcoxin Matched-Pairs Signed-Ranks Test, to the data collected (Siegel, 1956). In the other method, a single subject analysis was conducted for each student depicting daily performance levels under the differing conditions. These methods were applied to test the hypothesis that the direct instruction approach would be more effective for teaching at-risk kindergarten students the names of alphabet letters.

Non-Parametric Statistical Analysis

The Wilcoxin Matched-Pairs Signed-Ranks Test (Siegel, 1956) was selected because the subjects selected for this investigation were not randomly distributed. It should be noted that the students were randomly assigned, but not randomly distributed because students did not have equal chances of being selected for the original pool of participants. The participants were selected for this investigation because they were the children who were having difficulty learning the alphabet letter name associations as well as difficulties in other learning activities in their classroom. Because very few children in Kindergarten and first grade at Edison School met the criteria for inclusion in this investigation (viz., children who did not know the names of at least 10 pairs [upper and

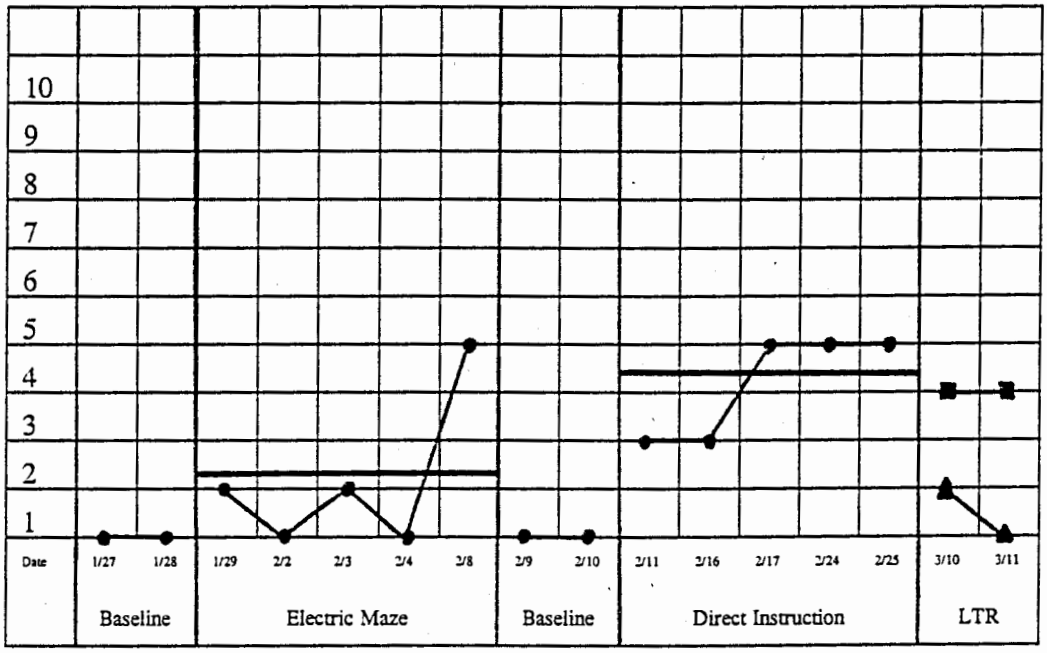
lower case] of alphabet letters), the size of the N in this study is relatively small (e.g., N = 9). Alphabet letter name recall scores of the participants were compared under the two differing conditions (viz., direct instruction and active learning using the Electric Maze). In this investigation, subjects performed better with the direct instructional technique at the alpha .05 level (see Table 3). For a comparison of mean scores between the two conditions, see Table 4.

Table 3

Wilcoxin Matched-Pairs Signed-Ranks Test: N = 9

	Mean performance				
Student	Electric Maze	Direct Instruction	d	Rank of d	Rank with Less Frequent Sign
Amber	1.2	3.2	-2.0	-4.0	
Chelsea	1.6	1.8	-0.2	1.5	
Daniel	2.4	6.8	-4.4	-9.0	
David	1.6	3.2	-1.6	-3.0	
Destiny	4.4	7.4	-3.0	-7.0	
Jeffrey	3.8	3.6	0.2	1.5	1.5
Jonathan	2.8	5.4	-2.6	5.5	
Lance	6.6	4.0	2.6	5.5	5.5
Shelbee	2.0	5.4	-3.4	-8.0	

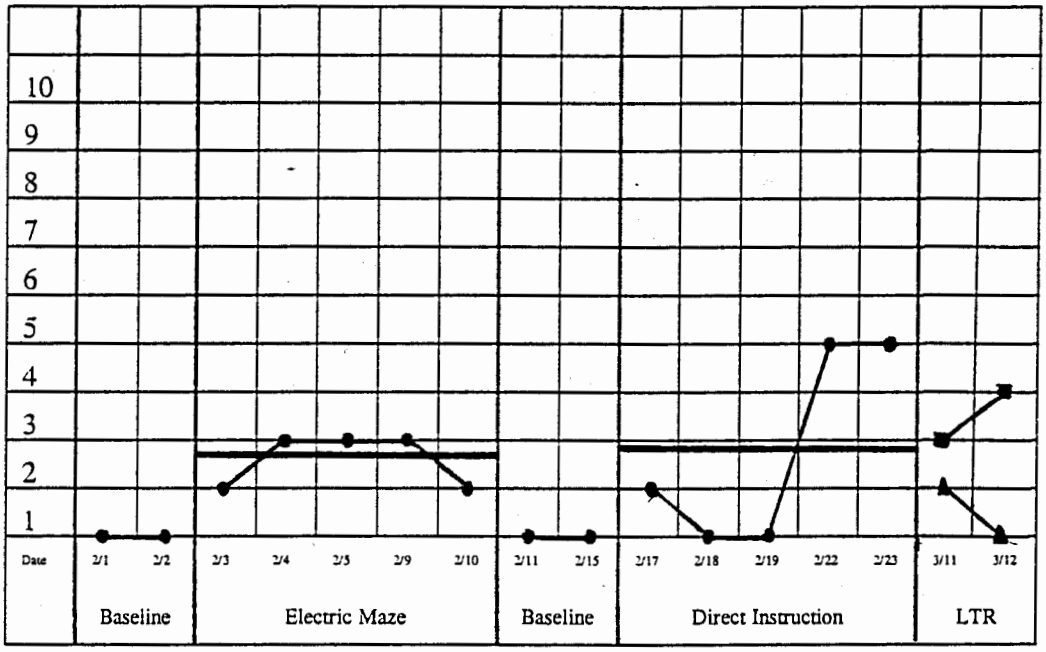
Figure 1. Amber's progress of alphabet letters learned.



- Daily performance
——— Mean
▲ LTR of letters learned using the Electric Maze
■ LTR of letters learned using Direct Instruction

Note. LTR = Long Term Recall (Baseline 3)

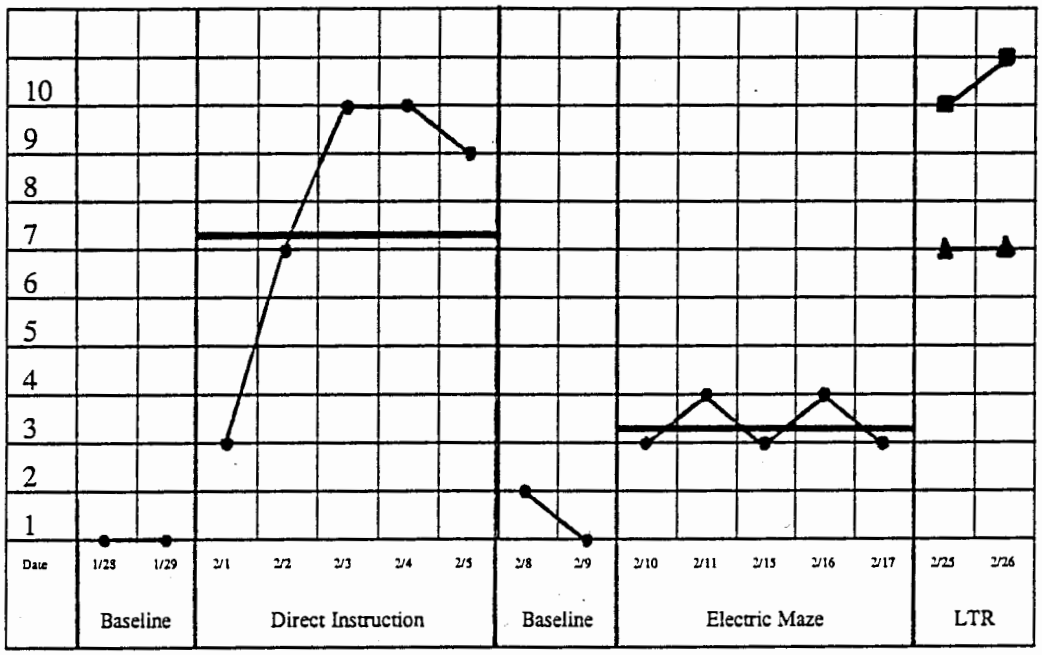
Figure 2. Chelsea's progress of alphabet letters learned.



● Daily performance
——— Mean
▲ LTR of letters learned using the Electric Maze
■ LTR of letters learned using Direct Instruction

Note. LTR = Long Term Recall (Baseline 3)

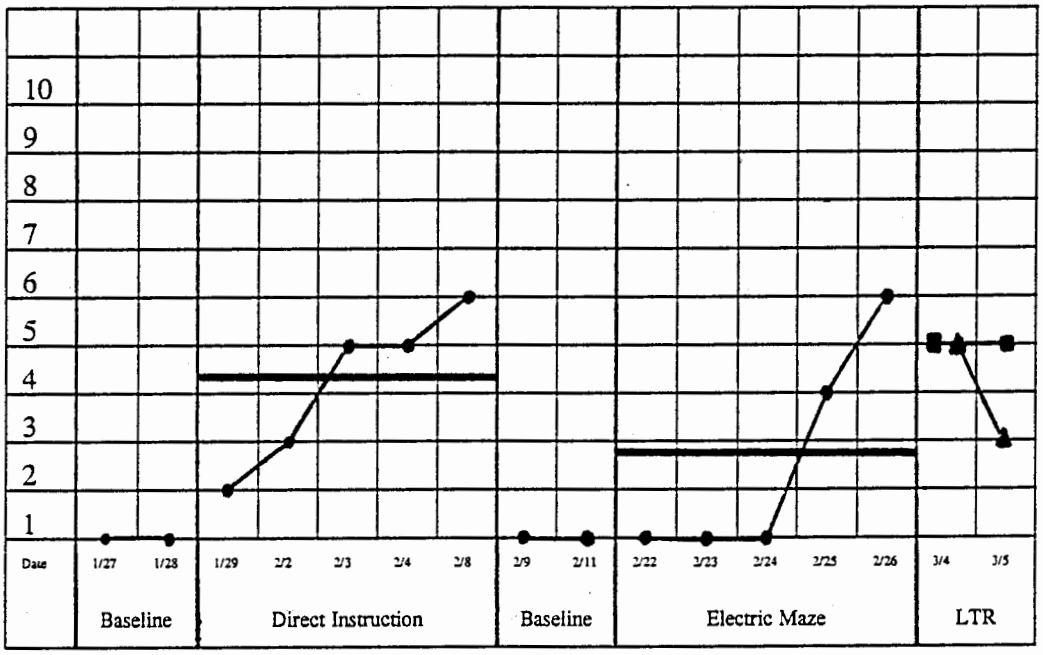
Figure 3. Daniel's progress of alphabet letters learned.



• Daily performance
——— Mean
▲ LTR of letters learned using the Electric Maze
■ LTR of letters learned using Direct Instruction

Note. LTR = Long Term Recall (Baseline 3)

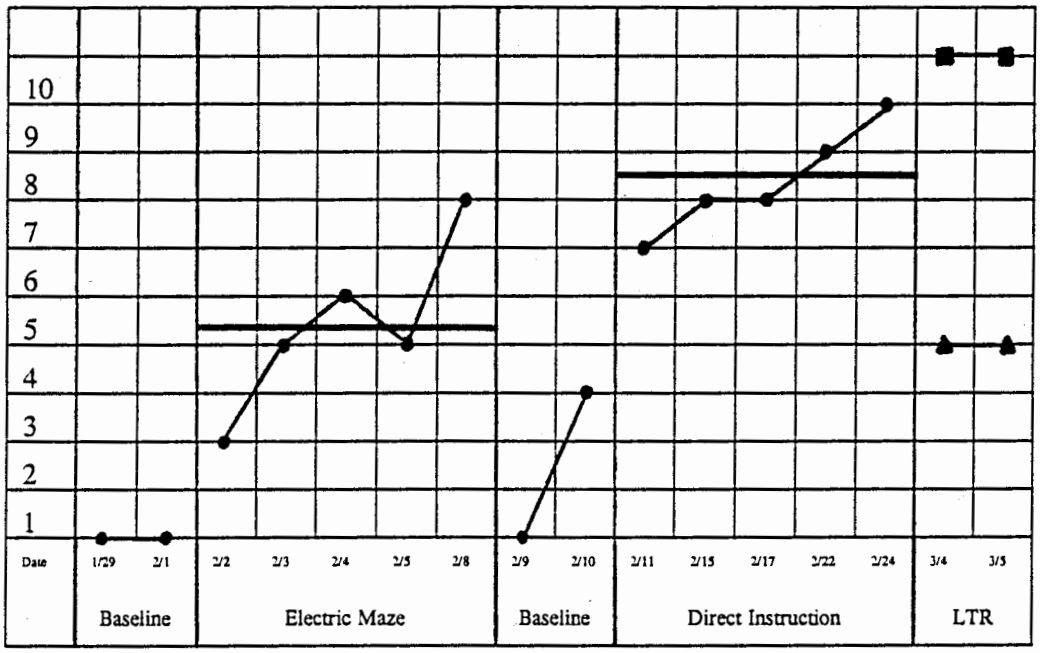
Figure 4. David's progress of alphabet letters learned.



• Daily performance
—— Mean
▲LTR of letters learned using the Electric Maze
■LTR of letters learned using Direct Instruction

Note. LTR = Long Term Recall (Baseline 3)

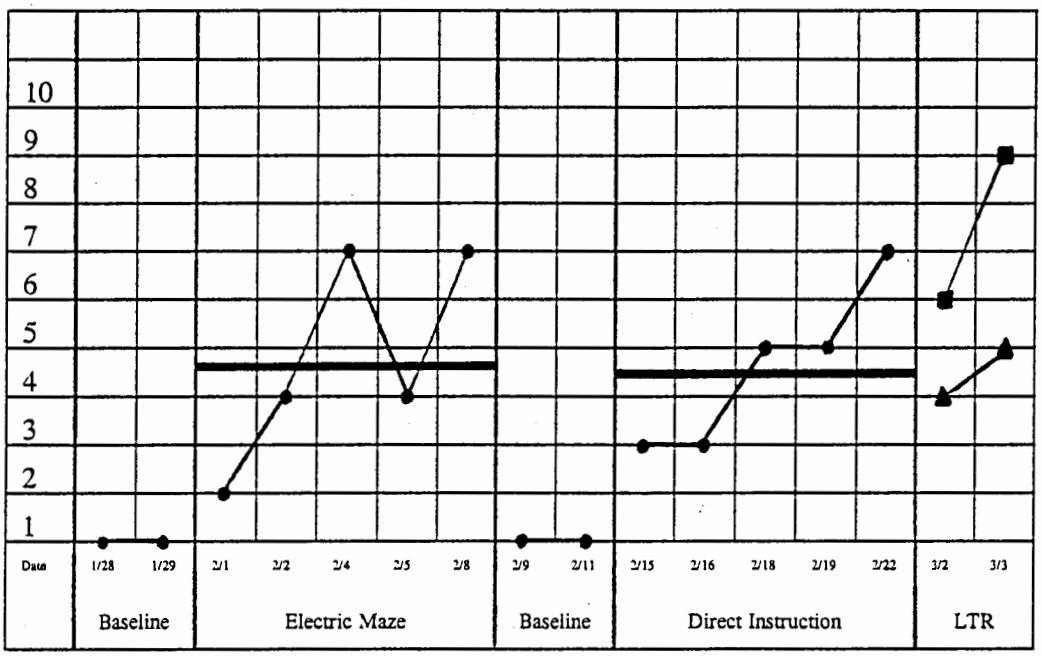
Figure 5. Destiny's progress of alphabet letters learned.



• Daily performance
——— Mean
▲ LTR of letters learned using the Electric Maze
■ LTR of letters learned using Direct Instruction

Note. LTR = Long Term Recall (Baseline 3)

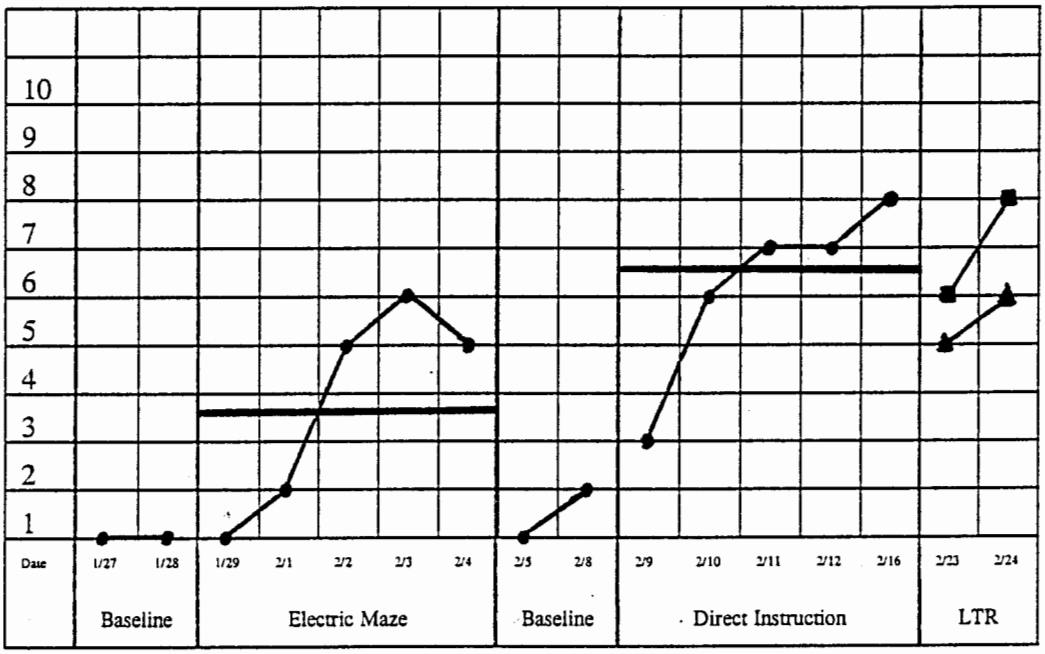
Figure 6. Jeffrey's progress of alphabet letters learned.



- Daily performance
——— Mean
▲ LTR of letters learned using the Electric Maze
■ LTR of letters learned using Direct Instruction

Note. LTR = Long Term Recall (Baseline 3)

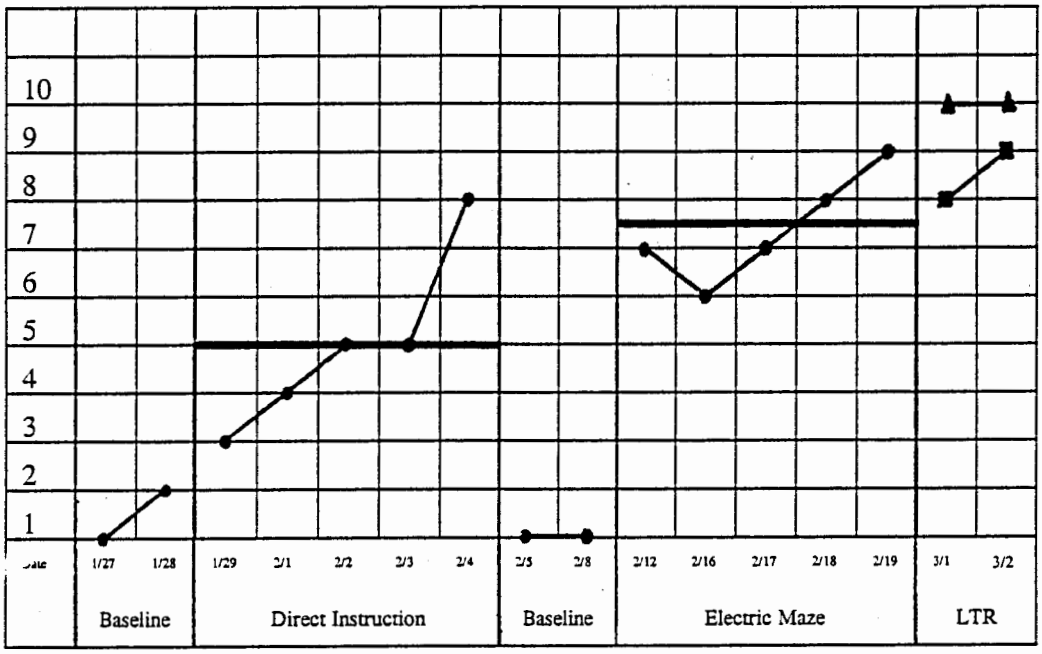
Figure 7. Jonathan's progress of alphabet letters learned.



• Daily performance
——— Mean
▲ LTR of letters learned using the Electric Maze
■ LTR of letters learned using Direct Instruction

Note. LTR = Long Term Recall (Baseline 3)

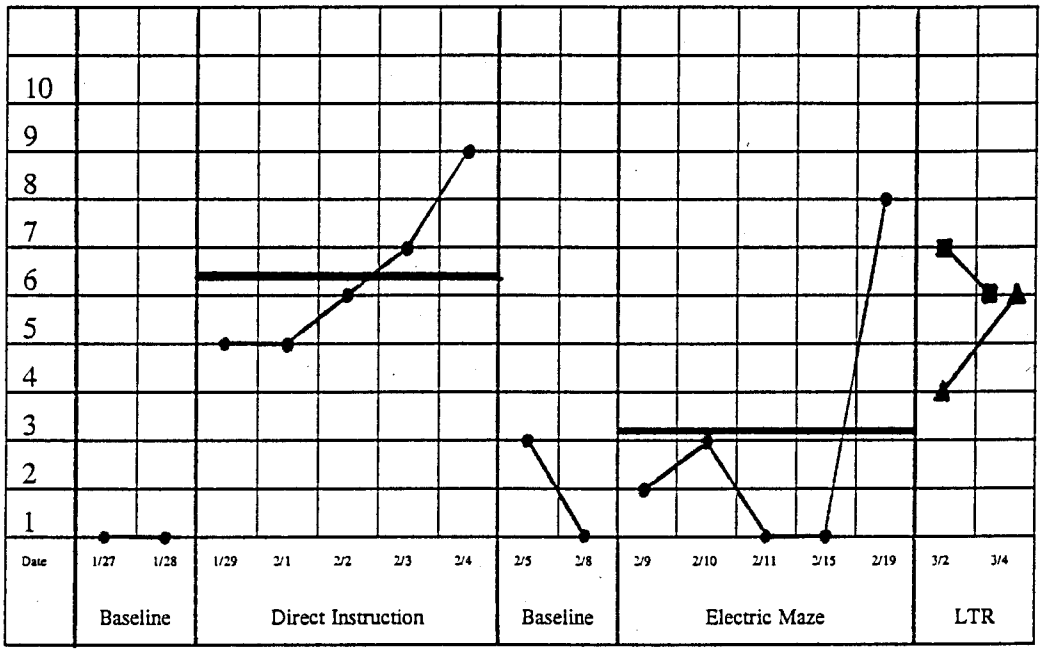
Figure 8. Lance's progress of alphabet letters learned.



• Daily performance
——— Mean
▲ LTR of letters learned using the Electric Maze
■ LTR of letters learned using Direct Instruction

Note. LTR = Long Term Recall (Baseline 3)

Figure 9. Shelbee's progress of alphabet letters learned.



- Daily performance
——— Mean
▲ LTR of letters learned using the Electric Maze
■ LTR of letters learned using Direct Instruction

Note. LTR = Long Term Recall (Baseline 3)

CHAPTER 5

DISCUSSION

Single Subject Analysis

Single subject comparisons of learning rates were made across the two instructional techniques for each student. Seven of the students performed at higher rates during the direct instructional intervention and two of the students performed at higher rates during the Electric Maze intervention. The performance of each student under each condition is depicted on graphs in the results chapter. Following is an individual interpretation of each student's performance.

Participant #1

Amber's results were inconsistent while learning the alphabet letter names with the Electric Maze technique. During the first 4 days of intervention, she alternated between zero and one letters learned. Then on the fifth day of the Electric Maze intervention, she had maintained four letters in her short-term memory.

Amber retained two letters on the first day of learning with the direct instruction technique. The second day remained constant with the same two letters learned. On day 3 of the direct instruction technique, Amber learned four letters. These letters remained constant on days 4 and 5 using this technique.

After a 5 day break from intervention or review (except for those letters which may have coincidentally been reviewed in the classroom), Amber demonstrated long-term retention of four letters; three of which were learned under the direct instruction method. On the second day of long-term recall, only the three letters taught under direct instruction were maintained.

The direct instruction technique appeared to be more effective for Amber in regard to both short term and long-term recall of the letter names. She was more consistent under

this method as the scores with the Electric Maze showed more variability. Amber displayed shy and reserved behaviors. The amount of activity involved with the Electric Maze may have been too overwhelming for her. Therefore, with her social style, she may perform better utilizing a more quiet and structured learning environment like that of direct instruction.

Participant #2

Chelsea's scores varied slightly with the Electric Maze intervention. At the end of each session, she had short-term recall of one or two letters. However, the letters retained were inconsistent across 4 of the 5 days.

Chelsea appeared to retain more letters using the direct instruction technique. However, the number of letters learned on a given day varied greatly; one on the first day, zero on the next 2 days and four on the last 2 days. Four particular letters were recalled fairly consistently using this method.

Following the 5 day break from intervention, Chelsea demonstrated long-term retention of three letters on both days. On the first day only one of the three letters were taught using the Electric Maze. On the second day all three letters recalled were learned using the direct instruction methodology.

As a result of the variability in scores, both the Electric Maze and direct instruction techniques demonstrated comparable effectiveness in regard to Chelsea's short term recall of the letter names. However, when considering long-term recall, the direct instruction technique appeared to be slightly more effective. This outcome may be influenced by the fact that direct instruction was the intervention that preceded the testing of long-term recall.

Chelsea appeared to be fascinated by the uniqueness of the Electric Maze. Chelsea was often off-task and required a "thinking minute." With this characteristic, one might

think she would perform better in a more structured learning environment using direct instruction. However, the two methods yielded comparable effectiveness in regard to short-term recall.

Participant #3

Daniel's scores from the direct instruction technique jumped from two to six to nine letters within the first 3 days of intervention. He maintained nine letters in short-term recall on the fourth day. On the final day of direct instruction, Daniel dropped back to eight letters.

Daniel retained two letters in his short-term recall on the first day of using the Electric Maze. On the second day, he retained three letters. He then alternated between two and three letters for the duration of this intervention.

Following a five day break from intervention, Daniel demonstrated long-term retention of 15 letters. Nine of these letters were taught using direct instruction. On the second day of testing, Daniel demonstrated long term retention of all 10 letters taught with direct instruction and 6 of the 10 letters taught with the Electric Maze for a total of 16 letters.

The direct instruction technique appeared to be significantly more effective than the Electric Maze for Daniel in regard to both short term and long term retention of alphabet letter names. Although the Daniel's overall retention rate was lower using the Electric Maze, scores with this technique appeared to show higher long term versus short-term retention. Daniel seemed to like both methods equally. However, it was noted that he really enjoyed a puzzle associated with the direct instruction intervention.

Participant #4

David's first intervention was the direct instruction technique. With this intervention, David's short term recall of letter names steadily increased from one to two

to four letters on the first 3 days. Then he maintained four letters and increased to five letters on the final day. The letters David retained were consistent over the 5 days.

During the first 3 days of using the Electric Maze intervention, David did not learn any letters. Then he was able to recall three letters on the fourth day and five on the last day. The letters retained were consistent during the last 2 days of intervention.

David was able to recall eight letters while being tested for long-term retention. Four of these letters were learned under direct instruction, and the other four were learned using the Electric Maze. Only six letters were identified by David on the second day; four of them were retained from the direct instruction technique.

David's average of total letters learned in short term recall was a little higher while using direct instruction compared to the Electric Maze. Long-term retention of letter names was also slightly higher with the direct instruction technique. It may be relevant to note that David was absent for several school days (approximately 2 weeks) during this investigation. His absence may attribute as to why he is behind academically. Additionally, David had a "don't care" attitude during several of the sessions particularly with the Electric Maze. He stated that his teacher was taking him out of centers (from the regular classroom) and this made him really mad. He became bored with the Electric Maze and verbalized that he did not want to do it anymore. Even though there were times when David did not want to participate in the direct instruction intervention (for the same reasons stated earlier), this method appeared a little more enjoyable for David.

Participant #5

Destiny's short term recall of letters using the Electric Maze increased from two to four to five letters within the first 3 days of intervention. On the fourth day of intervention, she regressed back to four letters. On the final day of using the Electric

Maze, Destiny was able to recall seven letters. The letters retained were consistent throughout the 5 days.

On the first day of learning with the direct instruction technique, Destiny was able to recall six letters. The next two days yielded short-term retention of seven letters. Destiny increased her score to eight and nine letters on the last two days respectively. The letters Destiny retained remained constant throughout the duration of the intervention.

Destiny was able to recall 14 letters on both days when being tested for long term retention. On both days, she had retained all 10 letters learned with the direct instruction method. The same four letters were recalled while using the Electric Maze on both days of testing.

The direct instruction technique appeared to be more effective for Destiny. This method was more effective for both short term and long term recall of the alphabet letter names. Destiny appeared to like the Electric Maze and put forth good effort in learning the letters. However, she was particularly fascinated with the variety of manipulatives involved with direct instruction.

Participant #6

Jeffery's scores increased immediately while using the Electric Maze. On the first 3 days he learned one, three, and six letters respectively. Then his scores were inconsistent as he dropped down to three letters learned on the fourth day and returned to six letters learned on the last day of using this intervention. The letters learned remained fairly consistent across the 5 days.

Jeffery's scores steadily increased during the five days of intervention using the direct instruction model. On the first day he learned two letters and repeated the same results on day two. On day 3 he learned four letters and once again repeated the same

scores on day four. On the final day of applying direct instruction, Jeffery had learned six letters. The letters learned for short-term recall remained fairly consistent during these 5 days.

On the first day of testing for long-term retention, Jeffery was able to recall eight letters. Five of these letters had been taught using direct instruction while the other three were taught using the Electric Maze. On the second day of testing, Jeffery was able to recall eight letters from direct instruction and four letters from the Electric Maze for a total of 12 letters retained in long-term recall.

Both the Electric Maze and direct instruction technique demonstrated comparable effectiveness in regard to short-term recall of the letter names for Jeffery. When considering total letters learned per day for each intervention, Jeffery had learned one more letter using the Electric Maze. However, when evaluating long-term retention, direct instruction appears to be more effective. These results may be influenced by the notion that direct instruction was the last method applied before being tested for long term retention. Jeffery would have had to think back several days in order to recall letters he learned while using the Electric Maze intervention.

Jeffery was reported to be a very "busy" and sometimes demanding or uncooperative child during the Electric Maze intervention. Because of his activeness, one might speculate that he would perform better while using the Electric Maze. In the end, he did perform slightly better with the Electric Maze in regard to short-term recall. However, direct instruction appeared to be more effective in regard to long-term retention. Jeffery showed interest in the manipulatives used for the direct instruction technique, and was even disappointed when the teacher did not bring an alphabet game that was played the day before. It should be noted that the teacher speculated that direct instruction appeared to work better with Jeffery. The direct instruction technique provides a more structured

environment, which may be what Jeffery requires to focus his attention. In this particular case where the effectiveness of the intervention varied between short and long term recall, it is difficult to say which intervention is more effective for a learner like Jeffery.

Participant #7

After the first day of applying the Electric Maze intervention, Jonathan's scores steadily increased. On the first day his score was zero, but then on the following 3 days his number of letters learned increased from one to four to five. On the final day of using this intervention, Jonathan regressed back to four letters learned in his short-term recall. A majority of the letters learned remained consistent during these 5 days.

Jonathan's scores increased after nearly each day with the direct instruction intervention. The number of letters learned increased from two to five to six during the first 3 days of using this intervention. Then Jonathan maintained six letters learned for the next day and increased to seven letters for the final day of applying direct instruction. Some letters varied slightly during the 5 days as he was able to recall a couple letters one day, but unable to recall them the next day.

Following the 5 day break from any interventions, Jonathan was tested for long term recall of the letters he had previously been taught. On the first day of testing, Jonathan was able to recall nine letters; four from using the Electric Maze and five from direct instruction. On the second day of long-term recall, Jonathan was able to recall seven letters that he had learned from direct instruction, but only five letters from using the Electric Maze.

When considering the average number of letters Jonathan learned each day, the direct instruction technique was more effective for short-term recall. The direct instruction technique was also slightly more effective for Jonathan when considering the number of letters maintained in long-term retention. Once again, it may be important to

note that direct instruction was the intervention that preceded testing of long term recall. Jonathan appears to be a student who likes variety. Therefore, direct instruction may be more effective for him because with this method it is easier to use different manipulatives each day for more variety.

Participant #8

Lance's first intervention was direct instruction. The number of letters Lance learned in short term recall increased from two to three to four during the first three days of intervention. On the fourth day, he maintained four letters learned. On the final day of direct instruction, Lance jumped to seven letters learned. The specific letters learned were fairly consistent during the 5 days of intervention.

Lance scored six letters correct after the first day of using the Electric Maze. On the second day, his score dropped back to five letters learned. From then on, Lance's scores steadily increased from six to seven to eight letters learned in short term recall using the Electric Maze. The letters he learned remained consistent with the exception of the day he scored one letter lower.

Lance was able to recall 16 letters when tested for long-term retention of letters learned. Seven of the letters were retained from the direct instruction technique and nine from the Electric Maze. On the second day of testing, Lance recalled a total of 17 letters; eight from direct instruction and nine from the Electric Maze intervention.

The Electric Maze intervention appeared to be significantly more effective for Lance in regard to short-term recall. When considering the long-term retention of letters learned, the Electric Maze was only slightly more effective for total letters learned. The Electric Maze intervention did precede the testing of long-term retention, but there was not a significant difference between the total number of letters learned from each intervention. Lance seemed to enjoy jumping around on the Electric Maze. It was undetermined

whether this technique accommodated a personal level of activity or if it was enjoyable because the Electric Maze was a new and unique way of learning letters of the alphabet.

Participant #9

Shelbee received direct instruction for her first intervention of learning alphabet letter names. On the first day, she learned four letters. She continued to have four letters on the second day of intervention. Then she increased the number of letters learned in short-term recall from five to six and finally to eight letters. A slight variation in the consistency of letters occurred from day to day.

Shelbee's scores were very inconsistent during the application of the Electric Maze. During the first 2 days of intervention, she learned one and two letters respectively. Then her score dropped down to zero for the next 2 days. On the final day of using the Electric Maze, her score jumped to seven letters learned in short term recall.

Following the 5 day break from any intervention, Shelbee was tested for long term recall of letters learned. On the first day of testing, she was able to recall nine letters; six from the direct instruction technique and three from using the Electric Maze. On the second day of testing, she was able to recall five letters from each intervention technique for a total of ten letters.

The direct instruction technique appears to be more effective for Shelbee in regard to short-term recall of alphabet letter names. Shelbee appears to have slightly better long-term retention from the total letters learned with the direct instruction intervention. Shelbee's case does not follow the same pattern as many other participants. Some of the other participants demonstrated better long-term recall of letter names from the intervention that preceded testing of long-term retention. However, Shelbee was able to recall slightly more letters with the first intervention that was applied to her which was direct instruction.

Shelbee appeared to enjoy participating in both of the interventions, but the activities involved with direct instruction were more appealing to her. After a few days of working with Shelbee, it was learned that she stays on-task better when she is rewarded for her efforts. One would assume that a correct beep with the Electric Maze would be a sufficient reward. However, this was not the case as Shelbee worked more efficiently when she was given a material reward like a sticker in exchange for her participation efforts. It should be noted that a sticker was given to Shelbee following the completion of the intervention, not after each correct letter.

The Wilcoxin Matched-Pairs Signed-Ranks Test

Scores of the participants were compared under two differing techniques using the Wilcoxin Matched-Pairs Signed-Ranks Test. It was hypothesized, in advance, that the direct instruction technique would be more effective than the Electric Maze. Thus, a directional one-tailed hypothesis was made. As anticipated, results of this analysis showed that learning rates were higher for seven of nine students when utilizing the direct instruction technique.

Relationship Between Results and the Literature

From two differing perspectives, single subject analysis and non-parametric comparisons, it is clear that one method was more effective for a majority of children (i.e., seven out of nine). The intervention incorporating the direct instructional paradigm was more effective than the intervention incorporating active learning with the Electric Maze.

Brophy and Good (1986) concluded that most students learn more efficiently when teachers structure the presentation of new information. It has further been demonstrated that learning is further enhanced when teachers relate this information to students' previous knowledge (Brophy & Good, 1986). These components are clearly incorporated

within the seven steps of the direct instructional paradigm and perhaps, not as well defined or incorporated into the Electric Maze learning paradigm.

The method of direct instruction has been targeted as most applicable when teaching learning associations frequently required in mathematical activities and reading decoding procedures (Rosenshine, 1986). Learning the names of alphabet letters provides a foundation for the early stages of reading decoding. As a result, the stages of direct instruction were easily implemented into the process of teaching students the alphabet letter names.

Research on aptitude treatment interaction suggests that the elements of direct instruction might be particularly effective for lower-ability students to effectively increase achievement (Corno & Snow, 1986; Cronbach & Snow, 1977; Snow, 1976). Snow (1976) speculated that lower-ability students require more external structure and instructional support to learn in contrast to higher-ability students. The participants in this investigation had not been identified as having an educational disability, but all were struggling in various academic areas within the classroom. It appears that the structure and instructional support provided by the direct instruction technique had a positive impact on a majority of student achievement in regards to learning the names of alphabet letters.

A more structured approach to learning may help less intelligent students by reducing the complexity of the task. On the other hand, Snow and Lohman (1984) proposed that the higher level of structure may either depress or nourish learning in higher ability students, or it may not affect learning at all. It could be hypothesized that two of the nine students performing better with the active learning technique were perhaps, somewhat confined within the limitations provided with the direct instruction technique. Doyle (1983) speculated that it might be necessary in some cases to allow

students a certain degree of "unstructuredness" and allow them to experience the content for themselves. The technique applied in the active learning component of the investigation was less structured which might have allowed these students to experience the content for themselves. Therefore, these individual students were given an opportunity for an optimal level of achievement in this particular area.

These results are indicative that different students learn best using various levels or techniques of instruction. As noted, the majority of students learned better using the direct instruction technique. However, not all students were as successful with the direct instruction technique as two particular students learned more names of alphabet letters with the active learning technique. As Snow and Lohman (1984) stated, the aim of education is to provide alternative instructional treatment to fit the major differences in aptitude among students. The direct instruction technique and the active learning technique utilizing the Electric Maze are two of numerous alternative instructional treatment approaches that may be incorporated into the classroom to optimally meet the individual learning needs of students.

Limitations

The two techniques used in this investigation, direct instruction and the Electric Maze, should not be mistaken as exemplary models of direct instruction and active learning. These techniques are only one of many interpretations of the direct instruction and active learning paradigms. A comparative analysis contrasting the differences of those two instructional approaches can be found on Table 1. Clearly, many differing variables are encompassed in each approach. As such, differences that evolved are reflective of the results of those differences across these two approaches.

Many components of the learning environment were unable to be controlled during the investigation. An incidental comparison of the learning environments using

Dunn and Dunn's (1978) findings imply that learners may be affected by different stimuli including temperature, light, noise level, structure, motivation, time of day, etc. Any one or combination of these variables could perhaps significantly impact the learner's performance. As these components may have varied across the two differing interventions, contamination from their effects could have impacted the results of this investigation.

This investigation targeted a particular sub-group of children (viz., those at risk for academic failure). Results from research contend that direct instruction might be particularly effective for lower-ability students (Corno & Snow, 1986; Cronbach & Snow, 1977; Snow, 1976). This particular group of at-risk students could have contributed to the higher levels of success experienced with the direct instruction technique.

It could be speculated that there was an unconscious experimental bias in favor of the direct instruction model. The experimenters selected for providing the instruction previously had 3 hours of coursework and a corresponding 3 hour practicum emphasizing the direct instruction model. The fact that they had more direct experience with direct instruction and were more comfortable with this technique versus the Electric Maze could have had an impact on the outcome.

From the perspective of astute academician, it might be noted that the response requirements differed across the two interventions. In the direct instructional paradigm, the student constantly practiced naming the alphabet letters. In the active learning paradigm with the Electric Maze, the students were told what letter to hop to, and once they hopped to the letter were asked to verbally name the letter. Thus, instruction during the direct instructional paradigm emphasized letter name delineation at the expressive level, while the Electric Maze first emphasized receptive identification of a letter, that is

hopping to that letter (receptive mastery), and subsequently were asked what letter they had hopped to (expressive mastery). This is a very subtle distinction of the response topographies when comparing the two teaching sequences.

Several additional uncontrollable factors exist which could have impacted the results of the study. The teacher may have worn a particular letter on her shirt one day increasing the student's awareness for that letter which made for quicker recall of the letter in one of the learning conditions. The child may have been working on some of the letters selected for one method of intervention at home or in the classroom during that particular time. Finally, even though the experimenters had scripts to follow for each instructional technique, differences are likely to be present among each experimenter's style of instruction.

Recommendations for Further Study

If this study were to be repeated, the investigator may want to consider keeping all variables like noise, light, temperature, etc. as consistent as possible across the two settings. Selecting participants from a broad spectrum of academic ability rather than focusing on at-risk students may yield a more true effectiveness of the two techniques. Bias towards the direct instruction paradigm could be decreased if the experimenters possessed the same level of experience across the differing techniques being implemented. A further recommendation would be to maintain consistency between receptive and expressive levels of mastery across the instructional sequences.

Conclusion

Findings seem to indicate that with the diverse characteristics that groups of children bring to the learning environment, no one approach can be identified as superior for all children. Educators must look at each child as an individual, and based on that child's learning strengths and limitations, delineate those approaches which they hypothesize to

have the highest probability of being effective for that particular child. If the approach initially selected is ineffective, based on documented learner performance rates, then an alternative approach needs to be incorporated.

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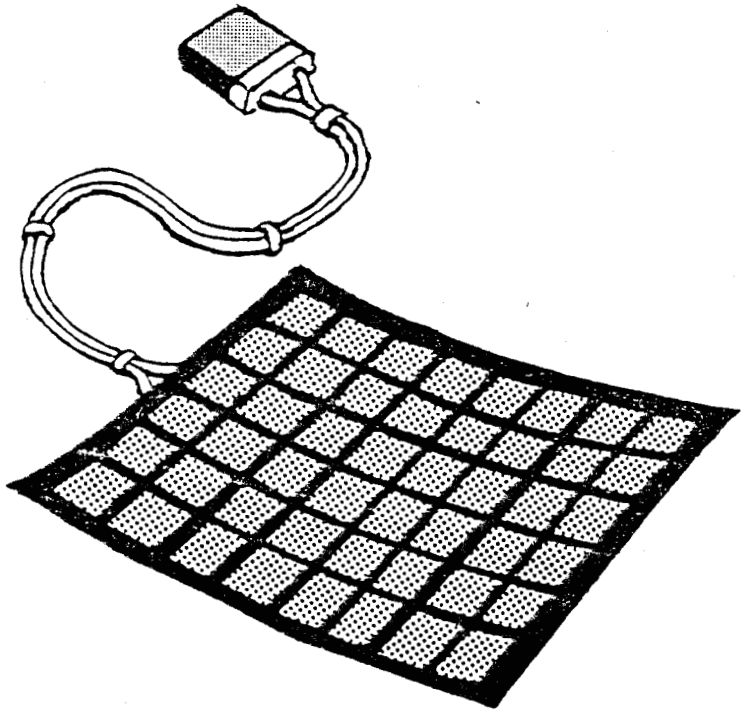
APPENDIX A

Picture of Electric Maze



APPENDIX B

Materials Inventory

Materials used during direct instruction:

Upper & Lower Case
Large foam letters
Finger puppets
Giant floor puzzle
Foam letters
Crepe rubber puzzle
Alphabet kit (50 possible activities)
Magnetic letters (3D)
Flash cards
A B Seas Fishing Game
Carpet Squares

Upper case ONLY
Little leap
Sponge painters
Mini stamp markers
Rubber stamps
Stickers (mini & 2")
Magnetic letters (2D)

Create-your-own (blanks)
Large cubes/dice
Frog bean bags
Clowns
Blank playing cards
Dice
Spinners
Fun notepads
Hippity Hop

Materials used with the Electric Maze:

Electric Maze
Frog bean bags
Spinners

APPENDIX C

Example of Data Forms

UG _____
Child _____

Pre-Experimental Phase

Date			Day 1		Date			Day 2	
A		a			A		a		
B		b			B		b		
C		c			C		c		
D		d			D		d		
E		e			E		e		
F		f			F		f		
G		g			G		g		
H		h			H		h		
I		i			I		i		
J		j			J		j		
K		k			K		k		
L		l			L		l		
M		m			M		m		
N		n			N		n		
O		o			O		o		
P		p			P		p		
Q		q			Q		q		
R		r			R		r		
S		s			S		s		
T		t			T		t		
U		u			U		u		
V		v			V		v		
W		w			W		w		
X		x			X		x		
Y		y			Y		y		
Z		z			Z		z		

Experiment

Base A - 5 Unknown Letters - Upper and Lower Case UG Name

Base B - 5 Unknown Letters - Upper and Lower Case Child's Name _____
Base C - Long Term Recall Child's Teacher _____
Int. 1 - Direct Teach
Int. 2 - Active Learning

Date	Phase	Letters Correct Circled	Letters Correct Int 1/Int 2	Comments
1.	Base A		/10	
2.	Base A		/10	
3.	Int.		/10	
4.	Int.		/10	
5.	Int.		/10	
6.	Int.		/10	
7.	Int.		/10	
8.	Base B		/10	
9.	Base B		/10	
10.	Int.		/10	
11.	Int.		/10	
12.	Int.		/10	
13.	Int.		/10	
14.	Int.		/10	
15.	Base C		/10	
16.	Base C		/10	

APPENDIX D

Parent Permission Form

January 21, 1999

Dear Parent(s),

We are very excited to announce a special project coming to Edison School from our friends at U.N.I.. This project is designed to teach the names of the 26 alphabet letters. Your child has been chosen to be a part of this project.

The U.N.I. participants will teach 5 unknown letters using the traditional way of teaching. Then they will teach an additional 5 unknown letters using a "magic carpet." The carpet s designed so that it will buzz if a student steps on the correct letter. We are interested in determining which of the two techniques appear to be more effective for teaching children the names of the alphabet letters. We will be working with your child on this project for approximately 20 minutes per day for 18 to 20 days. You are invited to observe the instruction any time. We anticipate beginning the project the week of January 25. If you have any questions about this project, please feel free to call either of the project coordinators. In advance, thank you for the opportunity to work with your youngster on this activity.

Please contact your child's teacher immediately if you do not want your child to participate in this alphabet project. Please call by January 22, 1999.

Sincerely,
Mrs. Robb, Mrs. White, Mrs. Whitmore, and Ms. Eggers

Our U.N.I. friends and coordinators are:

Donna Raschke, Ph.D.
Professor, Early Childhood Special Education
Office 319-273-3258
Fax 319-273-7852
Email donna.raschke@uni.edu

Sherry Jack
Graduate Student
Telephone 319-273-6061
Fax 319-273-7852
Email jacks1487@uni.edu

APPENDIX E

Script for Experimenters

What to say when...

1) Five seconds have passed, and the child has not responded:

"That is a hard one, the name of that letter is ___."

2) Child says, "B...I mean C":

"Which one is it?"

3) Timer goes off:

"Let's check and see where we're at." (to see what child has retained)

4) Incorrect answer is given:

Use the four-step correction procedure.

5) A correct answer is given:

Variations of verbal praise, high five, etc.

6) Child appears frustrated:

Be encouraging: "You're really thinking, etc.