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A COMPARISON OF TIME DELAY AND DECREASING PROMPT HIERARCHY IN TEACHING BED MAKING AND SANDWICH MAKING TO STUDENTS WITH SEVERE DISABILITIES

A Thesis

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Nicki Lynn Nye

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ABSTRACT

The purpose of this study was to compare two errorless learning teaching techniques, time delay and decreasing prompt hierarchy, to determine which technique was more efficient in teaching students with severe disabilities. Four students were taught bed making and sandwich making using an alternating treatment, single subject research design. Efficiency was measured by (a) the average number of steps learned and (b) the average percentage of errors made, across activities. In addition, types of errors made during probe sessions and 4 week follow-up maintenance and generalization data was collected. Results indicated that there were only slight differences between teaching techniques across activities in (a) the average number of steps learned favoring time delay instruction and (b) the average percentage of errors made favoring decreasing prompt hierarchy instruction. Four week follow-up maintenance and generalization data indicated mixed results across students and activities. There were no differences in the average number of types of errors made during probe sessions based on the teaching technique used. A major finding indicated a difference in the average number of steps learned based on the activity being taught. Additional findings, limitations, and recommendations for future research were also discussed.

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CHAPTER I

INTRODUCTION

Statement of the Problem

Brown, Nisbet, Ford, Sweet, Shiraga, York, and Loomis (1983) discussed six learning and performing characteristics of students with moderate, severe, and profound mental retardation and/or autism (hereafter referred to as students with severe disabilities). Instructors must consider these characteristics when determining what and how to teach their students with severe disabilities. The first learning and performing characteristic was the "number of skills that can be acquired" (Brown et al., 1983, p. 73). Students who are not disabled learn countless skills and activities over the course of their school careers. Some of these skills and activities are functional and assist them directly in independent performance across a variety of environments. Other skills and activities are not functional. By definition, students with severe disabilities learn fewer skills and activities than 99% of their chronological age peers. Instructors, therefore, must select and teach students with severe disabilities as many meaningful and functional skills and activities as possible. Given the number of skills and activities needed to maximize

independence and promote quality lives, it is imperative that instructors equally consider using the most efficient teaching techniques to maximize instructional time.

The second learning and performance characteristic was the "complexity of skills" that students with severe disabilities must learn (Brown et al., 1983, p. 73). Functional activities and skills which promote increased independence and quality of life are complex. That is, these activities are made up of many behaviors or skills that students must perform in a particular sequence. Teaching these sequences of skills is extremely time consuming. Again, instructors must use the most efficient teaching techniques to maximize instructional time.

The third learning and performance characteristic was the "number of instructional trials and amount of time needed to acquire skills at meaningful performance criteria" (Brown et al., 1983, p. 73). Students with severe disabilities almost always require more instructional trials and time to learn an activity at meaningful performance levels than their peers both without disabilities and with milder disabilities. With this in mind, instructors must plan for enough instructional time and trials to allow students with severe disabilities sufficient opportunities to learn the activities at meaningful performance levels.

The fourth learning and performance characteristic was "forgetting-recoupment" (Brown et al., 1983, p. 73).

Students with severe disabilities typically forget more than their peers without disabilities. Instructors, therefore, must spend time in "recouping" already learned activities that have been forgotten. It is important, therefore, that instructors choose the most efficient teaching techniques in terms of minimizing time spent recouping lost skills.

The fifth learning and performance characteristic was "transfer-generalization" (Brown et al., 1983, p. 74). Students with severe disabilities typically have difficulty generalizing what they have learned in one situation to a situation in which instruction or training did not occur. Instructors should use teaching techniques that facilitate generalization to environments in which students must ultimately perform the skills and activities that are taught in the classroom.

The sixth learning and performance characteristic was "synthesis skills" (Brown et al., 1983, p. 74). Students with severe disabilities typically find it difficult to synthesize information learned in two different situations and apply it correctly in a third situation. Again, instructors should use teaching techniques that help students with severe disabilities in synthesizing information from skills and activities already learned.

There is one common theme and overriding implication of these six learning and performance characteristics to instructors. Instructors must use the most efficient

teaching techniques to maximize instructional time. That is, given the number and complexity of activities and skills that students with severe disabilities must acquire, coupled with the number of instructional trials and amount of time needed to acquire, maintain, generalize, and synthesize these activities and skills, it is critical that instructors use the most efficient teaching techniques to teach the most meaningful activities. Instructors must teach students with severe disabilities using techniques that minimize the number of instructional trials and the time spent teaching, while maximizing the number of meaningful and functional activities taught, maintained, and generalized.

Need for the Study

Students with severe disabilities must acquire many complex activities to maximize independence across many environments. They also require more instructional trials and time to acquire, maintain, generalize, and synthesize these complex activities compared to their peers both with milder disabilities and without disabilities (Brown et al., 1983). It is critical, therefore, that instructors use the most efficient teaching techniques to teach these students. In order for instructors to use the most efficient teaching techniques, they must first know the most efficient teaching techniques. At present, research is limited. Of the

research available, results are inconclusive as to which teaching techniques are most efficient when instructing students with severe disabilities (Wolery, Ault, & Doyle, 1992).

Many different teaching techniques and their variations have been effective in teaching a variety of activities and skills to students with severe disabilities. These have included both **trial and error** and **errorless learning teaching techniques.** (Terms presented in bold print are operationally defined in the Glossary section.) In using **trial and error teaching techniques**, an instructor allows a student to respond to the **natural** or **instructional cue.** A **natural cue** is the naturally occurring stimulus variable(s) that elicits a desired response. For example, hunger is the natural cue to fix something to eat. An **instructional cue** is an artificial cue, usually a verbal instruction from an instructor, that elicits a desired response. For example, the verbal instruction, "Make a sandwich," is an instructional cue for making a sandwich. In trial and error teaching techniques, an instructor allows a student to respond to the natural or instructional cue. If the response to the natural or instructional cue is correct, the instructor provides reinforcement and/or allows the student to continue to the next required response or step in the activity. If the student makes an error, the instructor implements an **error correction procedure.** An **error**

correction procedure is added information that the instructor provides, after the student makes an error, to assist the student in responding correctly. The purpose of the error correction procedure is to correct the error that the student made. Researchers have reported using two error correction procedures effectively. These are **the system of least prompts**, (Doyle, Wolery, Ault, & Gast, 1988) and **verbal/physical assistance** (Close, Irvin, Prehm, & Taylor, 1978; Day, 1987; Gold, 1972; Gold & Barclay, 1973; Horner & Day, 1991).

The system of least prompts is an error correction procedure that involves proceeding through a predetermined hierarchy of **prompts**. A **prompt** is any information added to the natural or instructional cue to assist the student in responding correctly. Examples of prompts include verbal instructions, point cues, models, and physical assistance. The hierarchy may contain anywhere from three to six levels of prompts and is presumably structured from least to most intrusive. If the student does not respond correctly to the natural cue, the instructor gives the first level in the hierarchy. Often the first level in the hierarchy is a verbal prompt. If the student does not respond correctly to that level of prompt, the instructor gives the next level in the hierarchy. This continues until the student either correctly responds or reaches the last level in the hierarchy. The last level in the hierarchy elicits the

desired response (Billingsley & Romer, 1983; Doyle et al., 1988).

An example of the system of least prompts error correction procedure in sandwich making is as follows: The first step of the sandwich making activity is retrieving the mustard and bologna from the refrigerator and bringing the two items to the kitchen table. The four levels in this example of the system of least prompts are: (1) a verbal prompt, (2) point cues, (3) showing the student what to do, also known as modeling, and (4) full physical assistance. The instructor gives the student the instructional cue "Make a sandwich." If the student does not respond or makes an incorrect response to the instructional cue, the instructor delivers the first level in the hierarchy. The instructor says, "Get the mustard and bologna out of the refrigerator and bring them to the table." If the student responds correctly to that prompt, the student continues to the next step in the activity. If the student responds incorrectly, the instructor delivers the next level in the hierarchy. The instructor points to the refrigerator and back to the kitchen table. Again, if the student responds correctly, the student continues to the next step in the activity. If the student responds incorrectly, the instructor delivers the next level in the hierarchy. The instructor says, "Watch me" and shows the student what to do by getting the mustard and bologna out of the refrigerator and bringing

them to the kitchen table. The instructor then puts the items back in the refrigerator and prompts the student to do the same by saying, "You try" or "You do it." Again, if the student responds correctly, the student continues to the next step in the activity. If the student responds incorrectly, the instructor delivers the next level in the hierarchy. The instructor physically moves the student to the refrigerator, assists the student in opening the refrigerator and retrieving the mustard and bologna, and guides the student to the kitchen table. The student then continues to the next step in the activity.

In using a **verbal/physical assistance error correction procedure,** the instructor stops the student if he or she makes an incorrect response. After stopping the student, the instructor determines whether to back him or her up to the previous response(s) given correctly. If he or she determines to back the student up, the instructor next does so. Regardless of backing the student up to response(s) given correctly, the instructor next cues the student again to perform the response(s) originally performed incorrectly. This time the instructor assists the student, either verbally or physically, to perform correctly the response that was originally performed incorrectly. The student then continues to the next response in the activity.

An example of the verbal/physical assistance error correction procedure is as follows: An instructor gives a

student an instructional cue to make a sandwich. The student performs the first step of sandwich making independently. This step is to retrieve the mustard and bologna from the refrigerator and bring them to the kitchen table. The second step of the activity is to retrieve the plate from the cabinet and bring it to the kitchen table. The student makes an error on this step. He/She starts to open the bologna instead of retrieving the plate. As soon as the instructor realizes that the student is making an incorrect response, the instructor stops the student. The instructor then puts the mustard and bologna back in the refrigerator. This is backing the student up to the response performed correctly. That response was retrieving the items from the refrigerator and bringing them to the kitchen table. The instructor again gives the student the instructional cue, "Make a sandwich." The student retrieves the mustard and bologna from the refrigerator and brings them to the kitchen table. Before the student has the chance to make the error again, the instructor physically assists the student in retrieving the plate from the cabinet and bringing it to the kitchen table. This is assisting the student to perform correctly the response that the student originally performed incorrectly. After the instructor implements the error correction procedure, the student continues to make the sandwich.

Errorless learning teaching techniques are techniques

which require the instructor to provide added information (i.e., a prompt) before the student has a chance to respond. This is to minimize errors during instruction (Reichle & Sigafoos, 1991). Since a prompt is added information, it must be **faded** to ensure independent performance. **Fading** is the gradual and systematic removal of prompt(s) while maintaining correct responding (Billingsley & Romer, 1983). Two of the more common fading techniques in errorless learning are **time delay** and **decreasing prompt hierarchy.** In using **time delay techniques**, the instructor provides an effective prompt (i.e., added information such as a point cue or physical assistance) that elicits the desired response. He/She then attempts to fade the prompt by systematically manipulating the time between the natural or instructional cue and the prompt (Billingsley & Romer, 1983; Schuster & Griffen, 1990). There are two types of time delay: **constant time delay** and **progressive time delay.**

In using a **constant time delay** procedure, the instructor first delivers the prompt 0 seconds after the natural or instructional cue for the initial two to five trials. After the initial trials at 0 seconds, the instructor increases the amount of time between the natural or instructional cue and the prompt to a predetermined time delay interval. This time delay interval, which has ranged from 1 to 15 seconds, remains the same (i.e., constant) for the duration of the instruction (Billingsley & Romer, 1983;

Schuster & Griffen, 1990; Snell & Gast, 1981).

An example of a 2 second constant time delay is as follows: The instructor determines that he/she will provide the prompt immediately after the natural or instructional cue (i.e., a 0 second time delay) for the first three trials. After the initial three trials, the instructor increases the time delay interval to 2 seconds and keeps this interval at 2 seconds throughout the remaining instructional sessions until the student responds independently.

Researchers have reported constant time delay procedures to be effective in teaching a variety of functional activities and skills. These have included cooking skills (Schuster, Gast, Wolery, & Guiltinan, 1988); recipe following skills (Schuster & Griffen, 1992); signing manual signs (Kleinert & Gast, 1982; Browder, Morris, and Snell, 1981); reading sight words (Koury & Browder, 1986); and object identification (Johnson, 1977).

In using a **progressive time delay** procedure, the instructor begins with a 0 second time delay interval. The instructor then systematically increases the amount of time between the natural or instructional cue and the prompt by predetermined increments of time. These increases occur after a predetermined number of either correct responses or trials at each time delay interval (Billingsley & Romer, 1983; Schuster & Griffen, 1990).

An example of a progressive time delay is as follows: The instructor first provides the prompt immediately after the natural or instructional cue (i.e., a 0 second time delay interval). After a predetermined criterion of performance, for example, two consecutive correct responses, the instructor increases the time delay interval to 1 second. After two consecutive correct responses at 1 second, the instructor again increases the time delay interval, this time to 2 seconds. The instructor continues this process of increasing the time delay interval by one second until a predetermined ceiling is met (e.g., 5 seconds) or until the student responds independently.

Researchers have also reported progressive time delay procedures to be effective in teaching functional activities and skills. These have included bed making (Snell, 1982); toothbrushing skills (Snell, Lewis, & Houghton, 1989); using vending machines (Browder, Snell, & Wildonger, 1988); and purchasing skills using a calculator (Frederick-Dugan, Test, & Varn, 1992).

A second fading procedure is **decreasing prompt hierarchy**, also known as most-to-least prompting hierarchies or decreasing assistance (Sigafoos, Mustonen, DePaepe, Reichle, & York, 1991; Wolery et al., 1992). In using a decreasing prompt hierarchy the instructor provides as much added information as needed (i.e., a prompt) to obtain the desired response. The instructor provides this added

information before the student has the opportunity to respond. The instructor systematically fades the added information according to some predetermined hierarchy. Typically, the hierarchy of prompts includes full physical assistance, followed by visual prompts (models and gestures), and ends with verbal prompts (Billingsley & Romer, 1983; Sigafoos et al., 1991). Decreasing prompt hierarchy differs from the system of least prompts in that it is an errorless learning teaching technique rather than a trial and error technique. When using a decreasing prompt hierarchy, the instructor delivers the prompts before the student has a chance to respond to the natural or instructional cue. This is to minimize errors during instruction. In using the system of least prompts, the instructor waits for the student to respond to the natural or instructional cue. If the student makes an error, the instructor delivers the prompts in the hierarchy until the student either correctly responds or reaches the last level in the hierarchy.

An example of a typical decreasing prompt hierarchy in making a sandwich is as follows: The first step of the sandwich making activity is retrieving the mustard and bologna from the refrigerator and bringing the two items to the kitchen table. The hierarchy of prompts is: (1) full physical assistance, (2) showing the student what to do, modeling, (3) a point cue, and (4) a verbal prompt. The

instructor gives the student the instructional cue, "Make a sandwich." The instructor then immediately gives the student full physical assistance to retrieve the mustard and bologna from the refrigerator and bring them to the kitchen table. After a predetermined criterion of correct performance, for example, two consecutive correct responses, the instructor fades to the model prompt. Immediately after the instructional cue, the instructor models the correct response for the student. After two consecutive correct responses to the model prompt, the instructor fades to a point cue. Immediately after the instructional cue, the instructor points to the refrigerator. After two consecutive correct responses to the point cue, the instructor fades to a verbal prompt. Immediately after the instructional cue, "Make a sandwich," the instructor gives the verbal prompt, "Get the mustard and bologna." After two consecutive correct responses to the verbal prompt, the instructor fades the verbal prompt and gives only the instructional cue, "Make a sandwich". The instructor expects the student to retrieve the mustard and bologna from the refrigerator and bring them to the kitchen table independently.

Wilcox and Bellamy (1982) have recommended an alternative way of determining the levels in the decreasing prompt hierarchy. They suggest that the instructor choose "the type of assistance that seems most suited to the

learner, task, and setting, and use that strategy to provide different amounts of assistance" (Wilcox & Bellamy, 1982, p. 109). For example, a student requires a full physical prompt to get the desired response. Wilcox and Bellamy suggest that the levels in the decreasing prompt hierarchy be differing amounts of physical assistance until the student responds independently. This is instead of the more common prompting hierarchy that involves changing the types of prompts from physical assistance to a model to a verbal prompt.

An example of Wilcox and Bellamy's (1982) proposed decreasing prompt hierarchy in making a sandwich is as follows: The first step of the sandwich making activity is retrieving the mustard and bologna from the refrigerator and bringing the two items to the kitchen table. The student requires full physical assistance to complete the first step in the activity. The four prompt levels in this decreasing prompt hierarchy are: (1) full physical assistance, (2) physically assisting the student to walk to the refrigerator and retrieve the items, (3) physically guiding the student to walk to the refrigerator, and (4) touching the student to begin walking to the refrigerator. The instructor gives the instructional cue, "Make a sandwich." Immediately after the instructional cue, the instructor gives the student full physical assistance to retrieve the mustard and bologna from the refrigerator and bring them to the kitchen table. After

a predetermined criterion of performance, for example, two consecutive correct responses, the instructor fades to physically assisting the student to the refrigerator and retrieving the items. The instructor expects the student to walk to the kitchen table independently. After two consecutive correct responses to that level of prompt, the instructor fades the physical assistance. The instructor physically guides the student in walking to the refrigerator. The instructor expects the student to retrieve the items from the refrigerator and walk to the kitchen table independently. After two consecutive correct responses at that prompt level, the instructor fades the prompt once again. This time the instructor touches the student's back to prompt the student to walk to the refrigerator. After two consecutive correct responses to the touch prompt, the instructor gives the student the instructional cue, "Make a sandwich." He/She provides no prompt. The instructor then expects the student to retrieve the mustard and bologna from the refrigerator and bring the items to the kitchen table independently.

Researchers have reported decreasing prompt hierarchy effective in teaching a variety of functional activities and skills. These have included janitorial skills (Cuvo, Leaf, & Borakove, 1978); discrimination tasks (Csapo, 1981); banking skills (McDonnell & Ferguson, 1989); laundry skills (Miller & Test, 1989); folding a shirt, setting the table,

and using a cassette recorder (Walls, Crist, Sienicki, & Grant, 1981); and fine motor skills (Glendenning, Adams, & Sternberg, 1983). See Figure 1 for a brief outline of the two major teaching techniques.

There are many studies reporting various teaching techniques as effective. There are, however, relatively few studies that compare teaching techniques to determine which techniques are more efficient. Of the limited comparative studies available results suggest the following: First, the system of least prompts error correction procedure may be more efficient than the verbal/physical assistance error correction procedure (Doyle et al., 1988). Second, some time delay procedures may be more efficient than the system of least prompts (Bennett, Gast, Wolery, & Schuster, 1986; Doyle, Wolery, Gast, & Ault, 1990; Gast, Ault, Wolery, Doyle, & Belanger, 1988; Godby, Gast, & Wolery, 1987; McDonnell, 1987). Third, a decreasing prompt hierarchy strategy may be more efficient than the system of least prompts (Glendenning et al., 1983; Walls et al., 1981). Fourth, there are mixed results comparing decreasing prompt hierarchy and time delay. McDonnell and Ferguson (1989) found that decreasing prompt hierarchy was more efficient than time delay. On the other hand, Miller and Test (1989) found that time delay was more efficient than decreasing prompt hierarchy.

It is difficult to draw conclusions from the research

I. Trial and Error
   A. Reinforce correct responses
   B. Error correction procedures
      1. System of least prompts
      2. Verbal/physical assistance

II. Errorless Learning
   A. Reinforce correct responses
   B. Fading procedures
      1. Time delay
         a. constant
         b. progressive
      2. Decreasing prompt hierarchy
         a. across types of prompts
         b. within the same type of prompt

FIGURE 1. OUTLINE OF TWO MAJOR TEACHING TECHNIQUES

about the relative efficiency of teaching techniques. There seem to be at least two reasons that contribute to this difficulty. First, of five major studies reviewed, the researchers all described decreasing prompt hierarchy differently (Csapo, 1981; Cuvo et al., 1978; McDonnell & Ferguson, 1989; Miller & Test, 1989; Walls et al., 1981).

Second, researchers have implemented the decreasing prompt hierarchy differently. For instance, Glendenning et al. (1983), Miller and Test (1989), and Walls et al. (1981) used decreasing prompt hierarchy as an error correction procedure. Conversely, Csapo (1981), Cuvo et al. (1978), and McDonnell and Ferguson (1989) used decreasing prompt hierarchy as an errorless learning teaching technique.

In summary, there have been many studies documenting the effectiveness of both trial and error and errorless learning teaching techniques. There are, however, relatively few comparative studies to guide instructors in selecting the most efficient teaching technique. The overall purpose of this study was to add to the body of knowledge needed by instructors to assist them in selecting efficient teaching techniques.

Purpose of the Study

The purpose of this study was to compare two errorless learning teaching techniques, time delay and decreasing

prompt hierarchy, to determine which was more efficient in teaching students with severe disabilities. The researcher chose two errorless learning teaching techniques because the literature strongly suggested that errorless learning teaching techniques were more efficient in teaching students with severe disabilities than trial and error teaching techniques (Bennett et al., 1986; Doyle et al., 1990; Gast et al., 1988; Godby et al., 1987; McDonnell, 1987). The researcher determined the more efficient teaching technique by comparing (a) the average number of steps learned across activities by teaching technique and (b) the average percentage of errors made during instruction across activities by teaching technique.

Research Questions

1. Will there be a difference in the average number of steps learned, across activities, between time delay instruction and decreasing prompt hierarchy instruction?

2. Will there be a difference in the average percentage of errors made during instruction, across activities, between time delay instruction and decreasing prompt hierarchy instruction?

3. Will there be a difference in the average number of

types of errors made during probe sessions, across activities, between time delay instruction and decreasing prompt hierarchy instruction?

4. Will there be a difference between time delay instruction and decreasing prompt hierarchy instruction in the number of steps in each task analysis maintained and generalized during the 4 week follow-up probe sessions?

5. Will there be a difference between the two teaching techniques, time delay and decreasing prompt hierarchy, in efficiency of instruction?

CHAPTER II

LITERATURE REVIEW

This chapter presents a review of the research pertinent to this study. For organizational and clarity purposes, this chapter is divided into four major sections: (1) a brief overview of research related to teaching techniques that have been effective in teaching students with severe disabilities, (2) research comparing teaching techniques to determine the most efficient to use with students with severe disabilities, (3) limitations of the existing comparative research, and (4) the purpose and rationale for this study as it relates to the current research.

Research Related to Effective Teaching Techniques

Students with severe disabilities have many complex activities and skills that must be learned in order for them to become as independent as possible. Students with severe disabilities also require more instructional trials and time to acquire, maintain, generalize, and synthesize these complex activities and skills as compared to their peers without disabilities (Brown et al., 1983). Researchers have reported that many different teaching techniques have been

effective in teaching a wide variety of activities and skills to many different students and adults with severe disabilities. A brief overview of this research is presented below.

Two major teaching techniques are trial and error and errorless learning. In using trial and error teaching techniques, an instructor allows a student to respond to the natural or instructional cue. If the response to the natural or instructional cue is correct, the instructor provides reinforcement and/or allows the student to continue to the next required response or step in the activity. If the student makes an error, the instructor implements an error correction procedure. An error correction procedure is added information that the instructor provides, after the student makes an error, to assist the student in responding correctly. The purpose of the error correction procedure is to correct the error that the student made. Researchers have reported using two error correction procedures effectively. These are the system of least prompts and verbal/physical assistance.

The system of least prompts error correction procedure has been effective in teaching a wide variety of activities and skills. Koop, Martin, Yu, and Suthons (1980) and Wacker, Carroll, and Moe (1980) successfully taught individuals with severe mental retardation vocational skills. Azrin, Schaeffer, and Wesolowski (1976)

successfully taught adults with profound mental retardation dressing skills. Schleien, Ash, Kiernan, and Wehman, (1981) successfully taught a woman with profound mental retardation cooking skills. Cronin and Cuvo (1979) successfully taught adolescents with mental retardation mending skills. Nietupski and Svoboda (1982) successfully taught adults with severe mental retardation to play a lotto game. Giangreco (1983) successfully taught a man with severe mental retardation photography skills. Stainback, Stainback, Wehman, and Spangiers (1983) successfully taught adults with profound mental retardation physical fitness exercises. Storey, Bates, and Hanson (1984) successfully taught adults with severe disabilities coffee purchasing skills.

The verbal/physical assistance error correction procedure has been effective in teaching a variety of activities and skills. Close et al. (1978) successfully taught adults with severe mental retardation vocational skills. Gold (1972) successfully taught adolescents with moderate mental retardation to assemble bicycle brakes. Gold and Barclay (1973) successfully taught adolescents and adults with moderate and severe mental retardation to sort different size bolts. Day (1987) successfully taught adolescents with profound mental retardation to assemble items, sort objects, identify coins and utensils, and follow prepositions. Horner and Day (1991) successfully taught two students and one adult with severe to profound mental

retardation communication skills.

Errorless learning teaching techniques are techniques which require the instructor to provide added information (i.e., a prompt) before the student has a chance to respond. This is to minimize errors during instruction (Reichle & Sigafoos, 1991). Since a prompt is added information, it must be faded to ensure independent performance. Fading is the gradual and systematic removal of prompt(s) while maintaining correct responding (Billingsley & Romer, 1983). Two of the more common fading techniques in errorless learning are time delay and decreasing prompt hierarchy. In using time delay techniques, the instructor provides an effective prompt (i.e., added information such as a point cue or physical assistance) that elicits the desired response. He/She then attempts to fade the prompt by systematically manipulating the time between the natural or instructional cue and the prompt (Billingsley & Romer, 1983; Schuster & Griffen, 1990). There are two types of time delay: constant time delay and progressive time delay.

In using a constant time delay procedure, the instructor first delivers the prompt 0 seconds after the natural or instructional cue for the initial two to five trials. After the initial trials at 0 seconds, the instructor increases the amount of time between the natural or instructional cue and the prompt to a predetermined time delay interval. This time delay interval, which has ranged

from 1 to 15 seconds, remains the same (i.e., constant) for the duration of the instruction (Billingsley & Romer, 1983; Schuster & Griffen, 1990; Snell & Gast, 1981).

Constant time delay procedures have been reported effective in teaching a variety of functional activities and skills. Schuster et al. (1988) used a 5 second constant time delay and successfully taught four adolescents with moderate mental retardation to make a sandwich, to bake canned biscuits, and to boil a boil-in-bag item. Schuster and Griffen (1992) used a 5 second constant time delay and successfully taught five children with moderate mental retardation to follow a recipe to make Kool-Aid. Kleinert and Gast (1982) used a 4 second constant time delay and successfully taught a man with mild to moderate mental retardation, cerebral palsy, and a severe hearing loss to manually sign six different signs. Johnson (1977) used a 4 second constant time delay and successfully taught an adolescent with mental retardation and emotional disturbances object identification. Koury and Browder (1986) trained five peer tutors ranging in age from 9 to 11 to implement a 5 second constant time delay. The peer tutors successfully taught five children with moderate and severe mental retardation, ranging in age from 6 to 9, to read five sight words. Browder et al. (1981) used a 4 second constant time delay and successfully taught an adolescent male with severe mental retardation to manually

sign five food items.

In using a progressive time delay procedure, the instructor begins with a 0 second time delay interval. The instructor then systematically increases the amount of time between the natural or instructional cue and the prompt by predetermined increments of time. These increases occur after a predetermined number of either correct responses or trials at each time delay interval (Billingsley & Romer, 1983; Schuster & Griffen, 1990).

Progressive time delay procedures have also been reported effective in teaching functional activities and discrimination tasks. Snell (1982) used a progressive time delay starting at a 0 second delay interval. The delay interval was increased to 2 seconds, then was increased in 1 second increments until it reached 8 seconds. In using this progressive time delay, Snell (1982) successfully taught four young adult males with severe mental retardation to strip the sheets off an unmade bed. Using the same progressive time delay, Snell (1982) also taught three of the four males to make a partially unmade bed and to make a stripped bed with sheets. In addition, one of the four males also learned to make a bed with a blanket, pillow, and spread. Browder et al. (1988) used a progressive time delay starting at a 0 second delay interval. The delay interval was increased in 2 second increments until it reached 6 seconds. Using this progressive time delay, Browder et al.

(1988) successfully taught four students to use vending machines. Frederick-Dugan et al. (1992) used a progressive time delay starting at a 0 second delay interval. The delay interval was increased in 1 second increments. Using this progressive time delay Frederick-Dugan et al. (1992) successfully taught two young adults with moderate and severe mental retardation purchasing skills using a calculator. Snell et al. (1989) used a progressive time delay starting at a 0 second delay interval. The delay interval then increased to 1, 2, 3, 5, 7, and 9 seconds. Using this progressive time delay, Snell et al. (1989) successfully taught three students with severe mental and physical disabilities toothbrushing skills.

A second fading procedure used in errorless learning is decreasing prompt hierarchy, also known as most-to-least prompting hierarchies or decreasing assistance (Sigafoos et al., 1991; Wolery et al., 1992). In using a decreasing prompt hierarchy the instructor provides as much added information as needed (i.e., a prompt) to obtain the desired response. The instructor provides this added information before the student has the opportunity to respond. The instructor systematically fades the added information according to some predetermined hierarchy. Typically, the hierarchy of prompts includes full physical assistance, followed by visual prompts (models and gestures), and ends with verbal prompts (Billingsley & Romer, 1983; Sigafoos et

al., 1991).

Wilcox and Bellamy (1982) have recommended an alternative way of determining the levels in the decreasing prompt hierarchy. They suggest that the instructor choose "the type of assistance that seems most suited to the learner, task, and setting, and use that strategy to provide different amounts of assistance" (Wilcox & Bellamy, 1982, p. 109). For example, a student requires a full physical prompt to get the desired response. Wilcox and Bellamy suggest that the levels in the decreasing prompt hierarchy be differing amounts of physical assistance until the student responds independently. This is instead of the more common prompting hierarchy that involves changing the types of prompts from physical assistance to a model to a verbal prompt.

Decreasing prompt hierarchies have been reported effective in at least six studies. Five of these research articles are comparative studies and will be discussed in detail below. The sixth study was conducted by Cuvo et al. (1978) and involved teaching cleaning a restroom with the system of least prompts and decreasing prompt hierarchy both. Six students with IQs ranging from 40 to 50 participated in the study. Cleaning the restroom was broken down into six subtasks with a total of 181 component responses. The 20 most difficult responses were taught using a decreasing prompt hierarchy. The remaining 161

responses were taught using the system of least prompts. The four levels in the decreasing prompt hierarchy consisted of verbal instruction plus modeling, verbal instruction plus graduated physical guidance, verbal instruction, and no help. Cuvo et al. (1978) successfully taught the six students to clean the restroom using the decreasing prompt hierarchy on the 20 most difficult responses and the system of least prompts on the 161 remaining responses.

Research Related to Efficient Teaching Techniques

Time Delay Compared to System of Least Prompts

There have been several studies comparing time delay to the system of least prompts. In general, the studies reviewed suggested that time delay was more efficient than the system of least prompts. McDonnell (1987) conducted one of these studies in which four students participated. The students' ages ranged from 16 to 18 with a mean age of 16.75. Their IQs ranged from 10 to 34 with a mean of 21.8 as measured by the WAIS-R. The students were taught to purchase two items, a soft drink and a cookie, from a convenience store and a fast-food restaurant.

McDonnell (1987) used an alternating treatment, single subject design. He compared a 2 second constant time delay to the system of least prompts. Tasks, interventions, and trainer assignments were counterbalanced across students.

The levels in the system of least prompts were as follows: "(a) an indirect verbal prompt, (b) a direct verbal prompt plus gesture, and (c) direct verbal prompt plus full physical assistance" (McDonnell, 1987, p. 229). Trainers implemented the system of least prompts after a student made an error.

Specific prompts used during the time delay instruction were selected from one of the levels of the system of least prompts and remained constant throughout the study. Initially, the prompts were delivered at a 0 second time delay interval. After three consecutive correct responses, the time delay interval was increased to a 2 second constant time delay. Students received at least one training trial with the time delay and the system of least prompts daily. Probe sessions were conducted at the beginning of every third training trial.

McDonnell (1987) used three variables to determine the more efficient teaching technique. These were as follows: "the average number of instructional trials, errors, and sessions to criterion across students by interventions" (McDonnell, 1987, p. 229). He found that both time delay and the system of least prompts were effective in teaching the four students to purchase a soft drink and cookie in the convenience store and the fast-food restaurant. He also found time delay to be more efficient than the system of least prompts in terms of the average number of

instructional trials, errors, and sessions to criterion across students by interventions.

Bennett et al. (1986) conducted another study comparing time delay and the system of least prompts. Three students participated in their study. They ranged in age from 14 to 17. Their IQs ranged from untestable to 43. The students were each taught eight manual signs functional to their specific environment. Four of the manual signs were taught with time delay and the other four signs were taught with the system of least prompts. Two instructional sessions occurred daily with each instructional session containing ten trials on one sign until the student independently made the sign three consecutive sessions. Probe sessions were conducted at the beginning of the study and following the session once the sign was learned to test for maintenance of acquired signs.

Bennett et al. (1986) used a multiple probe, single subject design across behaviors (manual signs). They compared a progressive time delay to the system of least prompts. The levels in the system of least prompts were as follows:

> Level 1 - verbal and signed task request alone (i.e., "What is this?"); Level 2 - verbal and signed task request and verbal prompt (i.e., "Show me the sign."); Level 3 - verbal and signed task request with teacher modeling the manual sign;

> Level 4 - verbal and signed task request and partial physical prompt (i.e., teacher shaped the student's hands into the sign formation); and
> Level 5 - verbal and signed task request and full physical prompt (i.e., teacher physically manipulated the student's hands to form the requested sign) (Bennett et al., 1986, p. 121).

The trainer implemented the system of least prompts after a student made an error.

The controlling prompt used during the time delay instruction was the trainer's model of the targeted manual sign. This study used a 10 second progressive time delay. During the first instructional session, the trainer used a 0 second time delay interval. The trainer used the 0 second time delay for all 10 trials of the first instructional session. During the second instructional session, the trainer used a 1 second time delay interval. During the third instructional session, the trainer used a 2 second time delay interval, etc. up to the maximum delay interval of 10 seconds.

Bennett et al. (1986) used four variables to determine the more efficient teaching technique. These were as follows: "sessions to criterion, trials to criterion, errors to criterion, and direct instruction time" in minutes (Bennet et al., 1986, p. 124). They found that both time delay and the system of least prompts were effective in

teaching the three students their eight manual signs. They also found that, overall, the progressive time delay was more efficient than the system of least prompts in terms of sessions to criterion, trials to criterion, errors to criterion, and direct instruction time.

A third study comparing time delay and the system of least prompts was conducted by Gast et al. (1988). Four students participated in their study. They ranged in age from 8 to 13. Their IQs ranged from 44 to 51. Two students were taught to read 16 food words, eight with time delay and eight with the system of least prompts. The other two students were taught to read 12 food words, six with time delay and six with the system of least prompts. Two instructional sessions occurred daily with each instructional session containing twenty trials on two food words until the student independently read the food word three consecutive sessions. Probe sessions were conducted at the beginning of the study and following each session once the food words were learned to test for maintenance of acquired words.

Gast et al. (1988) used a single subject, multiple probe design. They compared a 4 second constant time delay to the system of least prompts. The levels in the system of least prompts were as follows: "(a) task request alone ('What word?'); (b) task request plus verbal description of the item; (c) task request plus photograph of the word; and

(d) task request plus model (verbal or verbal and signed model)" (Gast et al., 1988, p. 121). The trainer implemented the system of least prompts after a student made an error.

The controlling prompt used during the time delay instruction was the trainer's model (verbal or sign) of the targeted food word. During the initial instructional session, the model prompt was delivered at a 0 second delay interval. During the second instructional session and all subsequent sessions, the time delay interval was increased to the 4 second constant time delay.

Gast et al. (1988) used three variables to determine the more efficient teaching technique. These were as follows: "number of minutes of direct instruction time, number of sessions, and percent of errors through criterion" (Gast et al., 1988, p. 123). They found both time delay and the system of least prompts effective in teaching the four students to read food words. They also found that, overall, time delay was more efficient in terms of number of minutes of direct instruction time, number of sessions, and percent of errors through criterion in teaching the four students to read the food words.

Doyle et al. (1990) conducted a fourth study comparing time delay and the system of least prompts. Three students participated in their study. They ranged in age from 4 to 6. The six year old had a measured IQ of 53 according to the Wechsler Preschool and Primary Scale of Intelligence.

The two 4 year old students were developmentally delayed according to the Learning Accomplishment Profile-Diagnostic (LAP-D).

Two students were taught to read 16 sight words, eight with time delay and eight with the system of least prompts. The other student was taught to read 12 sight words, six with time delay and six with the system of least prompts. Two instructional sessions occurred daily. Each instructional session contained 16 trials, ten trials on the unknown sight word, two trials on known stimuli, two probe trials, and two review trials on already learned words. Criteria for considering the sight words learned was when a student read the sight word with 90% accuracy two consecutive sessions. Probe sessions "occurred (a) prior to beginning initial instruction; (b) during instruction on words from subsequent sets; and (c) following criterion level performance in each set of behaviors" (Doyle et al., 1990, p. 8).

Doyle et al. (1990) used a multiple probe, single subject design. They compared a 4 second constant time delay to the system of least prompts. The levels in the system of least prompts were as follows: "Level 1, the task direction alone; level 2, the task direction paired with a verbal prompt i.e., a verbal description of the object's action/function represented by the sight word; level 3, the task direction paired with a visual prompt i.e., a

photograph of the object; and level 4, the task direction plus a verbal model i.e., the instructor said the word" (Doyle et al., 1990, p. 9). The trainer implemented the system of least prompts after a student made an error.

The controlling prompt used during the time delay instruction was the trainer's vocal model of the targeted sight word. During the initial instructional session, the model prompt was delivered at a 0 second delay interval. During the second instructional session and all subsequent sessions, the time delay interval was increased to the 4 second constant time delay.

Doyle et al. (1990) used four variables to determine the more efficient teaching technique. These were as follows: "number of trials, number of errors, percent of errors, and minutes of direct instructional time through criterion" (Doyle et al., 1990, p. 15). They found both time delay and the system of least prompts to be effective in teaching the three students to read their specific sight words. They also found that, overall, time delay was more efficient in terms of number of trials, number of errors, percent of errors, and minutes of direct instructional time through criterion.

Godby et al. (1987) conducted a fifth study comparing time delay and the system of least prompts. Three students participated in their study. They ranged in age from 8 to 16. The 8 year old student was diagnosed with infantile

autism. She scored a 70 on the TARC Assessment System. The 11 year old student was diagnosed with cerebral palsy and severe mental retardation. She scored 62 on the TARC Assessment System. The 16 year old student was diagnosed with severe mental retardation, and was nonverbal. He scored a 51 on the TARC Assessment System.

The three students were taught to identify eight functional objects, four with time delay and four with the system of least prompts. Two instructional sessions occurred daily. Each instructional session contained 12 trials, ten trials on the unknown object word and two review trials on already learned objects. Three distractor objects were also included in the instructional sessions. The trainer gave the instructional cue, "'(Subject's name,) point to (object name)' and waited 5 s for a response" (Godby et al., 1987, p. 288). Objects were considered learned when a student identified the object with 100% accuracy two consecutive sessions when reinforced on a variable ratio three (VR3) schedule. A total of five probe sessions were conducted for each student over the course of the study. Probe sessions occurred before and after instruction on pairs of objects.

Godby et al. (1987) used a multiple probe, single subject design. They compared a 7 second progressive time delay to the system of least prompts. The levels in the system of least prompts were as follows: "the task

direction paired with a gestural cue related to the use of the object (Prompt Level I); the task direction paired with a model (Prompt Level II); the task direction paired with partial physicals (Prompt Level III); and the task direction paired with full physical manipulation (Prompt Level IV)" (Godby et al., 1987, p. 289). The trainer implemented the system of least prompts after a student made an error.

The controlling prompt used during the time delay instruction was the trainer's model of pointing to the correct object. This study used a 7 second progressive time delay. During the first instructional session for each object, the trainer used a 0 second time delay interval. The trainer used the 0 second time delay for all 10 trials of the first instructional session. During the second instructional session, the trainer used a 1 second time delay interval. During the third instructional session, the trainer used a 2 second time delay interval, etc. up to the maximum delay interval of 7 seconds.

The four variables used to determine the more efficient teaching technique were: "the number of sessions, the number and percentage of errors, and the number of minutes of direct instructional time to criterion" (Godby et al., 1987, p. 294). They found both time delay and the system of least prompts effective in teaching the three students object identification. They also found that, overall, time delay was more efficient than the system of least prompts in

terms of the number of sessions, the number and percentage of errors, and the number of minutes of direct instructional time to criterion.

Decreasing Prompt Hierarchy Compared to the System of Least Prompts

There have been three major studies comparing decreasing prompt hierarchy and the system of least prompts. Glendenning et al. (1983) conducted one of these studies and compared three prompting sequences. Twelve students participated in their study. They ranged in age from 16 to 20 with a mean age of 17.3. Their IQs ranged from 41 to 68 with a mean of 52.2 as measured by the Wechsler Adult Intelligence Scale. The students were taught to tie a string around a box using a 48 step task analysis. Glendenning et al. (1983) used three prompting sequences. One prompting sequence was the system of least prompts. The other two prompting sequences were variations of decreasing prompt hierarchy.

> The first sequence included the following prompts: verbal cue, gesture, model, and full physical assistance. The second sequence included: verbal cue and full physical assistance, verbal cue and light physical assistance, verbal cue and gesture, and verbal cue. The third sequence included: full physical assistance, moderate physical assistance, light physical assistance, and

> gesture. The definitions of the types of prompts used in the third sequence were as follows: full physical assistance meant complete hand-over-hand assistance, moderate physical assistance meant a lighter hand-over-hand assistance, light physical assistance meant touching the student and gesturing to the task, and gesture meant pointing to the task (Glendenning et al., 1983, p. 322-323).

The 12 students were assigned randomly into six groups of two students. Groupings were based on the six possible combinations of the order of the three prompting sequences. For example, in Group 1 the prompting sequences were ordered 1, 2, and then 3. For Group 2, the prompting sequences were ordered 1, 3, and then 2, and so on for the remaining four groups. All students were trained with all three prompting sequences which were counterbalanced. The students were taught a different part of the string tying activity with a different prompting sequence. The trainer implemented all three prompting sequences by providing the students the appropriate prompts <u>after</u> the students had the opportunity to respond to the natural cue.

Glendenning et al. (1983) used self-initiated responses by the students to measure the most efficient prompting sequence. The second prompting sequence, which started with the verbal and physical assistance prompt "resulted in a

significantly higher rate of self-initiated responses" (Glendenning et al., 1983, p. 321). Results of this study suggested, therefore, that decreasing prompt hierarchy was more efficient than the system of least prompts in terms of the students' self-initiated responses.

Walls et al. (1981) also compared decreasing prompt hierarchy to the system of least prompts using three prompting sequences. Fourteen adults participated in their study. They ranged in age from 16 to 50 with a mean age of 28.6. The participants were classified as either mildly or moderately mentally retarded. Seven adults were classified as mildly mentally retarded with a mean IQ of 71.1. The other seven participants were classified as moderately mentally retarded with a mean IQ of 47.1. The 14 participants were taught to fold a shirt, set the table, and use a cassette recorder.

Walls et al. (1981) used three prompting sequences. One prompting sequence was the system of least prompts. The other two prompting sequences were variations of decreasing prompt hierarchy. The first prompting sequence consisted of a verbal prompt, a model prompt, and then a physical prompt (VMP sequence). The second prompting sequence consisted of a physical prompt, a model prompt, and then a verbal prompt (PMV sequence). The third prompting sequence consisted of a full physical prompt, partial physical prompt, and a slight physical prompt (FPS sequence). Walls et al. (1981) used a

"2 x 3 mixed design with one between-subjects factor (mild, moderate classification) and one within-subjects factor (three prompting sequences)" (p. 243). The three prompting sequences were counterbalanced. Each student was taught all three activities, each activity with a different prompting sequence. The trainers implemented all three prompting sequences by providing the adults the appropriate prompts after they had the opportunity to respond to the natural cue.

Walls et al. (1981) used three variables to analyze the three prompting sequences. These were as follows: "number of errors to criterion, number of seconds to criterion, and percentage of responses that are correct (correct responses/errors plus correct responses)" (p. 244). Walls et al. (1981) found that all three prompting sequences were effective in teaching the three activities. The PMV prompting sequence was most efficient in terms of errors and seconds to criterion for the adults classified as moderately mentally retarded. The VMP prompting sequence was most efficient in terms percentage of correct responses for the adults classified as moderately mentally retarded. For the adults classified as mildly mentally retarded, the PMV prompting sequence was most efficient for all three measures. Results of this study suggested, therefore, that decreasing prompt hierarchy was more efficient than the system of least prompts in terms of errors, seconds, and

percentage of correct responses to criterion.

Another study comparing decreasing prompt hierarchy and the system of least prompts was conducted by Csapo (1981). Six students participated in her study. They ranged in age from 6 to 12. The Vineland Social Maturity Scale scores ranged from 20-41. All six students were nonverbal. The learners were taught to identify red, blue, yellow, and green. The red and blue blocks were in one set and the yellow and green blocks were in the other set.

Csapo (1981) used two instructional procedures during the fluency building stage, the system of least prompts (Procedure A) and decreasing prompt hierarchy (Procedure B). The order of conditions was ABA and BAB. Students 1, 3, and 5 were exposed to ABA, while Students 2, 4, and 6 were exposed to BAB. During the instructional and probe sessions the trainers instructed the students to hand them the designated color of block. The levels in the system of least prompts were as follows: verbal prompt, point cue, partial physical assistance, and full physical assistance. The trainers implemented the system of least prompts by providing the students the appropriate prompts <u>after</u> the student had the opportunity to respond. The levels in the decreasing prompt hierarchy were as follows: full physical assistance with verbal direction, partial physical assistance, a gestural prompt, and verbal direction. The trainers implemented the decreasing prompt hierarchy by

providing the students the appropriate prompts before the student had the opportunity to respond.

The instructional sessions during the acquisition stage consisted of 40 trials. The trainers used only decreasing prompt hierarchy during the acquisition stage. When the students reached acquisition, which was set at three consecutive instructional sessions with 20 correct responses per color, the fluency building stage began. It was during the fluency building stage that the ABA and BAB conditions were implemented. One minute probe sessions were conducted at the end of each instructional session. The rate of correct and error responses were recorded during the one minute probes.

Csapo (1981) used the correct and error responses during the one minute probe sessions to measure the efficiency of the two teaching techniques. Decreasing prompt hierarchy "resulted in steady increase of correct rates and the maintenance of low rate for errors" during the fluency stage (Csapo, 1981, p. 45). With the system of least prompts "correct rates dropped and errors increased for the initial trials. However, after having reached the previous level of correct rate, responses began to increase at a faster rate than under the" decreasing prompt hierarchy (Csapo, 1981, p. 45). Results suggested that during acquisition, decreasing prompt hierarchy was effective. Results also suggested that during fluency building, the

system of least prompts may be more efficient than decreasing prompt hierarchy.

Time Delay Compared to Decreasing Prompt Hierarchy

There have been two major studies comparing time delay and decreasing prompt hierarchy. Results of these studies were varied and inconclusive. McDonnell and Ferguson (1989) conducted one of these studies. Four students participated in their study. They ranged in age from 15 to 19 with a mean age of 17. Their IQs ranged from 39 to 48 with a mean of 40 as measured by the WISC-R. The students were taught two activities, making cash withdrawals from an automatic teller machine (ATM) and cashing a check in a bank.

McDonnell and Ferguson (1989) used an alternating treatment, single subject design. They compared a 3 second constant time delay procedure to a decreasing prompt hierarchy procedure. The decreasing prompt hierarchy instruction and time delay instruction were alternated daily throughout the course of the study. Probe sessions occurred at the beginning of every second instructional session. Tasks and interventions were counterbalanced across students. The levels in the decreasing prompt hierarchy were as follows: "(a) physical assistance plus direct verbal cue, (b) point plus direct verbal cue or model plus direct verbal cue, (c) direct verbal cue, and (d) gesture" (McDonnell & Ferguson, 1989, p. 87). Trainers implemented the decreasing prompt hierarchy by providing the students

the appropriate prompts before the student had the opportunity to respond to the natural cue.

Specific prompts used during the time delay instruction were selected from one of the levels of the decreasing prompt hierarchy and remained constant throughout the study. Initially, the prompts were delivered after a 0 second delay interval. After two consecutive correct responses, the time delay interval was increased to the 3 second constant time delay.

McDonnell and Ferguson (1989) used three variables to determine the more efficient teaching technique. These were as follows: "(a) the average number of training trials required for students to meet the criterion of 100% correct performance of task-analysis steps on two consecutive probe sessions, (b) the average number of errors to criterion made by students during training sessions, and (c) the average training time to criterion" (McDonnell & Ferguson, 1989, p. 87). They found that both decreasing prompt hierarchy and time delay were effective in teaching the four students to make cash withdrawals from the ATM and to cash a check. They also found decreasing prompt hierarchy to be more efficient than time delay in terms of training trials to criterion, errors made, and time in instruction.

Miller and Test (1989) conducted a second study comparing time delay and decreasing prompt hierarchy. Four students participated in their study. All four students

were 18 years old. Their IQs ranged from 39 to 54. The students were taught two activities, using a washing machine and using a dryer.

Miller and Test (1989) used an alternating treatment, single subject design. They compared a 2 second constant time delay procedure to a decreasing prompt hierarchy procedure. Tasks and interventions were counterbalanced across students. The levels in the decreasing prompt hierarchy were as follows: "(a) direct verbal plus physical assistance, (b) direct verbal plus gesture, (c) indirect verbal" (Miller & Test, 1989, p. 365). The trainer implemented the decreasing prompt hierarchy by providing the students "the most intrusive level of assistance" when an error occurred (Miller & Test, 1989, p. 365). The trainer, therefore, implemented the decreasing prompt hierarchy as an error correction procedure, not as an errorless learning teaching technique.

Specific prompts used during the time delay instruction were selected from one of the levels of the decreasing prompt hierarchy and remained the same throughout the study. Initially, the prompts were delivered after a 0 second time delay interval. After three consecutive correct responses, the time delay interval was increased to the 2 second constant time delay. Students received one instructional trial on each activity during the daily sessions. The trainer conducted probe sessions on both activities each

day.

Miller and Test (1989) used three variables to determine the more efficient teaching technique. These were as follows: "(a) percentage of correctly performed steps on the two task analyses by the students during probe sessions; (b) percentage of topographical errors made by the students during probe sessions; and (c) average number of instructional trials, errors, and sessions to criterion" (Miller & Test, 1989, p. 365). They found that both decreasing prompt hierarchy and time delay were effective in teaching the four students to use a washing machine and dryer. They also found that decreasing prompt hierarchy required fewer average instructional trials to criterion than time delay on the washing machine. Both teaching techniques required the same number of instructional trials to criterion on the dryer. In terms of instructional time and errors, time delay was more efficient than decreasing prompt hierarchy. Students made, on the average, almost three times as many errors during decreasing prompt hierarchy instructional sessions.

Limitations of the Existing Comparative Research

Of the comparative research discussed previously, a number of major limitations were apparent. An obvious limitation is the lack of comparative research available.

For example, there was no research comparing progressive time delay to decreasing prompt hierarchy. Much more comparative research is needed in order to draw strong conclusions about efficiency of teaching techniques.

Second, because of the few number of comparative research studies, the ability to generalize the research results was limited. This was true in terms of the populations, activities, and environments to which the results can be extended. In order to extend the results to different populations, activities, and environments, systematic replications of comparative studies are needed.

A third limitation was the way in which the decreasing prompt hierarchies were described. Of five comparative studies reviewed using decreasing prompt hierarchy, the researchers all described the levels in the decreasing prompt hierarchy differently (Csapo, 1981; Glendenning et al., 1983; McDonnell & Ferguson, 1989; Miller & Test, 1989; Walls et al., 1981). Given mixed results, it is difficult to draw conclusions about the relative efficiency of the decreasing prompt hierarchy sequences.

A fourth limitation in the comparative research was the way in which the decreasing prompt hierarchies were implemented. For instance, Glendenning et al. (1983), Miller and Test (1989), and Walls et al. (1981) all used decreasing prompt hierarchy as an error correction procedure. Conversely, Csapo (1981) and McDonnell and

Ferguson (1989) used decreasing prompt hierarchy as an errorless learning teaching technique. It is not surprising, therefore, that Miller and Test (1989) found decreasing prompt hierarchy less efficient than time delay. They technically compared an errorless learning technique, time delay, to a decreasing prompt hierarchy implemented as an error correction procedure.

Purpose and Rationale for This Study as It Relates to the Current Research

The purpose of this study was to expand the body of current comparative research. There were relatively few comparative studies available to assist instructors in selecting efficient teaching techniques for their students with severe disabilities. Of the research available, results were mixed. It is difficult, therefore, for instructors to determine which teaching techniques are more efficient.

The researcher chose two errorless learning teaching techniques, decreasing prompt hierarchy and time delay. This was because the research strongly suggested that errorless learning teaching techniques were more efficient in teaching students with severe disabilities than trial and error teaching techniques (Bennett et al., 1986; Doyle et al., 1990; Gast et al., 1988; Godby et al., 1987; McDonnell,

1987). Further, the researcher chose progressive time delay for two reasons. First, there were no studies comparing a progressive time delay to decreasing prompt hierarchy. Second, McDonnell and Ferguson (1989) suggested that a 3 second constant time delay was less efficient than a decreasing prompt hierarchy. They hypothesized that one reason for the inefficiency of the constant time delay was the large increase from 0 to 3 seconds in the time delay interval. This researcher sought to minimize potential negative effects on skill acquisition due to too large an interval size by implementing a progressive time delay procedure.

CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to compare two errorless learning teaching techniques, time delay and decreasing prompt hierarchy, to determine which was more efficient in teaching students with severe disabilities. This chapter presents the methods and procedures used to conduct this study. This includes the subjects, activities, setting, data collection procedures, research design, and procedures for implementing the two teaching techniques.

Subjects

The researcher selected four students from the total number of students enrolled in a summer camp program offered by a local school system at a special day school. During the regular school year, the special day school served approximately 100 students who were severely disabled. Fifty-two students with severe disabilities attended the summer camp program at the special day school.

Eligibility criteria to participate in this study included the following: (a) a measured IQ of 55 or below based on a standard IQ test administered within the last three years; (b) 10 to 18 years of age; (c) self-ambulatory;

(d) fine motor skills necessary to perform the bed making and sandwich making with minimal adaptations; (e) responsive to physical prompts; (f) no ongoing, systematic instruction in bed making or sandwich making within a year; (g) baseline data indicating that students independently completed no more than 7 steps (40%) of the task analyses for bed making and sandwich making; (h) no behavior problems that would significantly interfere with learning; and (i) attendance during all six weeks of the summer camp.

The researcher met with one of the two summer camp directors, the principal of the special day school, and a consultant for the school system to identify potential students for the study. They identified eight students as potential participants. The researcher mailed letters to the eight students' parents or guardians. A copy of this letter is in Appendix A. Four parents and one guardian returned the initial informed consent form to the researcher. A copy of this informed consent form is in Appendix B. From these five respondents, the researcher selected four students who best met the above criteria. The three parents and one guardian signed the second informed consent form. A copy of this informed consent form is in Appendix C. The researcher guaranteed the parents and guardian that she would keep their son/daughter's identity confidential.

Student 1 was an 18 year old female with a measured IQ

of less than 40 according to the WISC-R. She was imitative and had no physical disabilities that prevented her from making a bed and a sandwich. Her verbal skills were limited primarily to single words and simple phrases which were often unintelligible.

Student 2 was a 16 year old male certified as autistic according to the school system's psychological examination. He scored a 58 on the performance section of the WISC-R. The examiner, however, was unable to obtain a score on the verbal section of the WISC-R. An overall IQ, therefore, was not calculated. On the Vineland Adaptive Behavior Scale, Student 2 scored two standard deviations below the mean in communication, daily living skills, and socialization. He was imitative and had no physical disabilities that prevented him from making a bed and a sandwich. His verbal skills were primarily echolalic. He rarely initiated or responded to conversation. On occasion he initiated conversation by saying "popcorn" or "Coke" when he wanted something to eat or drink.

Student 3 was a 16 year old male with Down's Syndrome. He had a measured IQ of 36 according to the Stanford-Binet. He was imitative and had difficulty grasping small items. His verbal skills were limited primarily to single words and simple phrases which were often unintelligible. He also communicated with a limited number of signs.

Student 4 was a 17 year old male with a measured IQ of

36 according to the Stanford-Binet. He was imitative and had minor physical limitations. These limitations included stiff, awkward gross motor movements and poor fine motor skills. His fine motor skills, however, did not prevent him from performing either activity. His verbal skills were limited to approximately six one syllable words.

Activities

The researcher instructed the students in bed making and sandwich making. These two activities were chosen because the researcher believed them to be comparable in complexity. The researcher developed a **task analysis** for each activity by performing each activity and writing down the steps. A **task analysis** is the breakdown of a complex behavior (an activity) into its component parts (Alberto & Troutman, 1990). The researcher revised each task analysis to contain 18 steps each. This was done to increase the chances that only the independent variables, time delay and decreasing prompt hierarchy, and not differing complexities of the tasks, would be responsible for changes in the dependent variables. Table 1 depicts the task analysis for bed making. Table 2 depicts the task analysis for sandwich making.

After three days of instruction, the researcher noticed that Students 3 and 4 were having difficulty closing the

TABLE 1

TASK ANALYSIS FOR BED MAKING

Triad	Step	Response
1	18	Smooth out wrinkles.
	17	Straighten spread under pillow.
	16	Pull spread over left side of pillow and adjust.
2	15	Walk to left side of bed.
	14	Pull spread over right side of pillow and adjust.
	13	Get pillow (by walking to right side of bed) and place in the middle of the turned back spread.
3	12	Grasp top of bedspread and turn back 1 to 1.5 feet.
	11	Walk to left side of bed.
	10	Grasp top of bedspread and turn back 1 to 1.5 feet.
4	9	Grasp bedspread with two hands and pull to top of right side of bed.
	8	Walk to right side of bed.
	7	Grasp bedspread with two hands and pull to top of left side of bed.
5	6	Smooth out wrinkles.
	5	Grasp top sheet with two hands and pull to top of left side of bed.
	4	Walk to left side of bed.
6	3	Smooth out wrinkles.
	2	Grasp top sheet with two hands and pull to top of right side of bed.
	1	Starting on right side of bed, remove pillow and place on floor.

TABLE 2

TASK ANALYSIS FOR SANDWICH MAKING

Triad	Step	Response
1	18	Put up bread.
	17	Close bread.
	16	Put meat and mustard/mayonnaise in refrigerator.
2	15	Close meat package.
	14	Close mustard/mayonnaise.
	13	Put left bread on top of meat bread.
3	12	Place 1 slice of meat on right piece of bread.
	11	Open meat.
	10	Squirt mustard/mayonnaise on right piece of bread in a "Z" shape.
4	9	Squirt mustard/mayonnaise on left piece of bread in a "Z" shape.
	8	Pick up mustard/mayonnaise and shake down.
	7	Open mustard/mayonnaise.
5	6	Place slices of bread next to each other on plate.
	5	Get 2 slices of bread.
	4	Open bread.
6	3	Get bread from shelf.
	2	Get plate from cabinet.
	1	Get meat and mustard/mayonnaise from refrigerator.

bread wrapper using the twist tie. This was due to their poor fine motor grasping skills. The researcher, therefore, developed an alternative performance strategy for those students which involved changing step 17 of the sandwich making task analysis. Instead of requiring them to close the bread wrapper using a twist tie, she taught them to close the bread wrapper using a clothespin.

Setting

The researcher conducted the study in a 25 foot by 36 foot classroom at the special day school. One half of the classroom was partitioned off and used for storage. The daily instructional sessions were conducted in the remaining half of the classroom. This half of the classroom had a twin bed in one area. In the other area was a rectangular table, refrigerator, shelves for plates and cups, a bookcase where the bread was kept, and a chair for the students to sit between instructional trials.

The Instructor

The researcher also served as the instructor of the students. She is a certified special education teacher, a graduate student, and the project coordinator of a statewide technical assistance, systems-change grant. Through formal

course work at the university and extensive inservice sessions required by the grant, the instructor was trained in data recording procedures and in implementing time delay and decreasing prompt hierarchy teaching techniques.

Data Collection

Data Collection During Instruction

During the instructional sessions, the researcher collected data for each activity. She collected data on the number of instructional trials, the time engaged in actual instruction, and the total number of correct and error responses. A copy of the data sheet used during bed making instructional sessions is in Appendix D. A copy of the data sheet used during sandwich making instructional sessions is in Appendix E. Each student received one-on-one, individualized instruction. The instructional sessions averaged 39 minutes and 30 seconds, ranging from 10 to 50 minutes per day. Out of 25 possible days of instruction, (not counting the first three days of baseline and the last day of camp), the students averaged 22.5 days of instruction, ranging from 21 to 25 days. Each student received instruction on both activities during the daily instructional session for an average of 4.28 trials per activity, ranging from two to seven trials per activity. The researcher taught one activity using time delay while

she taught the other activity using decreasing prompt hierarchy.

Data Collection During Probes

The researcher conducted probe sessions daily at the beginning of each instructional session. During probe sessions, the researcher collected data on the steps independently performed, and the number and types of errors. A copy of the data sheet used during bed making probe sessions is in Appendix F. A copy of the data sheet used during the sandwich making probe sessions is in Appendix G. The researcher probed each activity on alternating days. For example, bed making probes occurred on Monday, Wednesday, and Friday while sandwich making probes occurred on Tuesday and Thursday. A probe session consisted of giving a student the instructional cue of "Make the bed" or "Make a sandwich."

If the student made an error on a particular step, the researcher immediately stopped the student and completed the step for him or her. She then prompted the student to continue by giving the initial instructional cue (i.e., "Make the bed" or "Make a sandwich") or by saying "Go on." This enabled the researcher to assess effectively all steps of the activity. The researcher gave no other assistance or feedback to students during probe sessions. The criteria for considering either activity learned was all steps of the activity completed independently for three consecutive probe

sessions.

Topography of Errors

During the probe sessions, the researcher recorded the type or topography of errors. She recorded errors using the same categories as McDonnell and Ferguson (1989). The categories were: (a) step initiation errors, (b) discrimination errors, and (c) response errors. McDonnell and Ferguson defined step initiation errors as not initiating a step in the task analysis within 5 seconds following the natural cue or instructional cue to continue after the student made an error. They defined discrimination errors as performing a task analysis step out of sequence or failing to respond correctly to either the natural or instructional cue. They defined response errors as steps of the task analysis performed correctly yet too slowly or partially completed responses.

Efficiency of Instruction

The researcher used two dependent variables to determine the efficiency of the two teaching techniques, time delay and decreasing prompt hierarchy. These variables were (a) the average number of steps learned across activities by teaching technique and (b) the average percentage of errors made during instruction by teaching technique.

Interobserver Agreement

The researcher videotaped all baseline, probe, and follow-up sessions for an independent observer to view. The independent observer viewed the tapes and collected data on student responses. She observed all baseline and follow-up sessions and 25% of the probe sessions selected randomly using a table of random numbers (Blalock, 1979). The independent observer recorded each student's responses on the steps of each task analysis as either correct or an error. The researcher then calculated interobserver agreement by dividing the number of agreements by the number of agreements plus disagreements and multiplying by 100 (Alberto & Troutman, 1990). The researcher recorded an agreement if both the researcher and the independent observer recorded the student's response as the same (correct or error) on a given step of the task analysis.

The average interobserver agreement across all baseline sessions was 90% with a range of 86% to 96%. The average interobserver agreement across all probe sessions was 94% with a range of 85% to 100%. The average interobserver agreement across all follow-up sessions was 98% with a range of 89% to 100%.

Design

This study used a single subject experimental design. According to Alberto and Troutman (1990):

> Most applied behavior analysts prefer to record specific information about an individual rather than information about the average performance of a group. The use of averages may obscure important information... To avoid the problems associated with the use of averages, most applied behavior analysis researchers prefer to use single-subject designs. These designs monitor the performance of individual subjects during manipulation of the independent variable(s) (p. 148 - 149).

Specifically, this study used an alternating treatment, single subject research design (Tawney & Gast, 1984). An alternating treatment research design seeks to reduce potential ordering effects and/or interactions within the independent variables by alternating and counterbalancing the independent variables. In this study, the researcher alternated the independent variables, time delay and decreasing prompt hierarchy. She counterbalanced these techniques across sessions and activities.

The researcher taught Students 1 and 3 bed making with time delay and sandwich making with decreasing prompt

hierarchy. She taught Students 2 and 4 bed making with decreasing prompt hierarchy and sandwich making with time delay. The researcher taught Students 1 and 2 bed making first and sandwich making second during the first instructional session. She taught Students 3 and 4 sandwich making first and bed making second during the first instructional session. During the second instructional session the next day, the researcher reversed the order in which she taught each activity for each student. The researcher taught sandwich making first and bed making second to Students 1 and 2 and bed making first and sandwich making second to Students 3 and 4. The researcher continued to alternate the order that she taught the activities for each student throughout the study.

The researcher taught both activities using a **backward chaining** procedure. **Backward chaining** entails teaching the last step or steps of an activity first. Steps are progressively added in a reverse sequence until the learner performs the complete activity independently (Spooner, Weber, & Spooner, 1983). The researcher selected backward chaining because she believed it was the most practical chaining strategy to implement. This was considering the students' baseline performances and requirements for systematic monitoring of eight different teaching sessions (i.e., teaching four students two different activities with two different teaching techniques). The researcher taught

the steps of the task analyses in groups of three, or triads, using the backward chaining procedure. (See Tables 1 and 2.) The researcher selected triads because she believed she could reasonably instruct and monitor three steps of the task analysis at a time for each student. For example, the researcher taught the last three steps of making a bed and making a sandwich to each student. Once the students performed the last triad independently two consecutive trials, the researcher then taught the next to the last triad.

To maximize student motivation, the researcher offered each student a choice between two edible items as a reinforcer. She offered each student the choice before each instructional session so each student knew what he/she might have at the end of the session. Once each student completed an instructional session, the researcher offered each student the same choice in case the student changed his/her mind. After each student chose his/her reinforcer, he/she consumed it while the researcher prepared for the next instructional session for the next student. She used Coke, Cheetos, popcorn, cookies, and popsicles as reinforcers.

Procedures

Baseline

During the first three days of the summer camp, the researcher collected baseline data on the four students for each activity. According to Tawney and Gast (1984), stability in baseline data is not essential when using the alternating treatment design. The researcher, however, collected baseline data until the last three data points on all four students for each activity showed no ascending trend. During the baseline sessions, when a student completed a step of the task analysis independently, the researcher considered that step a correct response. When the student made an error, the researcher stopped the student, completed that step of the task analysis for the student, and prompted the student to continue the activity.

Time Delay Instruction

With the time delay instruction, the researcher provided each student with a full physical assistance prompt. This was to ensure a correct response for each step of the task analysis being taught. Consistent with implementing a time delay procedure, the full physical assistance prompt provided to each student for each step of the task analysis remained the same across the instructional sessions. The researcher faded the prompt for each step of the task analysis by systematically increasing the time

between the natural or instructional cue and the prompt.

The researcher taught the steps of each task analysis in groups of three, or triads, in a backward chaining format. (See Tables 1 and 2.) Within this format, the researcher taught each step in the triad using a progressive time delay. With progressive time delay, the time delay between the instructional or natural cue and the prompt began at 0 seconds. The delay interval was systematically increased based on the student's correct or anticipated correct responses. The researcher chose progressive time delay because McDonnell and Ferguson (1989) suggested that a 0 second to 3 second constant time delay procedure was less efficient than a decreasing prompt hierarchy. McDonnell and Ferguson (1989) hypothesized that one reason for the inefficiency of the constant time delay was the large increase (from 0 to 3 seconds) in the delay interval. This researcher sought to minimize potential negative effects on skill acquisition due to too large an interval size by implementing a progressive time delay procedure.

The researcher used a progressive time delay procedure in this study that started at 0 seconds and systematically increased in 1 second increments. Criteria for increasing the delay by 1 second was the student successfully responding to a prompt for a particular step for two consecutive trials. With the 0 second delay interval, there was no time between the instructional and natural cues and

the researcher's prompts for each of the last three steps of the task analysis. Once each student completed a step of the last triad correctly with a prompt two consecutive trials with the 0 second delay, the researcher increased the time between the instructional or natural cue and the prompt to 1 second. For example, Student 1 correctly completed step 17 of the task analysis with the prompt for two consecutive trials at 0 seconds, but made errors on steps 16 and 18. The time, therefore, between the natural cue for step 17, which is step 16 of the task analysis, and the prompt for step 17 increased to 1 second, but remained at 0 seconds for steps 16 and 18.

The researcher established the maximum amount of time for the delay interval at 3 seconds. Once the delay interval reached 3 seconds, the researcher no longer increased the delay interval. Initially, the researcher taught and monitored the last triad of the task analysis for correct and error responses. Once the student independently completed (i.e., with no prompts) the last triad two consecutive times, she taught the next to last triad of the task analysis. She used the time delay procedure described above with all subsequent triads.

The researcher used a back-up procedure if a student made three consecutive errors on a particular step (a) after she increased the time between the instructional or natural cue and prompt or (b) if the student had been performing the

step independently. The researcher dropped back to a 0 second time delay for that particular step. After the student performed the step correctly with the prompt at 0 seconds two consecutive trials, the researcher then went back to the time delay interval where the error originally occurred.

The researcher praised each student verbally (e.g., "Good job!" or "That's great!") for independently initiating and correctly completing the steps of the task analysis. She provided descriptive feedback (e.g., "Nice job smoothing out the wrinkles" or "I like the way you're closing the bread") while completing prompted responses of the steps of the task analysis. If the student made an error, the researcher stopped the student and prompted him/her through the correct response with the level of assistance necessary.

In summary, the researcher taught steps of the task analyses for each activity in groups of three, or triads, in a backward manner, using a 0 to 3 second progressive time delay procedure. Criteria for increasing the time delay interval was successful response to a given prompt for two consecutive trials. The time delay intervals increased in 1 second increments. Once the student reached the 3 second time delay interval, the delay interval no longer increased. If a student made three consecutive errors, the researcher implemented a back-up procedure. Criteria for adding a new triad was (a) independent completion of each step in the

previous triad(s) for two consecutive instructional trials or (b) independent completion of each step in the previous triad(s) for two consecutive probe sessions. When the researcher added a new triad, she expected the student to perform the previously learned triad(s). The researcher monitored student responses to steps in the triad that she taught and previously learned triad(s) for correct and error responses.

Decreasing Prompt Hierarchy Instruction

This researcher used a decreasing prompt hierarchy proposed by Wilcox and Bellamy (1982). Wilcox and Bellamy (1982) suggested that switching types of assistance, for example, physical assistance to a model to a gesture to a verbal prompt, may not be the most efficient decreasing prompt hierarchy. Instead, they proposed selecting "the type of assistance that seems most suited to the learner, task, and setting," and using "that strategy to provide different amounts of assistance" (Wilcox & Bellamy, p. 109, 1982). In using this strategy, the researcher initially provided each student with full physical assistance prompts to ensure a correct response for each specific step of the task analysis. The researcher faded the prompt by systematically decreasing the amount of physical assistance needed to complete each task analysis step correctly.

The researcher also used physical prompts with the time delay procedure. The intent in keeping the types of prompts

constant (i.e., physical prompts only), for both teaching techniques, time delay and decreasing prompt hierarchy, was to minimize differential effects on acquisition due to the type of prompt used. Similar to the time delay instruction, the researcher taught the steps of each task analysis in groups of three, or triads, in a backward chaining format. Within this format, the researcher taught each step of the triad using a decreasing prompt hierarchy. The decreasing prompt hierarchy started with full physical assistance to ensure a correct response for each step of the triad. Once the student successfully completed a step of the last triad two consecutive times with full physical assistance (i.e., did not resist the prompt) the researcher faded the prompt. The amount of physical assistance faded depended upon the student. Initially, the researcher taught and monitored for correct and error responses on the last triad only.

Criteria for decreasing the amount of physical assistance was both (a) not resisting the prompt and (b) successfully completing the step of the task analysis with the prompt for two consecutive trials. The number of levels within the decreasing prompt hierarchy was dependent upon the student and the student's needs. Once the student independently completed (i.e., with no prompts) the last triad of the task analysis on two consecutive trials, the researcher taught the next to the last triad of the task analysis. She used the decreasing prompt hierarchy

procedure described above with all subsequent triads.

The researcher used a back-up procedure if a student made three consecutive errors on a particular step (a) after she had decreased the amount of physical assistance or (b) if the student had been performing the step independently. The back-up procedure entailed providing the student with additional physical assistance. Once the student performed the step correctly with the additional physical assistance on two consecutive trials, the researcher faded the amount of physical assistance again. If the student did not perform the step correctly with the additional physical assistance two consecutive trials, the researcher once again provided the student with additional physical assistance. This process continued until the student correctly completed the step on two consecutive trials with physical assistance.

The researcher praised each student verbally (e.g., "Nice job!" or "Terrific!") for correctly completing the steps of the task analysis. She also provided descriptive feedback (e.g., "Nice job pulling the bedspread up" or "I like the way you're putting the bologna and mustard away") while completing prompted responses of the steps of the task analysis. If a student made an error, the researcher stopped and prompted him or her through the correct response with the level of assistance necessary to ensure a correct response.

In summary, the researcher taught each activity in

groups of three, or triads, in a backward manner, using the decreasing prompt hierarchy as described above. Criteria for decreasing the amount of physical assistance was a successful response to a given prompt for two consecutive trials. The amount of decrease in the physical assistance was dependent on each student's response pattern. If a student made three consecutive errors, the researcher implemented a back-up procedure. Criteria for adding a new triad was (a) independent completion of each step in the previous triad(s) for two consecutive instructional trials or (b) independent completion of each step in the previous triad(s) for two consecutive probe sessions. When the researcher added a new triad, she expected the student to perform the previously learned triad(s). Student responses to steps in the triad being taught and previously learned triad(s) were monitored for correct and error responses.

Follow-Up

The researcher conducted maintenance and generalization probes four weeks following the completion of the summer program. She conducted the follow-up probes for Students 1, 2, and 3 in their respective homes. She conducted the follow-up probe for Student 4 in the Home Economics classroom at the special day school where the summer camp was held. The procedures for the follow-up probes were similar to the procedures for the regular probe sessions. Each student was given the instructional cues of "Make the

bed" and "Make a sandwich". The researcher collected data on each student's responses. If a student made an error, the researcher stopped the student, completed the step for the student, and then prompted the student to continue the activity. She gave no other assistance or feedback to the students during the maintenance and generalization probe sessions.

Fidelity of Treatment

Data was collected on the fidelity of treatment to ensure the researcher implemented the time delay and decreasing prompt hierarchy teaching techniques as designed. The researcher videotaped all instructional sessions. An independent observer viewed and collected fidelity of treatment data on 25% of the videotaped instructional sessions selected randomly using a table of random numbers (Blalock, 1979, p. 598). The independent observer considered the researcher's prompt correct if both (a) the researcher delivered the prompt within the specified time interval and (b) if the prompt was at the specified level of assistance for that particular step of the task analysis. The independent observer considered prompts incorrect if the researcher did not meet either of these two conditions above. The researcher calculated fidelity of treatment by dividing the total number of correct prompts by the number of correct plus incorrect prompts and multiplying by 100 (Alberto & Troutman, 1990).

The fidelity of treatment for time delay ranged between 93% to 98% with an average of 96%. The fidelity of treatment for decreasing prompt hierarchy ranged between 96% to 98% with an average of 97%. The fidelity of treatment for both teaching techniques combined ranged between 93% to 98% with an average of 97%.

CHAPTER IV

RESULTS

This chapter presents the results of the study. Figures 2 through 5 represent the number of task analyses steps completed independently by Students 1 through 4 during baseline sessions, probe sessions, and the follow-up sessions for both activities. Results are further explained in the remainder of this chapter in terms of the five major research questions and additional results.

Research Question 1

Will there be a difference in the average number of steps learned, across activities, between time delay instruction and decreasing prompt hierarchy instruction?

Figure 6 represents the average number of steps learned across activities by the teaching technique used. There was a slight difference in the average number of steps learned across activities between time delay instruction and decreasing prompt hierarchy instruction. Students learned an average of 5.09 steps of their respective task analyses with the time delay instruction. Students learned an average of 4.88 steps of their respective task analyses with

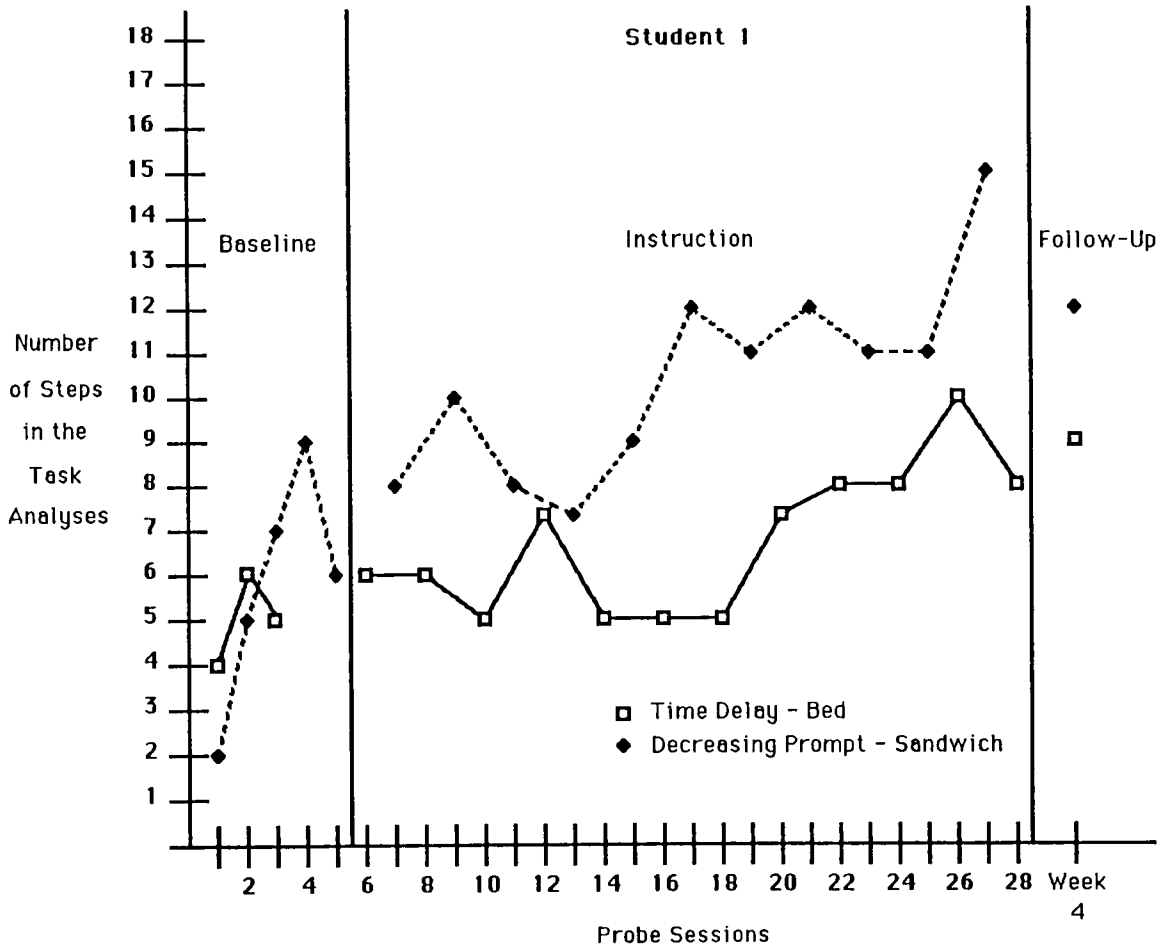

FIGURE 2. NUMBER OF TASK ANALYSES STEPS COMPLETED INDEPENDENTLY DURING PROBE SESSIONS BY STUDENT 1

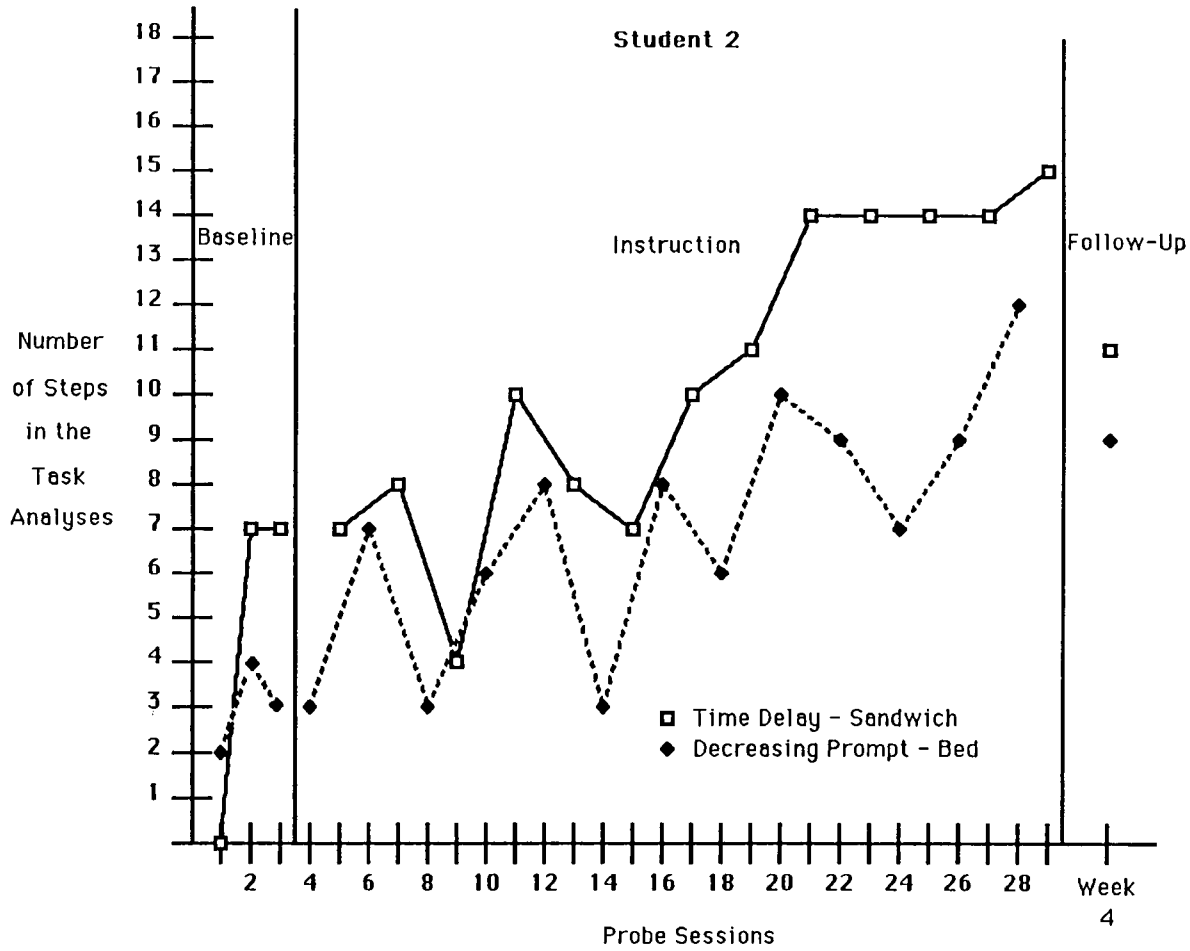

FIGURE 3. NUMBER OF TASK ANALYSES STEPS COMPLETED INDEPENDENTLY DURING PROBE SESSIONS BY STUDENT 2

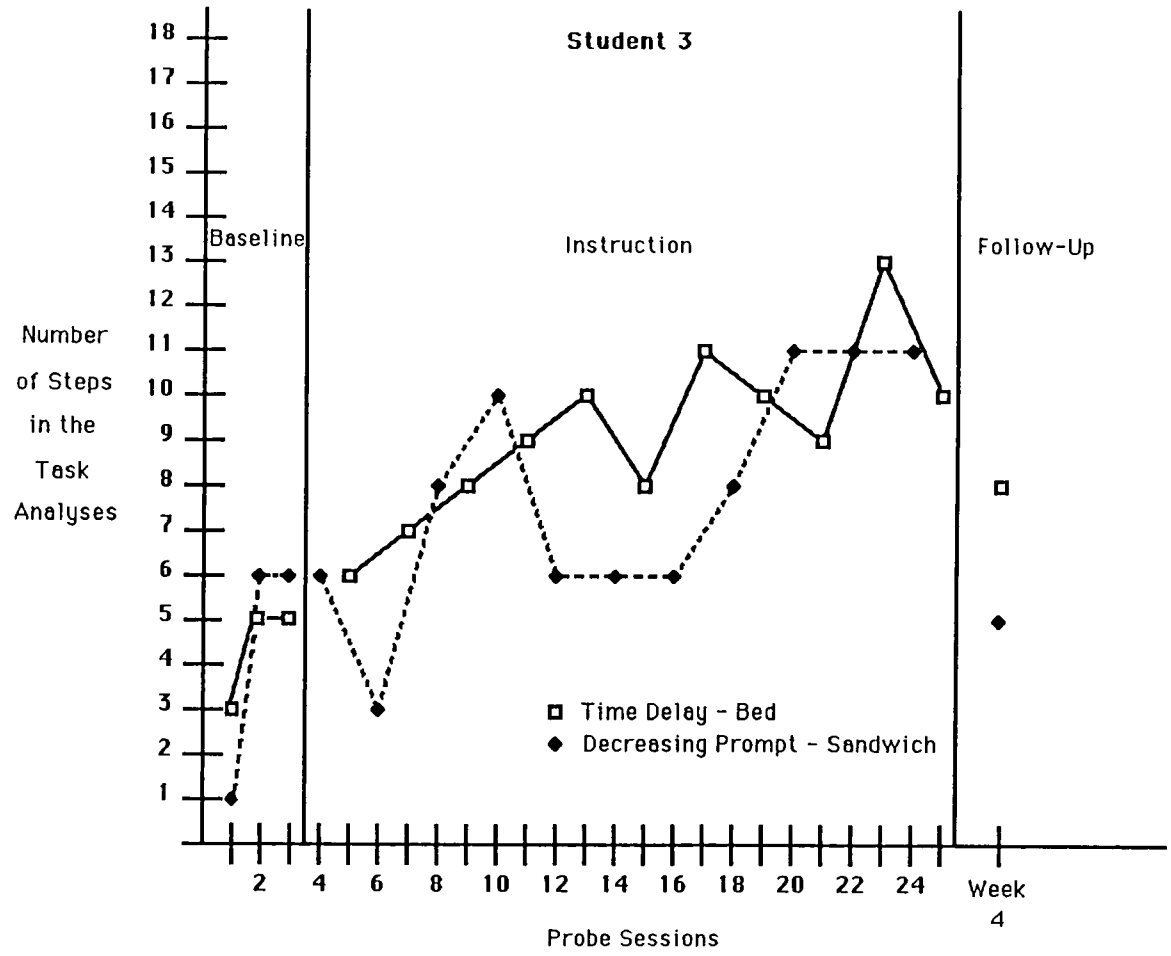

FIGURE 4. NUMBER OF TASK ANALYSES STEPS COMPLETED INDEPENDENTLY DURING PROBE SESSIONS BY STUDENT 3

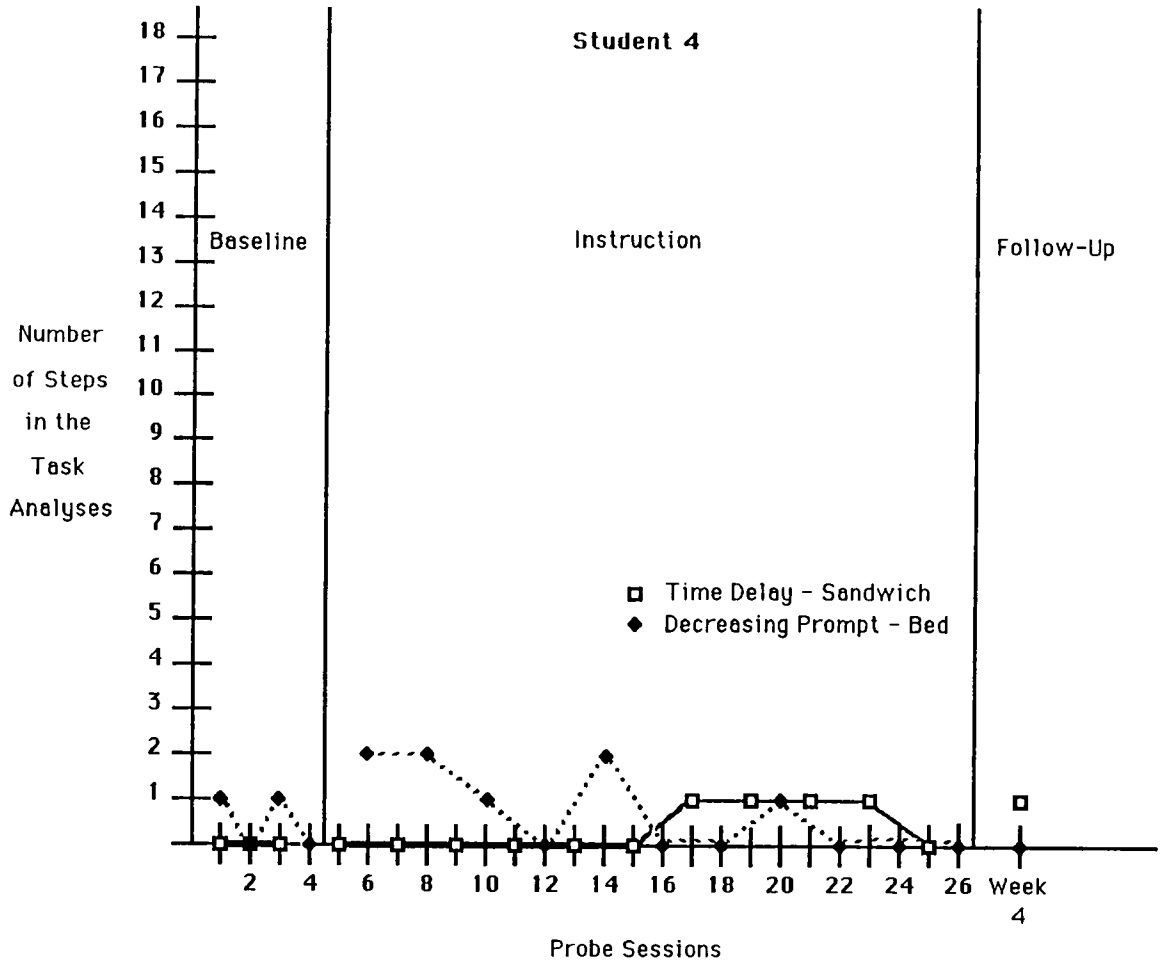

FIGURE 5. NUMBER OF TASK ANALYSES STEPS COMPLETED INDEPENDENTLY DURING PROBE SESSIONS BY STUDENT 4

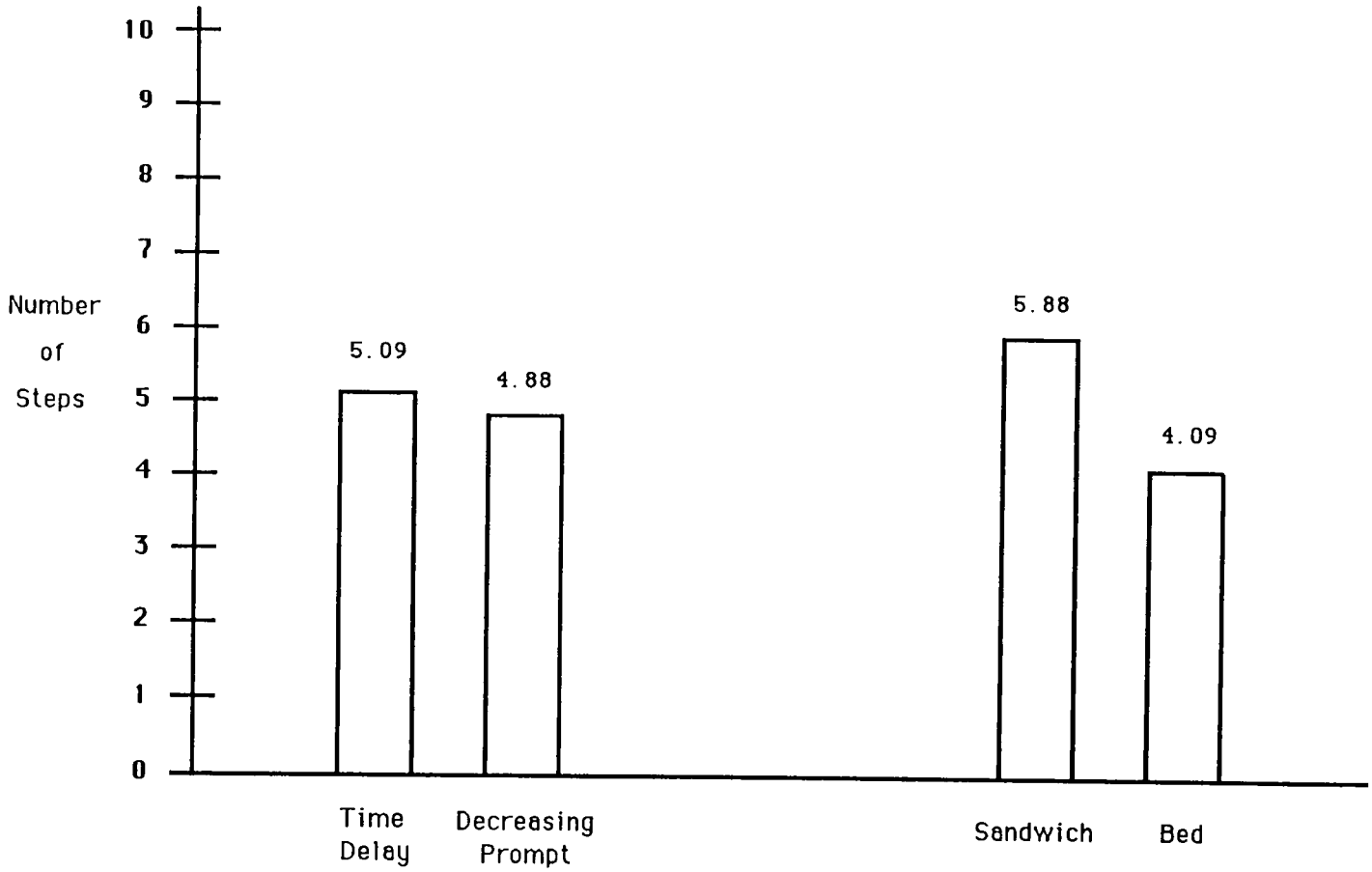

FIGURE 6. AVERAGE NUMBER OF STEPS LEARNED BY (left) TEACHING TECHNIQUE AND (right) ACTIVITY

the decreasing prompt hierarchy instruction. (See Figure 7 for the average number of steps each student learned by the teaching technique used.)

Table 3 presents specific data used to generate the number of steps learned for time delay and decreasing prompt hierarchy instruction. It summarizes the average number of steps completed independently during baseline and during the last three probe sessions. It also summarizes the number of steps learned by each student for each activity. The researcher taught Student 1 bed making using time delay and sandwich making using decreasing prompt hierarchy. During baseline, Student 1 independently completed an average of 5.00 steps of bed making and 5.80 steps of sandwich making. The researcher taught Student 2 bed making using decreasing prompt hierarchy and sandwich making using time delay. During baseline, Student 2 independently completed an average of 3.00 steps of bed making and 4.67 steps of sandwich making. The researcher taught Student 3 bed making using time delay and sandwich making using decreasing prompt hierarchy. During baseline, Student 3 independently completed an average of 4.33 steps of bed making and 4.33 steps of sandwich making. The researcher taught Student 4 bed making using decreasing prompt hierarchy and sandwich making using time delay. During baseline, Student 4 independently completed an average of 0.50 steps of bed making and 0.00 steps of sandwich making.

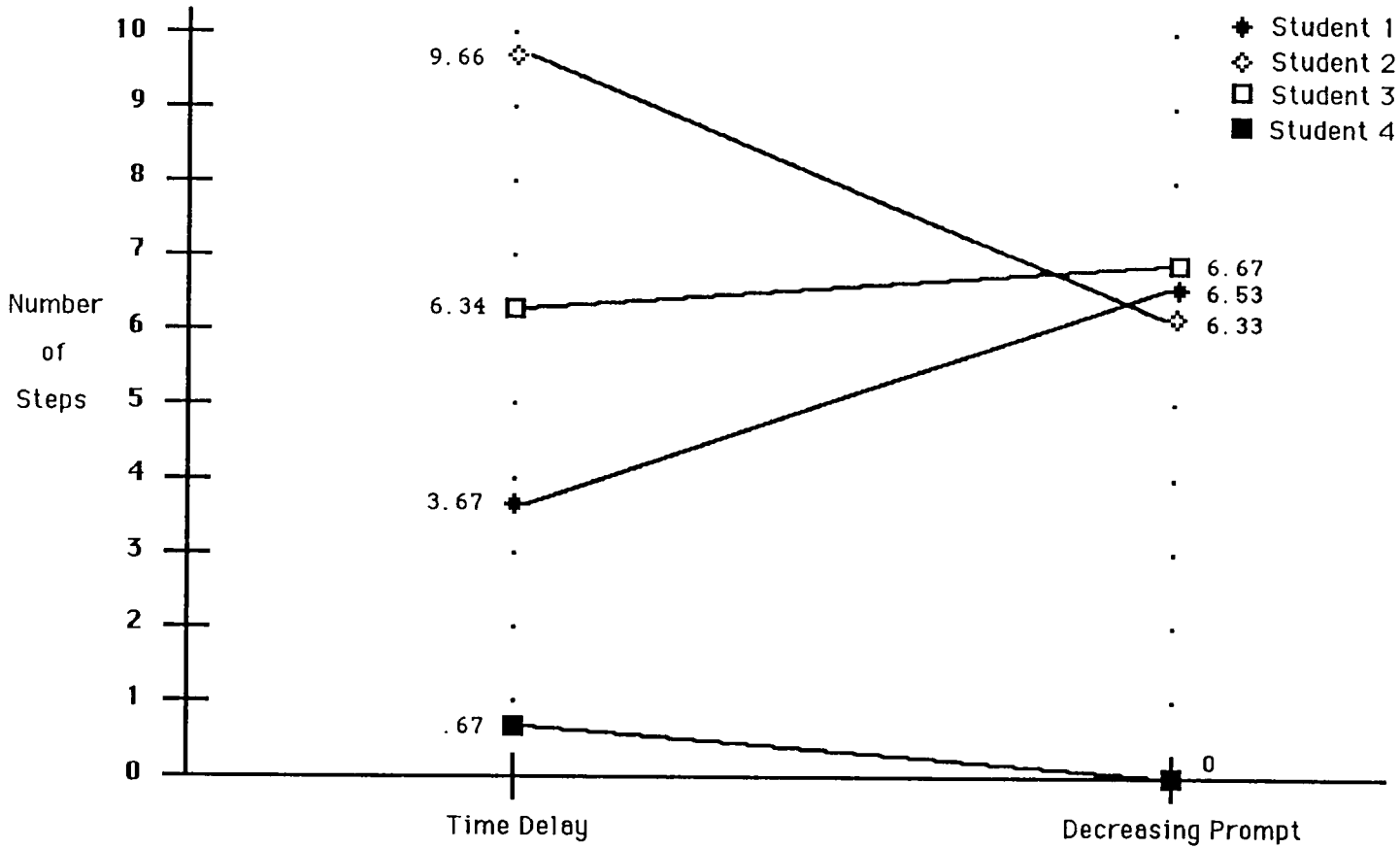

FIGURE 7. AVERAGE NUMBER OF STEPS EACH STUDENT LEARNED BY TEACHING TECHNIQUE

TABLE 3

SUMMARY OF STUDENT PERFORMANCE ON EACH ACTIVITY

	Activity	Teaching Technique	Average Number of Steps Completed Independently During Baseline	Average Number of Steps Completed Independently During the Last 3 Probe Sessions	Number of Steps Learned
Student 1	Bed	Time Delay	5.00	8.67	3.67
	Sandwich	Decreasing Prompt Hierarchy	5.80	12.33	6.53
Student 2	Bed	Decreasing Prompt Hierarchy	3.00	9.33	6.33
	Sandwich	Time Delay	4.67	14.33	9.66
Student 3	Bed	Time Delay	4.33	10.67	6.34
	Sandwich	Decreasing Prompt Hierarchy	4.33	11.00	6.67
Student 4	Bed	Decreasing Prompt Hierarchy	0.50	0.00	0.00
	Sandwich	Time Delay	0.00	0.67	0.67

During the probe sessions, three of the four students learned some steps of each activity. No student reached criteria for considering either activity learned. To determine the number of steps learned for each activity, the researcher first averaged the number of steps completed independently during the last three probe sessions. She then subtracted the average number of steps completed independently during the baseline sessions from this figure. For example, during the last three probe sessions for bed making, Student 1 independently completed an average of 8.67 steps of the task analysis. During baseline sessions, Student 1 independently completed an average of 5.00 steps of the task analysis. Student 1, therefore, learned 3.67 (8.67 - 5.00) steps of the bed making task analysis. Student 1 also learned 6.53 steps of the sandwich making task analysis. Student 2 learned 6.33 steps of the bed making task analysis and 9.66 steps of the sandwich making task analysis. Student 3 learned 6.34 steps of the bed making task analysis and 6.67 steps of the sandwich making task analysis. Student 4 learned 0.00 steps of the bed making task analysis and 0.67 steps of the sandwich making task analysis. (See Table 3.)

Research Question 2

Will there be a difference in the average percentage of errors made during instruction, across activities, between time delay instruction and decreasing prompt hierarchy instruction?

Figure 8 represents the average percentage of errors made during instruction across activities by teaching technique. There was a slight difference in the average percentage of errors made during instruction across activities between time delay instruction and decreasing prompt hierarchy instruction. During the instructional sessions using time delay, students, on the average, made errors 24% of the time. During the instructional sessions using decreasing prompt hierarchy, students, on the average, made errors 21% of the time.

The researcher calculated the average percentage of errors for time delay instruction in the following way: First, she calculated the total number of responses for all students. She did this by adding the number of steps, both correctly and incorrectly performed, in the activities being taught using time delay, for every trial throughout the entire six weeks of instruction. Second, the researcher calculated the total number of errors for all students. She did this by adding the errors made in the activities being

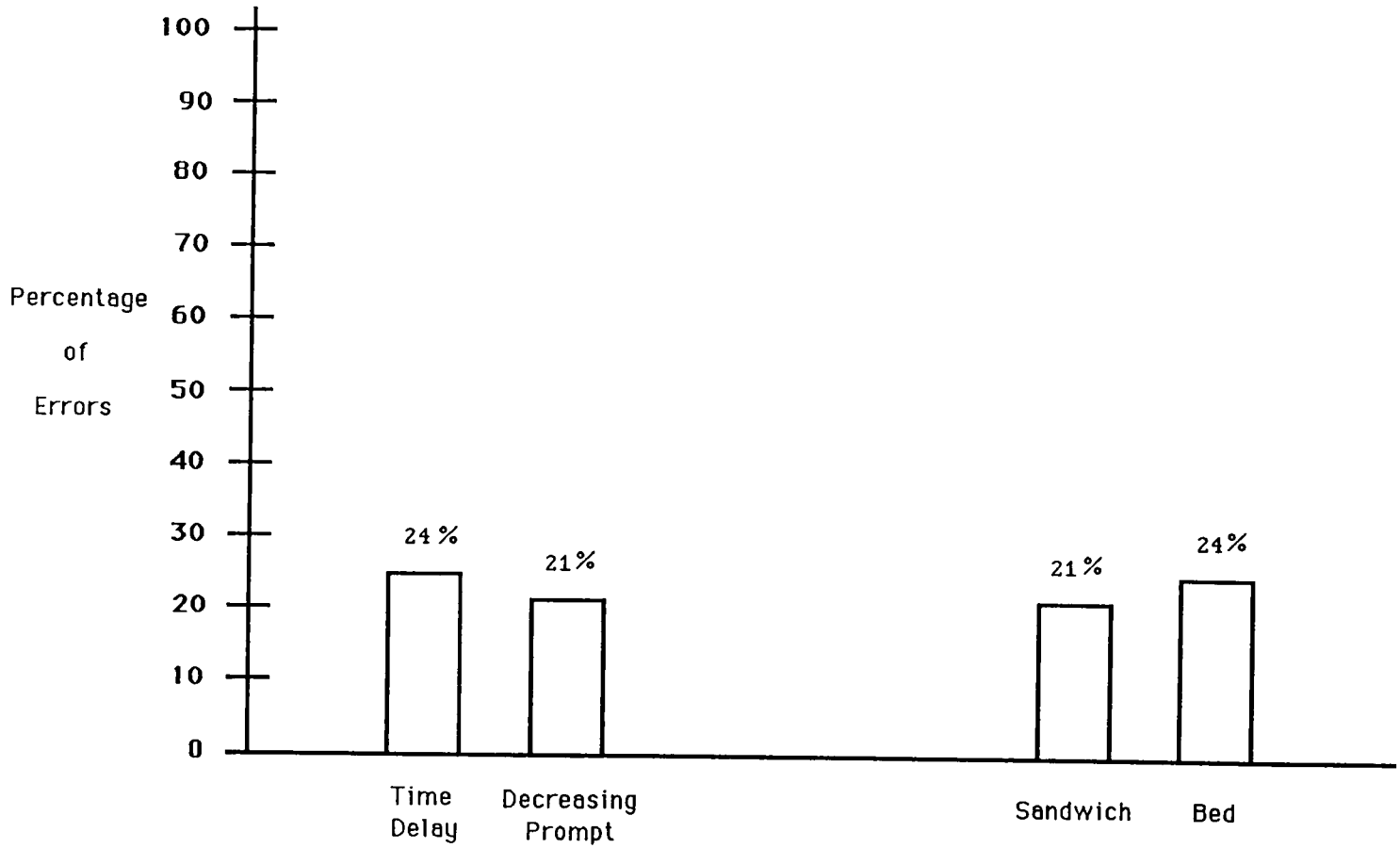

FIGURE 8. AVERAGE PERCENTAGE OF ERRORS DURING INSTRUCTION BY (left) TEACHING TECHNIQUE AND (right) ACTIVITY

taught using time delay, for every trial throughout the entire six weeks of instruction. Finally, the researcher divided the total number of errors for all four students by the total number of responses for all four students across all six weeks of instruction. This determined the average percentage of errors made during time delay instruction.

The researcher calculated the average percentage of errors for decreasing prompt hierarchy in the following way: First, the she calculated the total number of responses for all students. She did this by adding the number of steps, both correctly and incorrectly performed, in the activities being taught using decreasing prompt hierarchy, for every trial throughout the entire six weeks of instruction. Second, the she calculated the total number of errors for all students. She did this by adding the errors made in the activities being taught using decreasing prompt hierarchy, for every trial throughout the entire six weeks of instruction. Finally, the researcher divided the total number of errors for all four students by the total number of responses for all four students across all six weeks of instruction. This determined the average percentage of errors made during decreasing prompt hierarchy instruction.

Research Question 3

Will there be a difference in the average number of types of errors made during probe sessions across activities between time delay instruction and decreasing prompt hierarchy instruction?

Table 4 presents the data on the average number of types of errors made during probe sessions across actitivies. There was little difference in the average number of types of errors made during probe sessions across activities between time delay instruction and decreasing prompt hierarchy instruction. The average number of step initiation, discrimination, and response errors made by students receiving time delay instruction on their specific activity during the probe sessions was 23.75, 45.25, and 62.25 respectively. The average number of step initiation, discrimination, and response errors made by students receiving decreasing prompt hierarchy instruction on their specific activity during the probe sessions was 22.75, 47.75, and 64.00 respectively.

Research Question 4

Will there be a difference between time delay instruction and decreasing prompt hierarchy instruction in

TABLE 4

AVERAGE NUMBER OF TYPES OF ERRORS DURING PROBE SESSIONS

	Average Number of Step Initiation Errors	Average Number of Discrimination Errors	Average Number of Response Errors
Time Delay	23.75	45.25	62.25
Decreasing Prompt Hierarchy	22.75	47.75	64.00

the number of steps in each task analysis maintained and generalized during the 4 week follow-up probe sessions?

Once again there was little difference between time delay instruction and decreasing prompt hierarchy instruction in the number of steps in each task analysis maintained and generalized during the 4 week follow-up probe sessions. Students receiving time delay instruction for their specific activity regressed an average of 1.34 steps of their respective task analysis. Students receiving decreasing prompt hierarchy instruction for their specific activity regressed an average of 1.67 steps of their respective task analysis. The process for determining these two figures (-1.34 and -1.67) is described below.

First, the researcher reviewed the follow-up data. During the 4 week follow-up, Student 1 independently completed 9 steps of the bed making task analysis and 12 steps of the sandwich making task analysis. Student 2 independently completed 9 steps of the bed making task analysis and 11 steps of the sandwich making task analysis. Student 3 independently completed 8 steps of the bed making task analysis and 5 steps of the sandwich making task analysis. Student 4 did not complete any step of the bed making task analysis independently and independently completed 1 step of the sandwich making task analysis. Refer to Table 5 for the follow-up, maintenance, and

TABLE 5

SUMMARY OF STUDENT FOLLOW-UP, MAINTENANCE, AND GENERALIZATION DATA

	Activity	Teaching Technique	Average Number of Steps Completed Independently During the Last 3 Probe Sessions	Number of Steps Completed Independently During the Follow-Up Probe Session	Difference Between the Follow-Up Probe Session and Last 3 Probe Sessions
Student 1	Bed	Time Delay	8.67	9.00	+0.33
	Sandwich	Decreasing Prompt Hierarchy	12.33	12.00	-0.33
Student 2	Bed	Decreasing Prompt Hierarchy	9.33	9.00	-0.33
	Sandwich	Time Delay	14.33	11.00	-3.33
Student 3	Bed	Time Delay	10.67	8.00	-2.67
	Sandwich	Decreasing Prompt Hierarchy	11.00	5.00	-6.00
Student 4	Bed	Decreasing Prompt Hierarchy	0.00	0.00	0.00
	Sandwich	Time Delay	0.67	1.00	+0.33

generalization data.

Second, for each student, the researcher calculated the difference between the number of steps completed independently during the 4 week follow-up probe session and the average number of steps completed independently during the last three probe sessions for each activity. For example, Student 1 independently completed 9 steps of the bed making task analysis during the 4 week follow-up probe session. Student 1 independently completed an average of 8.67 steps of the bed making task analysis during the last three probe sessions. The difference, therefore, for Student 1 for the bed making task analysis was +.33 steps. Table 5 presents the data on the differences between the number of steps completed independently during the 4 week follow-up probe session and the average number of steps completed independently during the last three probe sessions for each student and activity.

Third, the researcher averaged the differences between the number of steps maintained and generalized during the 4 week follow-up probe session and the average number of steps completed independently during the last three probe sessions. She averaged these differences across students receiving time delay and decreasing prompt hierarchy instruction. These averaged differences were -1.34 steps of the task analyses for time delay instruction and -1.67 steps of the task analyses for decreasing prompt hierarchy

instruction.

Research Question 5

Will there be a difference between the two teaching techniques, time delay and decreasing prompt hierarchy, in efficiency of instruction?

There were two variables used to determine the efficiency of the two teaching techniques. These were the average (a) number of steps learned across activities by teaching technique and (b) percentage of errors made during instruction across activities by teaching technique.

As seen in Figure 6 there was a slight difference in the average number of steps learned across activities by teaching technique. This difference favored time delay instruction. With time delay instruction, the four students learned an average of 5.09 steps of their respective task analyses. The researcher calculated this figure by adding the average number of steps each student learned with time delay instruction and dividing by 4. With decreasing prompt hierarchy instruction, the four students learned an average of 4.88 steps of their respective task analyses. The researcher calculated this figure by adding up the average number of steps each student learned with decreasing prompt hierarchy instruction and dividing by 4.

As seen in Figure 8, there was a slight difference in the average percentage of errors made during instruction across actitivies. This difference favored decreasing prompt hierarchy instruction over time delay instruction. During the instructional sessions using decreasing prompt hierarchy, students, on the average, made errors 21% of the time. During the instructional sessions using time delay, students, on the average, made errors 24% of the time.

Additional Results

Each student received the same number of trials of instruction for both activities. The number of trials, however, varied across students. Students 1, 2, 3, and 4 received 93, 97, 105, and 89 trials of instruction respectively for both activities. Total time in instruction for each student and each activity varied depending on each of their rates of learning for each activity. Student 1 received 53 minutes and 57 seconds in bed making instruction with time delay and 97 minutes and 50 seconds in sandwich making instruction with decreasing prompt hierarchy. Student 2 received 87 minutes and 32 seconds in bed making instruction with decreasing prompt hierarchy and 103 minutes and 17 seconds in sandwich making instruction with time delay. Student 3 received 80 minutes and 22 seconds in bed making instruction with time delay and 88 minutes and 40

seconds in sandwich making instruction with decreasing prompt hierarchy. Student 4 received 89 minutes 12 seconds in bed making instruction with decreasing prompt hierarchy and 118 minutes and 27 seconds in sandwich making instruction with time delay.

During the study, the researcher began to suspect a difference in the learning rates of students based on the nature of the activity instead of the teaching technique used. Figure 6 also represents the average number of steps each student learned by activity. With bed making, the students learned an average of 4.09 steps of the task analysis. The researcher calculated this figure by adding up the average number of steps each student learned during bed making and dividing by 4. With sandwich making, the students learned an average of 5.88 steps of the task analysis. The researcher calculated this figure by adding up the average number of steps each student learned during sandwich making and dividing by 4. Figure 9 represents the average number of steps <u>each</u> student learned by activity.

Figure 8 also represents the average percentage of errors made during instruction by activity. During the sandwich making instructional sessions, students, on the average, made errors 21% of the time. During the bed making instructional sessions, students, on the average, made errors 24% of the time.

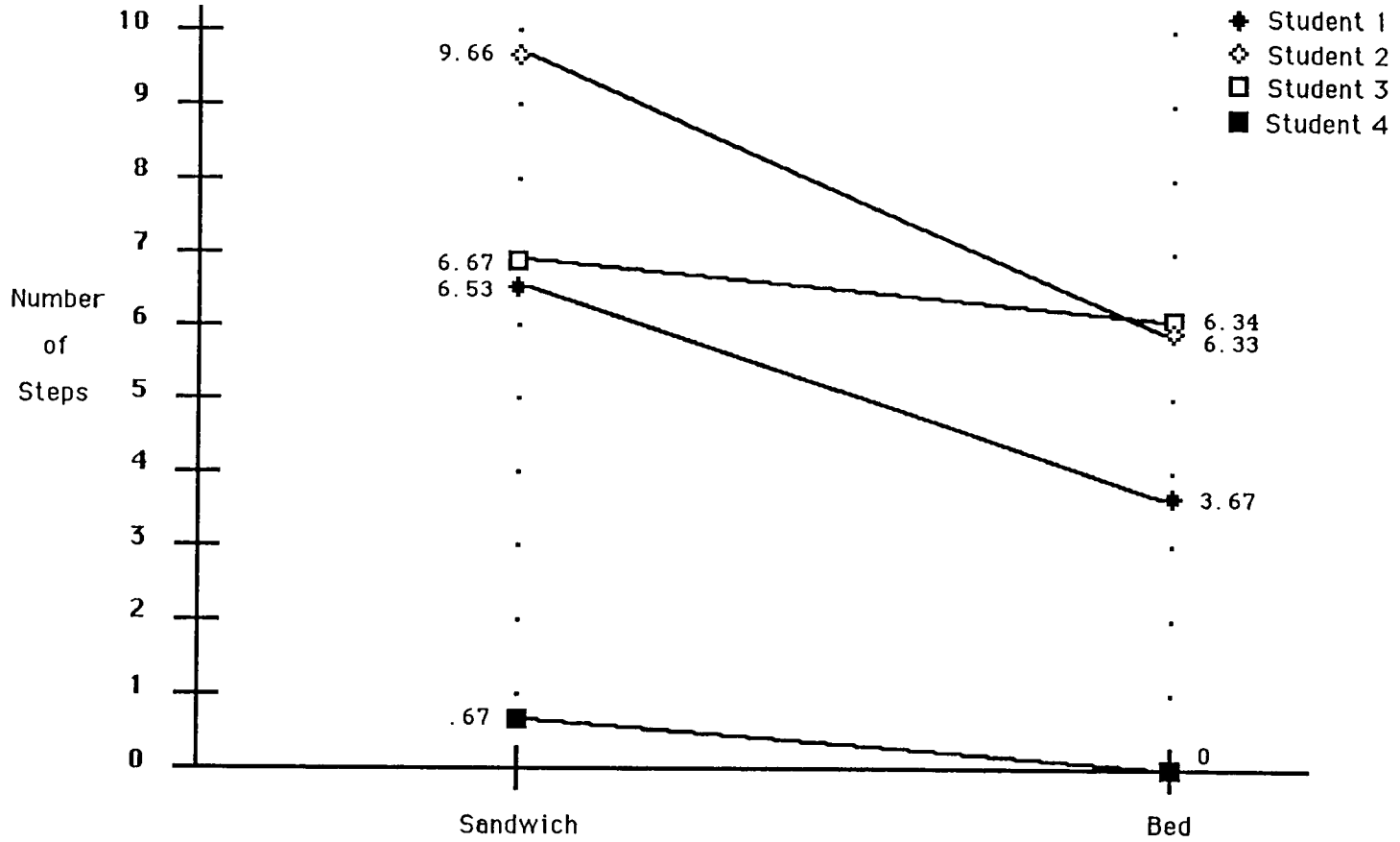

FIGURE 9. AVERAGE NUMBER OF STEPS EACH STUDENT LEARNED BY ACTIVITY

CHAPTER V

DISCUSSION

The purpose of this study was to compare two errorless learning teaching techniques, time delay and decreasing prompt hierarchy, to determine which technique was more efficient in teaching students with severe disabilities. The researcher taught four students two activities, bed making and sandwich making. She counterbalanced the two teaching techniques across activities and students. She taught Students 1 and 3 bed making with time delay and sandwich making with decreasing prompt hierarchy. She taught Students 2 and 4 bed making with decreasing prompt hierarchy and sandwich making with time delay. This chapter discusses (a) the major research findings, (b) additional findings concerning implementation of the two specific teaching techniques, (c) additional findings from the follow-up probe sessions, (d) the costs of the study, (e) limitations, and (f) future research.

Major Research Findings

This study addressed the following research questions:

1. Will there be a difference in the average number of steps learned, across activities, between time delay and

decreasing prompt hierarchy instruction?

2. Will there be a difference in the average percentage of errors made during instruction, across activities, between time delay and decreasing prompt hierarchy instruction?

3. Will there be a difference in the average number of types of errors made during probe sessions, across activities, between time delay and decreasing prompt hierarchy instruction?

4. Will there be a difference between time delay and decreasing prompt hierarchy instruction in the number of steps in each task analysis maintained and generalized during the 4 week follow-up probe sessions?

5. Will there be a difference between the two teaching techniques, time delay and decreasing prompt hierarchy, in efficiency of instruction?

The data indicated that there were only slight differences in (a) the average number of steps learned, favoring time delay instruction and (b) the average percentage of errors made during instruction, favoring decreasing prompt hierarchy instruction. The data also indicated negligible differences in both (a) the average number of types of errors made during probe sessions, and (b) the number of steps in each task analysis maintained and generalized during the 4 week follow-up probe sessions. Based on the results of this study, neither technique was

notably more efficient over the other.

Implementation of the Specific Teaching Techniques

Time Delay Instruction

Time delay appears to be a relatively easy errorless learning teaching technique to implement. Three major implementation issues concerning time delay, however, emerged during the study. First, it was difficult, particularly with Student 4, to continue providing the same prompt over time. By definition, time delay requires the delivery of the same prompt a predetermined amount of time after the delivery of the natural or instructional cue. The topography of the prompt should not change. Student 4 learned sandwich making with the time delay instruction and never progressed past the first triad. Initially, he required a full physical prompt to complete each step in the triad correctly. In this study, once the time delay interval reached 3 seconds, the researcher no longer increased the interval between the natural and instructional cues and the prompts. Student 4 remained at the 3 second time delay interval for most of the study unless the researcher implemented a back-up procedure. It was difficult, however, to continue providing Student 4 the full physical prompt over time. This was true for the other three students but less troublesome due to their rates of

learning. It was difficult to maintain the full physical prompts over time because it was natural for the researcher to fade the physical prompt once the time delay interval reached 3 seconds. This occurred because the only way to fade the prompt, once the interval reached 3 seconds, was to decrease the amount of physical assistance given to the student. Due to the nature of time delay, however, it was not possible to fade the amount of physical assistance.

Second, it was difficult to implement the time delay procedure on complex steps of the activities. Both activities had task analyses with steps that were relatively broad and complex. For example, in sandwich making, step 16 of the task analysis was "Put mustard/mayonnaise and meat in the refrigerator." This step involved picking up both the meat and the condiment, walking to the refrigerator, opening the refrigerator door, putting the meat and condiment in the refrigerator on the correct shelf, closing the refrigerator door, and walking to the table to finish the activity. To perform step 16 of the sandwich making task analysis correctly, the student had to complete all of the substeps independently. With complexly composed steps of the task analyses, the time delay was often effective with the first part of the step only. This was due to the nature of the time delay. The researcher reinforced the students for anticipating the first part of the step and, if necessary, prompted them through the last part of the step. The time

delay procedure was effective for the first part of a complex step. It was less effective, however, for the last part of a complex step. For example, the researcher gave Student 4 the instructional cue, "Make the sandwich." After the time delay interval, the researcher prompted him to perform step 16 of the task analysis. Student 4 learned to pick up the mayonnaise and bologna and walk to the refrigerator. He still had difficulty, however, opening the refrigerator door, placing the mayonnaise and bologna on the refrigerator shelf, closing the refrigerator door, and walking back to the table to continue the task. Even though Student 4 completed part of the step of the task analysis independently, he never did learn to complete the whole step independently. Step 16, therefore, may have been too complex for this student given the time delay procedure.

Third, when implementing the time delay procedure, it was difficult to maintain the correct time interval. One reason was the difficulty in providing verbal reinforcement while continuing to count the time delay interval. Once the interval reached 1, 2, or 3 seconds and the student anticipated a correct response, the researcher immediately reinforced the student. While verbally reinforcing the student, however, the researcher found it difficult to continue counting the time interval at the same time. It was important to count because this was the only way to know exactly when to deliver the rest of the prompt. When a

student anticipated a correct response, therefore, the researcher verbally reinforced the student and, in her opinion, estimated when to deliver the rest of the prompt. Fidelity of treatment measures, however, indicated that reinforcing correct anticipations did not interfere with the integrity of implementing the time delay procedure.

A second reason for difficulty in maintaining the correct interval while implementing the time delay procedure was the complexity of the steps and the rate at which each student responded. This was particularly true for Student 4. Student 4 responded slower than the other three students due to some physical limitations. He took longer both to complete the steps of the activities and to proceed to the next steps of the activities. Often Student 4 began a step then proceeded so slowly that it was difficult to know when to start counting for his time delay interval. One way to improve the ease of implementing the time delay would have been to break the steps of the task analyses down into smaller, more manageable steps. This would increase the certainty of knowing at what point to begin counting the delay interval. A second way to improve the ease of implementing the time delay would have been to increase the delay interval to 4 or 5 seconds to meet Student 4's needs.

Decreasing Prompt Hierarchy Instruction

The researcher often faded the prompts used during the decreasing prompt hierarchy instruction by backchaining the

specific step of the task analysis. For example, the researcher often broke the individual step of the activity down into three or four smaller substeps. When implementing the decreasing prompt hierarchy instruction, she usually started with a full physical prompt. After two consecutive correct responses, the researcher faded the physical prompt by providing full physical assistance through the first two or three substeps of the step. She then provided no physical assistance on the very last substep of the step. For example, the researcher faded steps 9 and 10 of the sandwich making task analysis by backchaining each step. The researcher started with a full physical prompt to make a "Z" with the mustard or mayonnaise. After two consecutive correct responses to the full physical prompt of making the "Z," the researcher faded the physical assistance. She did so by allowing the student to complete the last line of the "Z" independently. She physically assisted the student, however, in making the top bar and diagonal line of the "Z." The researcher continued this process until the student made the "Z" independently.

Backchaining an individual step to fade the prompt may be an indication that the steps of the task analyses should have been originally broken down into smaller, more manageable steps. If done so, perhaps the data would have shown a more notable difference in efficiency of instruction between the two techniques.

Time Delay and Decreasing Prompt Hierarchy Instruction

Three major implementation issues emerged that were common to both teaching techniques. First, the criteria for fading the prompts seemed inadequate on several occasions. The researcher designed the study to fade the prompt, i.e., physical assistance or delay interval, after two consecutive correct responses at a specified prompt level. During the study, however, the researcher suspected that two consecutive correct responses at certain prompt levels were too few before fading the prompt. That is, although a student may not have resisted the prompt or made a correct response two consecutive times, the researcher suspected that the student really was not "ready" to have the prompt faded. She based her suspicion on two response patterns. First, a student met criteria but was not anticipating what step or part of the step occurred next. Second, a student met criteria but the researcher was still prompting the student completely (i.e., a full physical prompt). The student did not attempt any part of the step. Due to the design of the study, the researcher was, nevertheless, required to fade the prompt. Often, when the researcher suspected that she faded a prompt too quickly, the student would make three consecutive errors. She then implemented the back-up procedure. It is possible that the data would have indicated that there was a more efficient teaching technique if the prompts were not faded as quickly as they

were. If the researcher faded prompts when she thought each student was "ready," as identified by a specific criteria, students may have made fewer errors than they did. If there were fewer errors, the researcher may have been able to avoid the back-up procedure in many instances.

Second, the researcher noticed that a pattern developed for all the students during the instructional sessions concerning the back-up procedure. The researcher implemented a back-up procedure after a student made three consecutive errors. Depending on the teaching technique used, the back-up procedure involved either decreasing the time delay interval back to 0 seconds or providing more physical assistance for a particular step. Once the student correctly performed the step two consecutive times either at the 0 second time delay or with the additional physical assistance, the researcher faded the prompt. She faded the prompt in one of two ways. She either increased the time delay interval back to the original delay interval (if using time delay), or she decreased the physical assistance to where the researcher believed the student would make a correct response on the next two trials (if using decreasing prompt hierarchy). During several instructional sessions, a student made three consecutive errors, and the researcher implemented the back-up procedure. The student then met the criteria for fading the prompt by performing the step correcty two consecutive times with the back-up procedure.

Time, however, expired for that day's instructional session. During the next instructional session which occurred as scheduled on the next day, the researcher faded the prompt. During the next day's instructional session, the student often made three more consecutive errors. The researcher implemented the back-up procedure once again. Again, the student met the criteria for fading the prompt by performing the step correctly two consecutive times with the back-up procedure. Again, time expired for that day's instructional session.

A pattern, therefore developed: First, the student made three consecutive errors. Second, the student correctly performed the step given the back-up procedure two consecutive times. Third, when it was time to fade the prompt, time expired for the instructional session. Fourth, the researcher faded the prompt at the beginning of the next day's session. Fifth, the student made three consecutive errors once again. This pattern occurred particularly with Students 1 and 3 on sandwich making and Students 3 and 4 with bed making.

A third implementation issue involves instructor preference of one teaching technique over another. At the beginning of the study, the researcher preferred time delay over decreasing prompt hierarchy. This was primarily because the researcher had never systematically implemented decreasing prompt hierarchy with students with severe

disabilities. She had, however, systematically implemented time delay with students with severe disabilities. As the study progressed, however, the researcher realized she preferred implementing the decreasing prompt hierarchy procedure when teaching most steps of both activities. This may have been due to the complexity of several steps in both task analyses which increased the difficulty of implementing the time delay procedure effectively. McDonnell and Ferguson (1989) also noted that their trainers preferred the decreasing prompt hierarchy over the time delay procedure. This perhaps suggests another variable in determining efficient teaching techniques.

Follow-up Probes

The researcher conducted follow-up probes to determine if the average number of steps the students learned during instruction maintained over time and generalized to another environment. She conducted the follow-up probes of Students 1, 2, and 3 in their respective homes. She conducted the follow-up probe of Student 4 in the home economics classroom of the segregated school where she conducted the study.

During the follow-up probe, Student 1 independently completed 9 of 18 steps of the bed making task analysis and 12 of 18 steps of the sandwich making task analysis. The average number of steps independently completed during the

last three probe sessions during the summer camp was 8.67 for bed making and 12.33 for sandwich making. These results are encouraging in that Student 1 maintained and generalized the number of steps learned during the instruction at the summer camp to her home. It is possible that Student 1 maintained the number of steps learned because, as reported by her guardian, she had only made her bed "a couple times" since the summer camp. Student 1 also had no opportunity to make a sandwich since the summer camp. Student 1 neither had the opportunity to practice errors nor had someone confusing her as to performance expectations. It was also encouraging to note that, as a result of this study, Student 1's guardian reported that she moved Student 1's bed away from the wall. This allowed Student 1 the freedom to walk around the bed while making it.

During the follow-up probe, Student 2 independently completed 9 of 18 steps of the bed making task analysis and 11 of 18 steps of the sandwich making task analysis. The average number of steps independently completed during the last three probe sessions during the summer camp was 9.33 for bed making and 14.33 for sandwich making. These results are also encouraging in that Student 2 maintained and generalized most steps learned during instruction at the summer camp to his home.

It is possible that Student 2 maintained the number of steps learned because, as reported by his mother, he had made his

bed only "some of the time" since the summer camp. Student 2 also had only "a couple" opportunities to make a sandwich since the summer camp. As with Student 1, Student 2 had little opportunity to practice errors and did not have someone confusing him as to performance expectations.

During the follow-up probe, Student 3 independently completed 8 of 18 steps of the bed making task analysis and 5 of 18 steps of the sandwich making task analysis. The average number of steps independently completed during the last three probe sessions during the summer camp was 10.67 for bed making and 11.00 for sandwich making. Student 3, therefore, regressed during the follow-up probe. His failure to maintain and generalize steps may be explained by two facts. First, at the summer camp the four students received instruction in making a twin bed. Student 3 had a double bed in his bedroom at home. The difference in the bed size may have made a difference in his follow-up probe. Second, Student 3's father reported that Student 3 had many opportunities to make his bed, his parent's bed, and a sandwich in the four weeks between the summer camp and the follow-up probe. Student 3 made several errors in performing the steps of the task analyses in the correct order. Student 3's father reported that he and his wife did not stress the order in which Student 3 was to complete the steps of the task analyses. He or his wife would assist Student 3 with a step if he was having difficulty.

Otherwise, they allowed Student 3 to initiate the steps of the task analyses in any order he chose. Student 3, therefore, had many opportunities to practice discrimination errors and was confused about the order in which he was to complete the steps of the activities. Student 3's performance during the follow-up probe reinforced the importance of the parent-school partnership. It is important to maximize student maintenance of learned activities and performances in untrained environments, particularly the home. To do so, it is critical that classroom teachers directly consult with parents as to how activities are performed in the home.

During the follow-up probe, Student 4 did not complete any step of the bed making task analysis and independently completed 1 step of the sandwich making task analysis. The average number of steps independently completed during the last three probe sessions during the summer camp was 0.00 for bed making and 0.67 for sandwich making. Given Student 4's performance during the last three probe sessions during the summer camp, the results of the follow-up probe were not surprising. The researcher was unable to reach Student 4's mother to see if he had the opportunity to practice either activity in his home after the summer camp. Student 4's mother, however, reported at the beginning of the study that they never gave Student 4 the opportunity to make his bed or a sandwich at home. A family member always did those

activities for him.

Costs of the Study

The cost to run the study using natural materials was relatively inexpensive. The cost for the materials to make the sandwiches, (i.e., bread, bologna, ham, mustard, and mayonnaise) for the entire six weeks came to a total of $32.61. During the first week of baseline and instruction, the students had the choice of eating their sandwiches if they desired. Eating the sandwiches consumed instructional time; therefore, after the first week, the researcher decided to take this option from the students. The researcher then was able to reuse the luncheon meat and bread. Reusing the luncheon meat and bread greatly assisted in decreasing the cost of the materials.

Due to time constraints for instruction, the researcher felt the best reinforcers were edibles instead of desired activities, such as playing basketball or putting together puzzles. The cost of purchasing the edible reinforcers was minimal for the entire six week period and amounted to $15.07. Total costs for training and probe sessions were $47.68. This averaged to be less than $2.00 per student per week. Given this small dollar amount per student per week, this study showed that instructors could used natural materials during instruction fairly inexpensively.

Limitations

There were three potential limitations to this study. First, there was a clear difference in the task composition between bed making and sandwich making. The data revealed a difference in the average number of steps learned based on the activity as opposed to the specific teaching technique used. Students on the average learned 5.88 steps of the sandwich making task analysis. They only learned on the average 4.09 steps of the bed making task analysis.

There is at least one possible reason that the students learned, on the average, more steps of the sandwich making than the bed making activity. Perhaps the definitions of correct and error responses in the sandwich making activity were clearer and better defined than those in the bed making activity. The steps of the sandwich making activity were discrete and clearly defined. On the other hand, some of the steps of the bed making activity were not clearly defined. The students were to use more judgment concerning whether their performance was correct or incorrect. For example, steps 7 and 9 of the bed making task analysis were "Grasp bedspread with two hands and pull to top of bed." A correct response required the students not only to pull the bedspread to the top of the bed with two hands, but also to ensure that no wrinkles were in the bedspread. The same was true for steps 17 and 18 of the bed making task analysis.

Step 17 was "Straighten spread under the pillow" i.e., no wrinkles. Step 18 was "Smooth out wrinkles." All four steps required the students to use a great deal of judgment in determining correct responses. With the sandwich making task analysis, the steps were clearer and more discrete. These steps required relatively less amounts of judgment from the students in determining correct responses. The researcher may have minimized the differences in amounts of judgment required in determining correct responses if she had task analyzed both activities into smaller steps.

A second potential limitation to this study was the existence of a clear activity preference. Student 1 definitely showed a preference for sandwich making over bed making. Toward the last three weeks in the study, the researcher had a difficult time even getting Student 1 over to the bed for her instructional sessions on bed making. Student 1's preference also was reflected in her data. Student 1 on the average learned 6.53 steps of the sandwich making task analysis while only learning, on the average, 3.67 steps of the bed making task analysis. Student 1 is the only student who verbally expressed a preference for sandwich making over bed making. In retrospect, it seems natural for students on the whole to prefer sandwich making over bed making. People often perceive bed making as a chore. The natural reinforcer to bed making is simply finishing the task and avoiding punishing consequences from

the caretaker. On the other hand, people often perceive sandwich making as a pleasurable activity. The natural reinforcer for making a sandwich is to eat it. Students may perceive sandwich making, therefore, as less work and more fun.

A third limitation to this study is the limited ability to generalize results. That there were only four students participating in this study limits the extent to which the researcher can apply the results of this study to other students of different ages or to other activities. With different students, different age groups, and different settings, (i.e., community settings) there may be more of a difference between time delay and decreasing prompt hierarchy in terms of efficiency. The limited ability to generalize results is an inherent limitation in a single subject research design.

Future Research

Based on the results of the study, this researcher recommends four major areas for future research. First, future research should extend the length of the study so the students have ample time to learn the targeted activities to criterion. This way, researchers could use more comprehensive dependent variables to determine the more efficient teaching technique. Such variables would include

(a) the average number of instructional trials required for students to complete 100% of the task analyses steps independently on three consecutive probe sessions, (b) the average number of errors to criterion made by students during instruction, and (c) the average time in instruction to criterion.

Second, future research should involve task analyzing the activities into smaller steps than this study. This would guard for two issues that emerged during this study. The first issue focused on the complexity of many of the steps in both task analyses. In this study the researcher noted that many steps of both activities were too complex. As such it was difficult to implement the teaching techniques, time delay and decreasing prompt hierarchy in a precise manner. The second issue focused on the observation that the steps in the task analyses for bed making and sandwich making varied in levels of judgment the students needed to use in order to determine correct responses. Breaking the activities down into smaller, more manageable steps would increase the similarity in construction between the two activities. This would be true for both the level of judgment required to perform each step correctly and the likelihood that instructors would implement the two teaching techniques more precisely. As a result, researchers would be able to compare the two teaching techniques more effectively.

Third, future research should systematically replicate this study using both different activities and individuals of different ages. People with severe disabilities have many functional activities to perform at all ages if they are maximally to participate in their homes, schools, communities, and work places. Replications with additional activities and individuals of different ages would expand the almost nonexistent research base in terms of generality of research results.

Fourth, future research designs should consider revising the procedures for fading the prompts. In particular, there are at least two major areas that researchers should explore to determine efficient strategies for fading prompts. First, researchers should determine more effective criteria for identifying when to fade a prompt. The researcher noted in this study that there were occasions when two consecutive correct responses at a given prompt level did not seem sufficient to fade the prompt. The students did not seem "ready" for the researcher to fade the prompt. Instead of establishing criteria for fading a prompt at a set number of correct responses at a prompt level (i.e., two or three), future research should consider alternative strategies. One strategy might be to define "ready" when the student responded to part or all of the prompt or when the student anticipated part or all of the step on either two or three consecutive trials.

A second area to explore in terms of procedures for fading prompts is determining the level of prompt at the beginning of each instructional session. In this study, the researcher noted that a pattern emerged with all students when they met criteria for fading a prompt. On several occasions, students met criteria for fading a prompt, yet time had expired for that day's instructional session. During the next instructional session, as scheduled, the researcher faded the prompt. Many times students made three consecutive errors. This required the researcher to implement the back-up procedure. After two correct responses with the back-up procedure, the students again met criteria for fading the prompt. Once again, time expired for that day's instructional session. Future research should include errorless learning teaching procedures that minimize this pattern of responses. One way would be for the researcher to begin each instructional session with the same prompt level that he or she used at the end of the previous session. After one or two consecutive correct responses, the researcher then could fade the prompt.

GLOSSARY

GLOSSARY

Backward chaining. Backward chaining entails teaching the last step or steps of an activity first. Steps are progressively added in a reverse sequence until the learner performs the complete activity independently (Spooner et al., 1983).

Constant time delay. In using a constant time delay procedure, the instructor first delivers the prompt 0 seconds after the natural or instructional cue for the initial two to five trials. After the initial trials at 0 seconds, the instructor increases the amount of time between the natural or instructional cue and the prompt to a predetermined time delay interval. This delay interval, which has ranged from 1 to 15 seconds, remains the same (i.e., constant) for the duration of the instruction (Billingsley & Romer, 1983; Schuster & Griffen, 1990; Snell & Gast, 1981). An example of a 2 second constant time delay is as follows: The instructor determines that he/she will provide the prompt immediately after the natural or instructional cue (i.e., a 0 second time delay) for the first three trials. After the initial three trials, the instructor increases the time delay interval to 2 seconds and keeps this interval at 2 seconds throughout the remaining instructional sessions until the student

responds independently.

Decreasing prompt hierarchy. Decreasing prompt hierarchy, also known as most-to-least prompting hierarchies or decreasing assistance is a common fading procedure used with errorless learning. In using a decreasing prompt hierarchy, the instructor provides as much added information as needed (i.e., a prompt) to obtain the desired response. The instructor provides this added information before the student has the opportunity to respond to the natural or instructional cue. The instructor then systematically fades the added information, according to some predetermined hierarchy. Typically the hierarchy of prompts includes full physical assistance, followed by visual prompts (models and gestures), and finally ends with verbal prompts (Billingsley & Romer, 1983; Sigafoos et al., 1991).

Error correction procedure. An error correction procedure is added information that the instructor provides, after the student makes an error, to assist the student in responding correctly. The purpose of the error correction procedure is to correct the error that the student made. Researchers have reported using two error correction procedures effectively. These are the system of least prompts and verbal/physical assistance.

Errorless learning teaching techniques. Errorless learning teaching techniques are techniques which require the

instructor to provide added information (i.e., a prompt) before the student has a chance to respond. This is to minimize errors during instruction (Reichle & Sigafoos, 1991).

Fading. Fading is the gradual and systematic removal of prompt(s) while maintaining correct responding (Billingsley & Romer, 1983).

Instructional cue. An instructional cue is an artificial cue, usually a verbal instruction from an instructor, that elicits a desired response. For example, an instructor giving the verbal instruction, "Make a sandwich," is an instructional cue for making a sandwich.

Natural cue. A natural cue is the naturally occurring stimulus variable(s) that elicits a desired response. For example, hunger is the natural cue to fix something to eat.

Progressive time delay. In using a progressive time delay procedure, the instructor begins with a 0 second time delay interval. The instructor then systematically increases the amount of time between the natural or instructional cue and the prompt by predetermined increments of time. These increases occur after a predetermined number of either correct responses or trials at each time delay interval (Billingsley & Romer, 1983; Schuster & Griffen, 1990). An example of

a progressive time delay is as follows: The instructor first provides the prompt immediately after the natural or instructional cue (i.e., a 0 second time delay interval). After a predetermined criterion of performance, for example, two consecutive correct responses, the instructor increases the time delay interval to 1 second. After two consecutive correct responses at 1 second, the instructor again increases the time delay interval, this time to 2 seconds. The instructor continues this process of increasing the time delay interval by one second until a predetermined ceiling is met (e.g., 5 seconds) or until the student responds independently.

Prompt. A prompt is any information added to the natural or instructional cue in order for a student to respond correctly. Examples of prompts include verbal instructions, point cues, and physical assistance. Since a prompt is added information, it must be faded to ensure independent performance.

System of least prompts. The system of least prompts is an error correction procedure that involves proceeding through a predetermined hierarchy of prompts. The hierarchy may contain anywhere from three to six levels of prompts and is presumably structured from least to most intrusive. If the student does not respond correctly to the natural or instructional cue, the

instructor provides the first level in the hierarchy of prompts. Often the first level in the hierarchy of prompts is a verbal prompt. If the student does not respond correctly to that level of prompt, the instructor gives the next level in the hierarchy. This continues until the student either correctly responds or reaches the last level in the hierarchy. The last level in the hierarchy elicits the desired response (Billingsley & Romer, 1983; Doyle et al., 1988).

Task analysis. A task analysis is the breakdown of a complex behavior (an activity) into its component parts (Alberto & Troutman, 1990).

Time delay. Time delay is a common fading technique in errorless learning. In using time delay techniques, the instructor provides an <u>effective</u> prompt (i.e., added information such as a point cue or physical assistance) that elicits the desired response. The instructor then attempts to fade the prompt by systematically manipulating the time between the natural or instructional cue and the prompt. There are two types of time delay: constant time delay and progressive time delay (Billingsley & Romer, 1983; Schuster & Griffen, 1990).

Trial and error teaching techniques. In using trial and error teaching techniques, an instructor allows a student to make a response to the natural or

instructional cue. If the response to the natural or instructional cue is correct, the instructor provides reinforcement and/or allows the student to continue to the next required response or step in the activity. If the student makes an error, the instructor implements an error correction procedure.

Verbal/physical assistance error correction procedure. In using a verbal/physical assistance error correction procedure, the instructor stops the student if he or she makes an incorrect response. After stopping the student, the instructor determines whether to back him or her up to the previous response(s) given correctly. If he or she determines to back the student up, the instructor next does so. Regardless of backing the student up to response(s) given correctly, the instructor next cues the student again to perform the response(s) originally performed incorrectly. This time the instructor assists the student, either verbally or physically, to perform correctly the response that was originally performed incorrectly. The student then continues to the next response in the activity.

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APPENDICES

APPENDIX A

THE UNIVERSITY OF TENNESSEE
KNOXVILLE

College of Education
Department of Special Services Education
102 Claxton Addition
Knoxville, Tennessee 37996-3400
(615) 974-2321
FAX (615) 974-8674

Dear Parent(s),

I am a graduate student at the University of Tennessee, and am working on my Master's thesis. I am writing to ask if you will allow your son/daughter to participate in my study.

In my research I will compare two accepted teaching methods to see which one is better in teaching bed making and sandwich making. Instruction will occur during the summer day program at Fort Sanders Developmental Center for the entire 6 week period. If you allow your son/daughter to participate and if he/she is selected, I will work with him/her daily on an individual basis for approximately 45 minutes each day. If your son/daughter participates in my study, a major benefit is that he/she will receive one-on-one instruction for approximately 45 minutes a day on how to make a sandwich and a bed. There are no foreseeable risks involved in participating in the activities. The teaching methods are in no way harmful. In fact, both methods are accepted special education instructional techniques.

My thesis will not mention any participant's name. All data will be confidential and reported as Student 1, Student 2, Student 3, and Student 4. I will be videotaping your son/daughter every teaching session. The videotapes will be viewed by two professionals from the University of Tennessee to determine how well I am teaching the activities and how accurately I am recording your son/daughter's responses. The videotapes will be used for the purposes of this study only. I am hoping the results of my study will help inform special educators on the best ways to teach students who experience moderate and severe disabilities. I will also be more than happy to share with you the results of my study.

If you are interested in having your son/daughter participate in my study, please read and sign the attached informed consent form and return it in the envelope provided. Your signature on this consent form will allow me to determine if your son/daughter meets the criteria for participation. If he/she does meet the criteria, I will contact you and obtain your consent to teach him/her during the summer school program.

If you have any questions regarding my study or if you would like more information, please do not hesitate to call me. My home phone is 688-8935 and my work phone is 974-2760. I hope that you will consider your son/daughter's participation in my study.

Sincerely,

Nicki Nye

APPENDIX B

INFORMED CONSENT FORM

I have read the introductory letter and understand the following:

1. The purpose of this study is to compare two teaching methods to determine which one teaches activities faster.

2. There are no foreseeable risks in participating in the two activities, bed making and sandwich making. If my son/daughter is selected to participate in the study, the major benefit would be that he/she will receive the opportunity to learn two meaningful activities.

3. All information is confidential. My son/daughter's name will not be used. All data will be reported as Student 1, Student 2, Student 3, and Student 4.

I also understand that by signing this informed consent form, I am giving Nicki Nye permission to do the following:

1. Review my son/daughter's records to determine if he/she has a measured IQ of 55 or below.

2. Talk with my son/daughter's teacher to find out how he/she learns best.

3. Conduct a pretest at my son/daughter's current school or my home to find out what parts of the two activities, sandwich making and bed making, he/she already does.

4. Videotape my son/daughter while he/she is learning bed making and sandwich making for data collection purposes only.

I also understand the following:

1. Participation in the pretest does not guarantee that my son/daughter will be selected to participate in the study.

2. My son/daughter's participation is entirely voluntary and I may withdraw him/her from the study at any time.

3. If I have any questions I may contact Nicki Nye at home at 688-8935 or at work at 974-2760.

_____
Signature

_____
Phone Number

_____
Date

APPENDIX C

INFORMED CONSENT FORM

I understand that my son/daughter has been selected to participate in Nicki Nye's thesis study. I also understand the following:

1. The purpose of this study is to compare two teaching methods to determine which one teaches activities faster.

2. There are no foreseeable risks in participating in the two activities, bed making and sandwich making. The major benefit is that my son/daughter will receive the opportunity to learn two meaningful activities.

3. All information is confidential. My son/daughter's name will not be used. All data will be reported as Student 1, Student 2, Student 3, and Student 4.

I also understand that by signing this informed consent form, I am giving Nicki Nye permission to do the following:

1. Teach my son/daughter the two activities selected, sandwich making and bed making, with two accepted teaching methods.

2. Deliver one-on-one, individualized instruction to my son/daughter for 45 minutes a day while he/she is at Fort Sanders Developmental Center participating in the summer program.

3. Conduct postests with my son/daughter at 4- and 8-week intervals following the completion of the Fort Sanders summer progam to determine how well the instruction was retained. These postests will be conducted at my son/daughter's school or my home.

4. Videotape my son/daughter while he/she is learning bed making and sandwich making for data collection purposes only.

I also understand the following:

1. My son/daughter's participation is entirely voluntary and I may withdraw him/her from the study at any time.

2. If I have any questions I may contact Nicki Nye at home at 688-8935 or at work at 974-2760.

_____

Signature

_____

Date

APPENDIX D

NAME: _____

	STEP/BEHAVIOR I: Independent RP: Resisted Prompt A: Anticipation C: Correct w/ Prompt E: Error w/ Anticipation or Independent EP: Error w/ Prompt													
18	Smooth out wrinkles													
17	Straighten bedspread under pillow													
16	Pull spread over pillow (left side) and adjust													
15	Walk to left side of bed													
14	Pull spread over pillow (right side) and adjust													
13	Get pillow + place in middle of the turned back spread													
12	Grasp top of bedspread + turn back 1-1½ feet													
11	Walk to left side of bed													
10	Grasp top of bedspread + turn back 1-1½ feet													
9	Grasp bedspread w/2 hands + pull to top of bed													
8	Walk to right side of bed													
7	Grasp bedspread w/2 hands + pull to top of bed													
6	Smooth out wrinkles													
5	Grasp top sheet w/2 hands + pull to top of bed													
4	Walk to left side of bed													
3	Smooth out wrinkles													
2	Grasp top sheet w/2 hands + pull to top of bed													
1	Remove pillow and place on floor (right side)													
0														
	DATE													
	INSTRUCTIONAL TIME													

APPENDIX E

NAME: _____

	STEP/BEHAVIOR I = Independent RP = Resisted Prompt A = Anticipation C = Correct w/ Prompt E = Error w/ Anticipation or Independent EP = Error w/ Prompt												
18	Put up bread												
17	Close bread												
16	Put mustard/mayo & meat back in the refrigerator												
15	Close meat package												
14	Close mustard/mayo												
13	Put left bread on top of meat bread												
12	Place 1 slice of meat on right piece of bread												
11	Open meat												
10	Squirt mustard/mayo on right piece of bread in Z												
9	Squirt mustard/mayo on left piece of bread in Z												
8	Pick up mustard/mayo & shake down												
7	Open mustard/mayo												
6	Place slices on plate next to each other												
5	Get 2 slices of bread												
4	Open bread												
3	Get bread												
2	Get plate from the cabinet												
1	Get meat & mustard/mayo from the refrigerator												
0													
	DATE												
	INSTRUCTIONAL TIME												

APPENDIX F

NAME:_____

	STEP/BEHAVIOR	I = Independent SI = Step Initiation Error D = Discrimination Error R = Response Error											
18	Smooth out wrinkles												
17	Straighten bedspread under pillow												
16	Pull spread over pillow (left side) and adjust												
15	Walk to left side of bed												
14	Pull spread over pillow (right side) and adjust												
13	Get pillow & place in middle of the turned back spread												
12	Grasp top of bedspread & turn back 1-1½ feet												
11	Walk to left side of bed												
10	Grasp top of bedspread & turn back 1-1½ feet												
9	Grasp bedspread w/2 hands & pull to top of bed												
8	Walk to right side of bed												
7	Grasp bedspread w/2 hands & pull to top of bed												
6	Smooth out wrinkles												
5	Grasp top sheet w/2 hands & pull to top of bed												
4	Walk to left side of bed												
3	Smooth out wrinkles												
2	Grasp top sheet w/2 hands & pull to top of bed												
1	Remove pillow and place on floor (right side)												
0													
	DATE												
	INSTRUCTIONAL TIME												

APPENDIX G

NAME: _____

	STEP/BEHAVIOR	I: Independent SI: Step Initiation Error D: Discrimination Error R: Response Error												
18	Put up bread													
17	Close bread													
16	Put mustard/mayo & meat back in the refrigerator													
15	Close meat package													
14	Close mustard/mayo													
13	Put left bread on top of meat bread													
12	Place 1 slice of meat on right piece of bread													
11	Open meat													
10	Squirt mustard/mayo on right piece of bread in Z													
9	Squirt mustard/mayo on left piece of bread in Z													
8	Pick up mustard/mayo & shake down													
7	Open mustard/mayo													
6	Place slices on plate next to each other													
5	Get 2 slices of bread													
4	Open bread													
3	Get bread													
2	Get plate from the cabinet													
1	Get meat & mustard/mayo from the refrigerator													
0														
	DATE													
	INSTRUCTIONAL TIME													

VITA

Nicholet Lynn Nye was born in Dayton, Ohio on December 1, 1961. She attended West Carrollton High School in West Carrollton, Ohio and graduated in June 1980. The following September she entered the University of Tennessee, Knoxville and in June 1984 received a Bachelor of Science degree in Business Administration with a major in Finance.

In August 1984, Nicki volunteered for a year of mission work in Asheville, North Carolina. She then worked in the field of business for three years. In August 1988, Nicki reentered the University of Tennessee, Knoxville and began her graduate studies in Special Education. In February 1989, she was employed as a Graduate Research Assistant for the Tennessee LRE for LIFE Project as a site consultant. Nicki provided technical assistance to special education teachers across the state of Tennessee in programming for students with severe disabilities until August 1992. She received a Master of Science degree in Education with a major in Special Education in May 1992. Nicki plans to teach students with severe disabilities in August 1992.