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EFFECTS OF A FOUR-STEP STRATEGY
ON THE ACQUISITION, MAINTENANCE, AND GENERALIZATION
OF THREE GROSS MOTOR SKILLS
BY ADOLESCENTS WITH MILD MENTAL RETARDATION

DISSertation

Presented in Partial Fulfillment of the Requirements for
the Degree Doctor of Philosophy in the Graduate
School of The Ohio State University

By

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The Ohio State University
1997

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ABSTRACT

Interest in the use of appropriate strategies for improving motor skills has been growing over the past few years (e.g., Anshel & Singer, 1980; Epstein, 1980; Singer, Defrancesco, & Randall, 1989a). Findings have demonstrated that the use of suitable learning strategies can enhance the acquisition, retention, and transfer of motor skills. Professionals who work with individuals with mental retardation (MR) have also recognized the importance of teaching effective learning strategies. A number of different strategies have been investigated with individuals with MR (e.g., Bishop, 1990; Porretta & Surburg, 1995; Reid, 1980a; Yang, 1995). Results suggest that individuals with MR can be taught various strategies to improve motor skills. These strategies have been used, however, only within very specific contexts and skills, and generalization effects have been limited (Reid, 1993). Therefore, further investigation into the use of learning strategies relative to motor skills in individuals with MR is warranted. Among these studies, Singer’s five-step strategy (1986) has been found to be effective for persons without MR. It has been suggested that the Singer strategy is generalizable across skills. Because individuals with MR typically exhibit deficits with processing information, Singer’s five-step strategy was modified to four steps which consisted of “ready”, “look”, “do”, and “score”. The purpose of this study was to investigate the
effects of this four-step strategy on the acquisition, maintenance, and generalization of
three closed gross motor skills (basketball free throw, overhand softball throw, and dart
throw) by adolescents with mild MR. A multiple baseline across skills design was used.
The performance of six subjects across these skills was examined. Results indicated that
all subjects increased performance in all three gross motor skills during the training
phase of the study. Four of the six subjects maintained performance on all three skills
when reminders (visual and verbal) were present. When the reminders were removed,
two subjects decreased performance level. However, all subjects improved performance
when a reinforcer (a soft drink) was introduced. Moreover, a majority of subjects (five of
the six) were able to generalize the four-step strategy to a different setting. This study
demonstrated that students with mild MR were able to learn the four-step strategy.
Therefore, performance increases were demonstrated for the training phase. However,
performance did not continue to consistently increase during the maintenance phase.
This was perhaps due to the length of training and the length of time the reminders were
provided. Performance during the generalization phase was similar to performance
during the training phase of the study. The use of this strategy has practical implications.
It is simple, requires no special equipment, and can be conducted in a normal teaching
environment.
Dedicated to my father,

Yun Yang,

who passed away May 30, 1996.
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PUBLICATIONS

Research Publication

   throw shooting performance of Special Olympics basketball players: A pilot study


FIELD OF STUDY

Major Field: Education

Specialization area: Adapted Physical Activity
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Interest in learning strategy research (Torgeson, 1982) has grown rapidly over the past two decades. Weinstein and Mayer (1986) suggest that the outcome of learning depends jointly on what information is presented and on how the learner processes the information. This information processing (cognitive) approach has greatly influenced the teaching-learning process. In almost every instance, strategy usage increases the efficiency with which information is passed through the neural structure, and adds to the capacity of the memorizer to handling additional information (Spitz, 1979). This is a common theme in learning research today.

According Derry and Murphy (1986), numerous studies have dealt with training individuals to use learning strategies relative to academic achievement. At this time, research on the effectiveness of learning strategies with respect to the psychomotor domain is limited. However, researchers have demonstrated that training individuals to use suitable learning strategies can enhance the acquisition, retention, and transfer of motor skills (Anshel & Singer, 1980; Epstein, 1980; Singer & Suwanthada, 1986; Singer, Defrancesco, & Randall, 1989a).
In this connection, Singer (1986) proposes a five-step learning strategy which consists of five sequential tasks: readying, imaging, focusing, executing, and evaluating. The first step of the strategy, readying, directs the learner to create an optimal state of preparation for performance (physically, mechanically, and psychologically). The second step of the strategy, imaging, requires the learner to mentally picture performing the act. Focusing is the third step of the strategy. Focusing requires the learner to concentrate intensely on one relevant aspect (cue) of the task, thereby blocking out all other irrelevant thoughts. The fourth step of the strategy, executing, requires the learner to perform the task (skill) without thinking about the act itself or possible outcomes. In the final step, evaluating, the learner is expected to assess the performance outcome and the previous four steps. Adjustments should then be made as necessary for subsequent performances.

Singer's five-step strategy is based on the assumption that the acquisition of motor skills requires the use of cognition in an extensive and consistent manner. This strategy is expected to help a learner acquire motor skills, develop positive expectancies toward performance, and monitor and evaluate the learning process to direct and regulate motor behavior effectively. According to Singer (1989a), once individuals have learned this strategy, it can be effective in the learning of all types of closed skills. Closed skills are those in which the environment is relatively stable and the situation is predictable. Moreover with closed skills, learners have enough time to prepare, preview the situation, and completely control the movement. Bowling, basketball free throws, and serving a tennis ball are examples of closed skills. Singer and colleagues conducted a series of
studies which have examined the effectiveness of the five-step strategy. These results indicate that subjects can use the strategy to learn closed motor skills and are able to effectively transfer to related closed motor skills as well (e.g., Singer & Suwanthada, 1986; Singer, Flora, & Abourezk, 1989b; Singer, et, al., 1989a; Singer, Lidor, & Cauraugh, 1994).

Singer (1989b) suggests that the five-step strategy is generalizable and can be used by individuals at all skill levels. At this time, research on Singer's five-step strategy has been limited to college students. Therefore, the applicability of this strategy to other populations (e.g., high and middle school students, students with mental retardation) still remains to be examined. Instructing individuals in the development of appropriate strategies that might facilitate motor learning seems to be an appropriate direction for future psychomotor research, especially those with learning difficulties.

Professionals who work with individuals possessing mental retardation (MR) have recognized the importance of teaching learning strategies to these individuals. However, there has not been a great deal of motor learning research that deals with instructional strategies (Newell & Rovegno, 1990). Significant gaps remain among theoretical motor learning researches, applied motor learning research, and practice in adapted physical activity. It is necessary for the researchers to bridge the gap between theoretical research and practice by using learning (instructional) strategies in the practice setting (Reid, 1993). A number of different strategies have been investigated with individuals who are mentally retarded. For example, Porretta and Surburg (1995) compared the use of physical practice and imagery to a physical practice only approach for individuals with
MR in a baseball striking skill. Results supported the notion that imagery enhanced motor performance. A suggestion was made by the authors of testing the use of imagery without prompting over an extended period of time. Surburg, Porretta, and Sutlive (1995) utilized imagery as a strategy in an underhand throwing task for individuals with MR. Their results indicated that groups supplemented with imagery practice were superior in performance to non-imagery groups. Reid (1980a) investigated the effectiveness of teaching the mentally retarded students to use a memory strategy. The conclusion of this study was that mentally retarded individuals do benefit from use of a memory strategy. In another study, Reid (1980b) tested the use of overt and covert rehearsal strategies with both mentally retarded and nonretarded individuals. Results indicated that overt rehearsal was an effective way to maintain an item in memory for retarded individuals. In addition, Bishop (1990) investigated the effectiveness of using a self-recording strategy for motivating adolescents with mild mental retardation in order to increase running duration. Bishop's findings revealed that self-recording facilitated a longer duration of running for adolescents with MR. These studies suggest that individuals with MR can be taught strategies to improve various motor skills.

While individuals with MR can generally acquire motor skills, they have particular difficulty in retention and generalization (Porretta, 1990; Reid, 1993). It is frequently noted that individuals with MR do not demonstrate appropriately learned skills when the settings have physically changed, when new people appear, or the activity time schedule changes. Reid (1993) suggests that researchers need to assess and ensure the generalization of treatments. It is, therefore, important to determine if a general learning
strategy can be utilized by individuals with MR across a variety of motor skills. From both the acquisition and generalization aspects, it seems worthwhile to investigate Singer’s five-step strategy with individuals who possess MR. Because individuals with MR typically exhibit deficits in processing information, Singer’s 5-step strategy seems to be too complex. Therefore, Singer’s 5-step strategy has been modified to a four-step strategy in the present study. The four-step strategy consists of ready, look, do, and score. Can this type of strategy be a benefit to the learning/performing of gross motor skills in MR adolescents? This has yet to be tested.

Purpose of the Study

The purpose of this study was to investigate the effects of a four-step strategy on the acquisition, maintenance, and generalization of three closed gross motor skills (basketball free throw, overhand softball throw, and dart throw) by adolescents with mild mental retardation.

Research Questions

1. Does training individuals with mild mental retardation to use a four-step learning strategy with three closed gross motor skills (basketball free throw, overhand softball throw, and dart throw) affect performance?

2. Are individuals with mild mental retardation able to continue using the four-step learning with three closed gross motor skills (basketball free throw, overhand softball throw, and dart throw) after training has been terminated?

3. Will individuals with mild mental retardation be able to use the four-step learning strategy with each of the three gross motor skills (basketball free throw, overhand
softball throw, and dart throw) in a different setting?

4. Is there a performance change between male and female individuals with mild mental retardation across three closed gross motor skills (basketball free throw, overhand softball throw, and dart throw) following experimental intervention (the four-step strategy)?

5. What is the social value of the four-step strategy as viewed by parents and teachers relative to enhancing subjects' acquisition, maintenance, and generalization of the three gross motor skills?

**Definitions of Terms**

The following are operational definitions of the terms used in this study.

**Closed skills.**

Skills initiated by individuals when they are ready. There is time to prepare, preview the situation, and control the movement. The characteristics of such skills are that the environment is relatively stable, the situation is predictable, and there is little concern for rapid perceptual adjustment (Singer, 1986, 1988).

**Mild Mental Retardation (mild MR)**

In this study, mild MR refers to adolescents who have a performance score (two or more standard deviations below the norm) on a standardized intelligence quotient (IQ) score (range of 55-70). They also exhibit deficits in adaptive behavior that encompass the areas of learning, social adjustment, communication, and psychomotor development (American Psychiatric Association, 1994).
Learning Strategy

Torgesen (1982) defined a strategy as any organized sequence of processing activities that helps solve an intellectual task. A learning strategy represents the enactment of sequences of higher order mental procedures that enable learners to develop an understanding of their mental processes and how to use them effectively (Nesbitt & Shucksmith, 1986).
This chapter consists of four sections to review the literature related to this study. The first section discusses learning theories and strategies with nondisabled individuals in motor skill learning and performance. The second section provides information on learning theory and individuals with mental retardation (MR). The third section focuses on strategic learning and performance of skills for individuals with MR. The fourth and final section summarizes the related literature.

**Learning Theories and Strategies with Nondisabled Individuals**

**in Motor Skill Learning and Performance**

A learning strategy represents the enactment of sequences of higher order mental procedures that enable learners to develop an understanding of their mental processes and how to use them effectively (Nesbitt & Shucksmith, 1986). Singer (1984) has classified learning strategies as either primary or secondary. Primary strategies are associated with improving the capacity to learn/perform from an information processing perspective. Secondary strategies are associated with a person's ability to self-evaluate in terms of readiness to train, learn, and perform. Both strategies reflect potential cognitive control over performances and feelings. Based on his classification, Singer (1986)
proposed a five-step strategy that includes (1) readying, (2) imaging, (3) focusing, (4) executing, and (5) evaluating. Each step consists of 2 to 4 components (see Appendix A). In explaining the five-step strategy, Singer noted that athletic acts occur under one of two types of skills: self-paced (closed) and externally paced (open). Externally paced skills are reactive to conditions, such as catching a fly ball in the game of baseball. Self-paced skills (closed skills) are initiated by the athlete when he or she is ready, and time exists to prepare, preview the situation, and completely control the movement, such as hitting a golf ball, rolling a bowling ball, serving a tennis ball, and shooting a basketball free throw.

Singer and his colleagues have conducted a series of studies to test this five-step strategy on the acquisition and transfer of self-paced motor skills. In the earliest study, Singer and Suwanthada (1986) first investigated the use of this strategy on two primary tasks (underhand dart and jart throwing) and one secondary task (soccer foul shooting) within a laboratory setting. Eighty university students served as subjects and were randomly placed into five groups of equal sex and number: a content-dependent strategy group (CDS), a content-dependent strategy plus reminders group (CDSR), a content-independent strategy group (CIS), a content-independent strategy plus reminders group (CISR), and a control group. Results indicated that the CISR group performed significantly better than the CDS group. Apparently, reminders are necessary to focus learners. Furthermore, another important finding is that the CIS group exhibited greater generalization than the CDS group. Therefore, a more general task-referenced strategy seems more desirable than a task specific strategy. Overall, the five-step strategy appears
to be quite beneficial for the learning of self-paced motor skills because it is
generalizable.

Singer, DeFrancesco, and Randall (1989) next examined both the applied and
laboratory tasks using the same five-step strategy. The purpose of this study was to
determine which type of task was most effective in facilitating the learning and transfer
of motor skills. Forty university students were randomly assigned to one of four groups: a
strategy group that attempted to master a laboratory task following the learning of the
strategy (SL); a laboratory control group (CL); a strategy group that first learned the
strategy and then attempted to demonstrate it in an applied sport task (SA); and an
applied-task control group. A complex laboratory motor task was designed for testing
speed and accuracy in movement. The apparatus consisted of a 50.80-cm X 50.80-cm
board on which six circular targets, 6.99 cm in diameter, were attached. The distance
between the targets ranged from 7.62 to 35.56 cm. All targets were attached to a coiled
piece of stainless steel wire. When a subject touched a hand-held stylus to a target, the
resulting pressure forced the stainless steel wire to make contact with a copper plate,
sending a signal from the target board to the display panel which illuminated a
corresponding numbered light. A multiple light stimulus display illuminated a numbered
light (1-6) indicating the numbered target with which to begin the movement sequence.
The applied sport task was a modified table-tennis service and the transfer task was a
seated underhanded dart throw. For the applied laboratory task, the strategy (SL) group
had significantly longer preparation and faster movement times than the control group
(CL). For the transfer task, the SA group was the only strategy group to significantly
outperform both control groups. These findings supported previous investigations that
demonstrated the effectiveness of using the five-step strategy for enhancing self-paced
motor skill performance (Singer et al., 1986; Singer et al., 1989.)

Singer, Lidor, and Cauraugh (1993) investigated further on the effectiveness of the
five-step strategy. Specifically, the investigation compared the influence of three learning
strategies on the learning and performing of a closed motor task (ball throwing). Three
separate learning strategies were used. These were an awareness strategy, a nonawareness
strategy, and the traditional five-step strategy. Seventy-two students (36 females and 36
males) were randomly assigned in one of three strategy groups and a control group. A
specific set of strategy instructions were provided to each group. Radial error (distance
from the center of the circular target without regard to direction) and average variances
(throwing variability) were measured and analyzed. During the acquisition stage, all three
strategy groups demonstrated higher ball-throwing accuracy than the control group. In
addition, the five-step and nonawareness groups displayed less radial error and average
variances than the awareness group. However, no significant difference was observed
between the five-step and nonawareness groups. From a practical point of view, one may
argue that instead of spending equal time teaching all the stages of the five-step strategy,
the instructor might allocate more time explaining to individuals how to focus their
attention during execution. With this in mind, the authors speculated that the five-step
strategy might be better used with more complex tasks.

A follow-up study was therefore conducted by Singer, Lidor, and Cauraugh (1994) to
investigate the influence of the above-mentioned three strategies in a complex laboratory
task. The task involved pressing nine keys in an assigned sequential order. A software program controlled stimulus presentation and recorded accuracy and response time for the keypressing task. Response time for correct sequences were measured. It is not surprising that both the five-step and nonawareness groups completed the task faster than the control group during acquisition. These results are similar to the 1993 study (Singer, et al.) However, results also indicated that the five-step strategy group was better than the awareness group during the acquisition phase.

In view of the above-mentioned investigations, one could conclude that the five-step strategy is effective for learning motor skills. This strategy emphasizes the appropriate use of cognitive processes prior to, during, and after completion of a movement. Being mentally prepared for what needs to be done and then executing it with one cue seems to be desirable for learning. Singer and his colleagues (1989) believe the five-step strategy can be easily modified and adopted for all levels of learners when learning self-paced skills.

Other strategies for effectively learning motor skills have also been investigated (Anshel, 1988; French, Rink, Rikard, Mays, Lynn, & Werner, 1991; Ravizza & Osborne, 1991). Anshel (1988) studied the effects of cognitive strategies on learning an overhand volleyball serve. Subjects were 36 first-year female college students, age 18 to 19 years. The experimental procedure required students to watch a videotape of the criterion task. Experimental groups then used one of three different rehearsal strategies (self-talk, a mental imagery, and physical task with a tactual learning style). Results showed that all three experimental groups increased accuracy in a volleyball overhand serve. The authors
suggest that motor performance can be further enhanced if a profile can be developed for learning motor skills as opposed to cognitive materials.

French, Rink, Rikard, Mays, Lynn, and Werner (1991) studied the learning of complex tasks (volleyball serve and volleyball sets) with ninth-grade students of varying skill levels. Authors divided the volleyball serve and volleyball set into four levels according to task difficulty. For the serve, Level one was designated as serving from a distance of 10 feet, Level was designated as serving from the midcourt over the net to the baseline. Level 3 was designated as serving the ball from baseline to an opposite baseline, and Level four was designated as serving the ball over the net from the baseline into different areas of the court associated with point values (a higher point value was given to the ball landing near the baseline and the sidelines). The same level of difficulty criteria was used in the volleyball set task. In other words, the harder the task is, the higher the points value the subject obtained. Three experimental groups (progression, criterion, and final-test) practiced the overhand serve and set for ten trials each day for six days. Students were instructed to score each trial of serve and set by individually or working with partners. Results demonstrated that the average-skilled students in the progression and criterion groups achieved higher success rates during acquisition and maintained higher success rates throughout the experiment. In contrast, the low-skilled students in the progression and criterion groups showed moderate levels of success during acquisition but little or no progress made after acquisition. However, the authors suggested that low-skilled students need to develop prerequisite skills necessary for mastering the more complex skills. There was also no evidence to support that the final
test was the most efficient way to produce learning of complex skills such as volleyball
serve and volleyball sets.

Ravizza and Osborne (1991) developed a three-step pre-performance strategy
(routine) for the University of Nebraska football team. This three-step routine consists of
ready, responds, and refocuses. It emphasized that play begins with the “ready” signal,
then it is followed by the player’s “response,” and then “refocus” starts at the beginning
of the next play. The authors believe that football players must focus on one play at a
time by exhibiting self-control and taking responsibility for optimal performance.
Moreover, the use of the three-step strategy helps players concentrate on one cue in order
to avoid feeling the pressure of time ticking away on the game clock and worrying about
the score. The implementation of the three-step strategy begins in practice and continues
in the game situation. On the game day, the player is encouraged to focus on one play at
a time and not to focus on the end result. The authors found that this simple strategy
helped players keep things simple and allowed them to feel more in control. As the
players begin viewing the game play-by-play, the player does not have to turn the whole
game around whether it is leading or losing. They just deal with the next play so it is
easier to regain the confidence, control the feeling, and commit the task. The authors
further suggested that coaches must reinforce the procedure constantly in order for it to be
effective and encourage players to extend it to all other aspects of life, such as dealing
with a mistake, coping with distractions, and trying not to make a mistake.
Learning Theory and Individuals with Mental Retardation

It is commonly known that individuals with mental retardation (MR) exhibit poor performance of motor skills. Researchers have put a great deal of effort into finding solutions in order to help these individuals enhance their learning and performance. Generally, three cognitive approaches have led to the majority of research in the area of mental retardation during the past three decades. These approaches include attention theory (Zeaman & House, 1963), short-term memory theory (Ellis, 1970), and the retrieval and recalling theory (Spitz, 1973). All three contain attributes of information processing theory and deal with skill learning and performance.

Zeaman and House (1963) tested visual discrimination tasks by using the Wisconsin General Test Apparatus for examining the attention processes of individuals with MR. Results indicated that individuals with MR exhibit lower ability to make the correct choice in discriminating the stimuli (color, form, size). They also noted that individuals with MR had longer initial discrimination learning stages than individuals without MR. Zeaman and House called this stage an attention phase "in which the subject randomly attends to the various dimensions of the stimulus" (p. 95). According to this finding, Zeaman and House suggested that learning deficiency of individuals with MR may result in a function of attention, not instrumental learning. They further claimed that "the difference between fast and slow learning was not the actual rate of improvement (correct responding) but the amount of time (number of trials needed)" (p. 97). In other words, individuals with MR can select the correct response but need more trials (practice) to accomplish the task. Zeaman and House's (1963) attention theory is a major contribution
in understanding the attention processes of individuals with MR on discrimination tasks (Mercer & Snell, 1977).

Both of these scientists have been persistent in their continuing research and empirical findings have led to revisions and refinements in their original theory. Fisher and Zeaman (1973) proposed the attention-retention theory to explain certain phenomenon (influence of feedback, retention loss, and redundancy of relevant dimensions) and enhance our knowledge in this area. The attention-retention theory focuses more directly on retention processes than on attention processes. In examining the attention-retention theory, numerous studies have been conducted from several aspects including studies on the number of dimensions, on incentive conditions, on transfer operations, and on oddity learning (Evans & Beedle, 1970; Clinton & Evans, 1972). The findings of these studies have all supported either Zeaman’s attention theory or Fisher and Zeaman’s attention-retention theory. Individuals with MR perform poorly compared to individuals without MR because they require more time to begin to discriminate the task correctly, (Ullman & Routh, 1971), produce more (Evans, 1968), exhibit short-term memory problems in terms of transfer operations (Lobb & Stogdill, 1974), and require more trials to reach criteria on the complex form tasks. However, while all researchers detected that individuals with MR have attention problems but they can be improved by teaching them appropriate learning strategies. Researchers have suggested enhancing learning by individuals with MR by reducing the number of irrelevant dimensions on a learning task (Clinton & Evans, 1972; Gruen & Berg, 1973), providing reinforcement for attention to a relevant dimension (Fisher & Zeaman, 1973),

Ellis (1970) proposed a Multiprocess Memory model and conducted a number of studies to support his theory. In the multiprocess memory model information is taken in by the learner through the attention process. This information goes immediately to the primary memory (a limited storage system). The learner recalls (rehearsal) the information and then transfers it to tertiary memory (the long-term memory). Findings from his studies showed that individuals with MR were not deficient in the processes of primary and tertiary memories, but that they failed to use active rehearsal strategies spontaneously. Ellis suggested that training an individual with MR to use rehearsal strategies may help this individual transfer information into tertiary memory with less information will be lost and more remembered.

Spitz (1973) had a slightly different view than Ellis relative to the memory processes of persons with MR. Spitz noted that individuals with MR can store most information, but that they exhibit a deficit in the ability to retrieve and transfer this information (Spitz, Goettler, & Webreck, 1972; Spitz & Webreck, 1972). The majority of individuals with mild MR have sufficient fundamental information processing capability in that they will respond similarly to any particular set of tactics. The use of deficient tactics results from the use of deficient strategies (Belmont & Mitchell, 1987). The question is why individuals with MR utilize deficient strategies. Torgesen and his colleagues have conducted several studies (Torgesen, 1977; Torgesen, 1979; Torgesen, 1980; Torgesen & Houck, 1980; Torgesen & Licht 1982) in the area of children's cognitive behaviors.
relative to learning strategies. Studies showed that when an appropriate strategy is taught, the person with MR used it quite well for its specific purpose. They did not however, easily maintain and transfer the strategy to a new task without additional training (Kurtz & Borkowski, 1984). It was therefore, they suggested that children with MR demonstrate poor performance, in part, due to inefficient use of strategies. Whereas, children without MR are able to use the learned strategy continuously and able to transfer it to new tasks. Furthermore, since individuals with MR exhibit significantly less efficiency in motor learning and performance, they oftentimes experience failure. This failure experience enhances the lack of self-confidence, self-esteem, and social interaction with others. It therefore behooves professionals to utilize the teaching of strategies that will maximize skill learning and performance for individuals with MR.

**Strategic Learning and Performance of Skills**

**for Individuals with Mental Retardation**

Miller, Galanter, and Pribram (1960) proposed the Strategy-deficiency Hypothesis that suggests that task performance will be zero unless an appropriate strategy is executed. This hypothesis gained acceptance as a favored explanation for problems that children have in memory, reading, and learning (Belmont & Mitchell, 1987). It purports that performance will increase to the maximum extent possible for a task when an optimum strategy is properly executed. A proper strategy is the one that guides the construction of an effective sequence of tactics. Several researchers have conducted studies to test this hypothesis in order to obtain a satisfactory understanding of why individuals with MR are strategy-deficient (Turnure, Buium, and Thurlow, 1976; Kestner
& Borkowski, 1979; Glidden, Bilsky, Mar, Judd, & Warner, 1983; Turner & Bray, 1985). Two closely related studies are Kestner and Borkowski’s (1979) post-instruction ratings of verbal elaborations generated by children with and without MR, and Glidden, Bilsky, Mar, Judd, and Warner’s (1983) post-instruction ratings of stories generated by retarded adolescents for free recall. As the result of instruction, subjects with MR showed substantial performance increases, suggesting that they were not previously using appropriate strategies. On the other hand, “normal” subjects also showed performance increases, suggesting that they were tactically deficient. It is at this point that one might doubt the strategy-deficiency explanation of differences in performance between two groups. Indeed, if this was the only evidence available concerning the strategy/performance relationship, one might easily conclude that strategies utilized in instructional studies have little to do with performance differences in individuals with and without MR under non-instructional (free-strategy) conditions. However, free-strategy studies in which strategies are actually measured, have shown systematic strategy/performance correlations both within and between the individuals with and without MR (Belmont, Ferretti, & Mitchell, 1982). Therefore, individuals with MR do exhibit strategy deficiencies. Nevertheless, studies have shown that when an appropriate strategy is trained, individuals with MR may use it quite well for the original task. The problem is that individuals with MR are unable to generalize the strategy to other tasks without additional training (Stokes, Fowler, & Baer, 1978). Moreover, these individuals fail to use the trained strategy after the original task reappears later. The failure of maintenance and transfer of strategies may not be due to the fundamental process, but
rather found in the higher order processes. These higher order processes are termed as metastrategic processes (Belmont & Mitchell, 1987). Metastrategic learning refers to teach students how to think in order to improve their skill performance. This concept is similar to the term “cognitive strategy” used by other researchers (e.g., Kurtz & Borkowski, 1984, Pressley, Scruggs, & Mastropieri, 1989). Furthermore, maybe the better term to use is learning strategy instead of metastrategy, or cognitive strategy, to ultimately when looking at how individuals with MR learn best (Campione & Brown, 1977).

Strategies and Motor Skill Learning

As indicated earlier, Singer’s five-step strategy comprises five sequential substrategies, including readying, imaging, focusing, executing, and evaluating. Some of these substrategies have been investigated separately with individuals who have mental retardation (MR). For example, Surburg (1991) investigated the use of imagery practice to facilitate reaction and movement times in individuals with MR. Thirty-two subjects with mild mental retardation and 32 subjects without MR participated in the study. The task of this study was to perform a response-type task by using an apparatus which consists of a visual stimulus (signal light), a telegraph key, and an incandescent light served as a fixation point. Subjects were divided into four experimental groups (no catch trials, 30% catch trials, 30% catch trials with imagery practice, and no catch trials with imagery practice) for both the subjects with MR and without MR. All subjects participated in an orientation session. During the orientation session subjects were instructed to depress the telegraph with the index finger after the illumination of the
signal light. The key was held in the depression position until the middle neon light was activated, and then rapidly released upon stimulus recognition. The two “no catch” trial groups were given 10 practice trials during the orientation session. In addition to the orientation, the 30% “catch trial” groups received instruction about the “catch trial” involvement. The imagery practice groups were instructed to close their eyes and rehearse the task. Following these rehearsals subjects opened their eyes, depressed the telegraph key and waited for the stimulus. The 30% “catch” trials with imagery practice groups utilized the same procedure with the imagery group except they had 30% of catch trial practice prior to the rehearsal. Results indicated that imagery groups were significantly faster in reaction time (RT) performance than the 30% catch trial groups. The imagery practice groups exposed to catch trials benefited from this type of practice in terms of the movement time (faster). Moreover, imagery practice was effective with subjects with and without MR.

Surburg, Porretta, and Sutlive (1995) used an imagery strategy for individuals with mild mental retardation in the performance of a throwing task. Forty adolescents with mild mental retardation participated in this study and were randomly assigned to the following four groups: low cognitive loading-physical practice, low cognitive loading-imagery and physical practice, high cognitive loading-physical practice, and high cognitive loading-imagery and physical practice. All subjects were attended one orientation session and practiced ten underhand throws with the nonpreferred hand prior to the seven experimental sessions. In addition to the orientation, the imagery groups were taught to use imagery practice by closing their eyes and mentally executing the
throwing task. To ensure that subjects were attempting imagery practice, the experimenter queried the subjects as to what they had done during the imagery period. During the experimental sessions all subjects performed the underhand throw task associated with a baseball game situation (throw to first, second, or third base). Results indicated that all groups exhibited significant improvement over the experimental period and that the imagery practice groups were superior in performance to nonimagery groups. Moreover, alternating physical practice and imagery was found to be the most effective method for persons with MR. However, the two types of cognitive demands (low and high cognitive) did not affect imagery practice in any different ways. Therefore, the use of imagery techniques with individuals possessing MR was found to enhance task performance.

Owlia, French, Ben-Zra, and Silliman (1995) investigated the influence of audio and audiovisual reinforcers on the time-on-task performances of individuals with profound mental retardation (PMR) when riding a stationary motorized bicycle ergometer. Five adolescents with PMR participated in this study. The study consisted of intervention (use of audio and audiovisual reinforcers), generalization, and follow-up phases. Results showed that four of five subjects increased their time-on-task performance when an audio or audiovisual reinforcer was introduced. During the follow-up phase, time-on-task performances of the subjects were similar with the intervention phase. The authors noted that the similarity in performance could be due to two factors: 1) the selected reinforcers had a controlling effect on the performance level of these subjects, and 2) the experimental period may have not been long enough to permanently alter the
performance level of these subjects. The researchers also found that time-on-task performance of subjects was increased during the generalization phase (using the nonmotorized bicycle ergometer). This may due to the experience of paddling skills used during the experimental period.

Deener and Horvat (1995) investigated the effects of using a reinforcer only or using a reinforcer with self-recording on the run/walk distances for adolescents with moderate MR. Thirteen subjects were divided into two groups (A and B). Subjects in group A were given verbal encouragement and praise during the run/walk task while subjects in group B were taught to self-record their performance in addition to receiving praise after the run/walk task. Results indicated that both groups increased their run/walk distance but that the praise plus self-recording group (group B) increased its distance to a greater extent than the praise only group (group A). The improvement observed in this study is encouraging. The effect of a self-recording strategy applied to the motor task has applicability to individuals with MR.

Recently, Yang (1994) conducted a pilot study by using a preshot routine on the basketball free-throw shooting performance with Special Olympics basketball players. Four subjects with mild to moderate mental retardation participated in this study. A multiple baseline across subjects design was utilized. During the baseline, subjects performed twenty free throws without any pre-shot routine. Once steady state free throw shooting accuracy for each subject was obtained, a pre-shot routine was introduced and practiced during the intervention phase. The pre-shot routine consists of following instructions: 1) bounce the ball three times. 2) hold the ball in a comfortable position. 3)
look at the front of the rim, and, 4) shoot the ball. Subjects practiced the routine and shot
free throws on an individual basis with only the experimenter present. Subjects
performed twenty free throws per session for a total of 12-17 sessions. Results indicated
that four subjects exhibited increases in free throw shooting accuracy of 7%, 18%, 15%,
and 10%, respectively. These preliminary findings demonstrated that a pre-shot routine
may be beneficial for improving the free-throw shooting accuracy of players with MR in
a practice situation.

Summary

Zeaman and House (1963) have noted that learning deficiencies in individuals with
MR may result from a deficiency in attention span. Spitz (1973), on the other hand, noted
that individuals with MR can store most information, but are unable to retrieve it.
According to Spitz, the majority of individuals with mild MR however have sufficient
fundamental information processing ability and any comparative performance
deficiencies result from differences among their tactics. Poor performance by individuals
with MR may be due to inefficient use of strategies because when trained in an
appropriate strategy, individuals with MR were found to use it quite effectively for its
specific purpose (Torgesen and Houck, 1980). Although numerous studies have been
conducted (e.g., Glidden et al, 1983; Reid, 1980; Suburg, 1991; Surburg, Porretta,
Sutlive, 1995; Owlia et al., 1995; Deener & Horvat, 1995; Yang, 1994), studies
conducted in a natural setting remain lacking. Furthermore, few studies have been
conducted on how strategy learning can be generalized by individuals with MR. The
majority of strategy learning investigations suggest that individuals with mental
retardation can learn to use strategies for improving motor performance but many strategies are unique for situations associated with specific task learning. It is apparent that further investigations are needed to determine alternative strategies for classes of tasks (e.g., closed or open skills). With this consideration, this study considered the effectiveness of a four-step (ready, look, do, and score) strategy in improving the performance (accuracy) of three gross motor skills during the training, maintenance, and generalization phases. Related research questions addressed the following factors: type of skills, student disability type, gender, and social acceptance.
CHAPTER III

PROCEDURES

This chapter describes the procedures used to investigate the effects of a four-step learning strategy on the acquisition, maintenance, and generalization of three closed gross motor skills (basketball free-throw shooting, overhand softball throw, and dart throw) by adolescents with mild mental retardation (MR). It is composed of the following sections: subject selection, description of the independent variable, description of the dependent variables, interobserver reliability, treatment integrity and procedural reliability, methodology, research design, data collection, data analysis, and social validity.

Subject Selection

Six high school students (three males and three females) with mild MR ranging in age from 16-18 years (average 17.2 years of age) served as subjects for this study. All subjects' intelligence quotient (IQ) scores were between 55-70, and subjects were receiving special educational services through Columbus Public City Schools. According to Columbus Public Schools, subjects exhibited deficits in adaptive behaviors. However, all subjects had no known physical or sensory impairments that would inhibit performance on any of the three motor skills (basketball free throw, overhand softball throw, and dart throw) used in this study. The research protocol was approved by the Behavioral and
Social Sciences Human Subjects Review Committee of the Ohio State University (see Appendix B). Permission to acquire written consent from subjects was obtained from Columbus Public City Schools (see Appendix C). Written consent forms were sent home to the parents or guardians of the six subjects (Appendix D). The consent form included an explanation of the proposed study and required a parent's or guardians' signature before the student was able to participate. All six consent forms were signed and returned.

**Description of Independent Variable**

The independent variable for this study was a four-step learning strategy training package. The four-step strategy consists of *ready, look, do, and score*. A training package was designed for the basketball free-throw, the overhand softball throw, and dart throw, included a training protocol (see Appendix E), a wall poster (see Appendix F), and a scoring system poster for acquiring each step. Subjects utilized the four-step strategy during the training, maintenance, and generalization phases across each of the three gross motor skills.

**Description of the Dependent Variables**

The performance accuracy (number of points earned) of three gross motor skills served as the dependent variables in this study. These skills were the basketball free throw, the overhand softball throw, and the dart throw. During each session the subject had ten trials for each skill and a five-point scoring system (see Appendix G) with a maximum point possibility of 50 for each skill per session. Therefore, the number of
points earned for the basketball free throw, overhand softball throw, and dart throw served as the first, second, and third dependent measure, respectively. Data were collected during the baseline, acquisition, maintenance, and generalization phases.

**Interobserver Reliability**

A master student of teacher education was trained as the second observer to collect data on three variables, the accuracy of basketball free throws, overhand softball throws, and dart throws. The primary observer discussed the criteria of data collection with the second observer and showed him the data sheet. The second observer then went to the experimental for a practice session on how to use the data sheet and symbols recording the data. The primary and the secondary observers discussed concerns arising from the practice session. Data were not taken until the second observer reached competency with recording.

The second observer simultaneously but independently collected data on the site. To ensure that the observers were observing at the same time during the experimental trial, the primary observer signaled the second observer to begin recording. Interval-by-interval agreement between the primary and secondary observer were calculated by using the formula:

\[
\frac{\text{Agreement}}{\text{Agreement} + \text{Disagreement}} \times 100 = \% \text{ Agreement}
\]
Treatment Integrity and Procedural Reliability

The degree to which an independent variable is implemented as planned has come to be known as treatment integrity (Cooper, Heron, & Heward, 1987). Treatment integrity for this study was conducted by using a procedural integrity checklist (see Appendix H) to ensure that procedure for implement the independent variable was accurately and consistently presented. By utilizing the same observers who followed a checklist with all treatment components, procedural reliability was ensured. Observer training was conducted through watching a videotaped session with both experimenter and observer present. The experimenter clarified the procedures of the study to the observers and answered questions. This training took about two hours. All treatment integrity and procedural reliability were accomplished through the use of videotaped sessions.

Methodology

General Procedures

In accordance with the physical education curriculum of Columbus Public City Schools, throwing and shooting skills are taught during the school year. The three skills used in this study were basketball free throws, overhand softball throws, and dart throws. All three skills incorporate some form of throwing and shooting. Except for dart throw, all subjects in this study had an opportunity to performed basketball free throw and the overhand softball throw in physical education classes. Subjects performed three gross motor skills on a one-to-one basis. During the baseline, acquisition, and maintenance phases, three subjects came together as a group to the experimental site, however, only one subject would perform at a time, while the others observed. Although this group
situation may have confounded the results, this was the best environmental situation the school could offer. Small groups are common for conducting research in natural setting. The order of skills was performed randomly to control for potential sequence effects. A schedule chart was provided for each session throughout the entire study (see Appendix I).

**Equipment**

A standard basketball foul line, a basketball rim with backboard, and the regulation basketball were used for the free-throw shooting. An archery target (10 concentric circles) was placed on a target stand for the overhand softball throws (see Appendix J). The bottom portion of the target was one foot off the floor. A line was taped on the floor 10-meter away from the target. Each subject stood behind the line and faced target when he or she performed the throw. A smaller archery target (5 concentric circles) was drawn on a cork and placed on a two-chair stacked stand for dart throws (see Appendix K). A line was taped on the floor 5-meter away from the target. Each subject stood behind the line when he or she performed the throw.

**Experimental Design**

A multiple baseline across skills design (Cooper, Heron, & Heward, 1987) was used for this study. In this type of design, a single behavior of an individual is targeted for two or more different skills. The three skills in this study were basketball free throws, overhand softball throws, and dart throws.
**Baseline Phase**

During the baseline sessions, the experimenter set up the basketball free throw, overhand softball throw, and dart throw stations in the weight room. Subjects were assigned to either first or second period depending upon their class schedule. When the subjects walked into the weight room, the experimenter said: “You are going to perform the basketball free throws, softball overhand throws, and dart throws. Try to do your best for each skill for all 10 trials.”

The procedure for the basketball free throw was for the subject to stand behind the regulation foul line and try to make a basket. The procedure for overhand softball throws was for the subject to stand behind a line which was 10-meter from the target and throw the ball at the target. The procedure for dart throws was for the subject to stand behind a line which was 5-meter from the target and throw the dart at the target.

After steady state responding had been established for a skill under baseline conditions, the four-step strategy training package was applied to each subject for that particular skill. The other two skills remained in the baseline condition. However, whether the training package was applied or not depended upon the subject’s response during the baseline. In other words, the beginning of training was contingent on establishing a steady state baseline. This differed among the subjects.

**Training Phase**

The investigator conducted training sessions on a one-on-one basis to allow subjects to better understand and acquire the four-step strategy procedure. There was a poster (see Appendix A) on the wall that included all four steps in sequence. There was
also a scoring poster (see Appendix G) on the wall that identified indicated the five-point scale for basketball free throws, softball overhand throws, and dart throws, respectively. At the first training session, the experimenter stated the purpose of the study and communicated to the subjects what was required of them. Then the experimenter demonstrated all four steps for each skill. After the demonstrations the experimenter asked subjects to imitate the demonstration (see the Appendix E - training protocol for detail). There were no changes from baseline for all three skills in terms of distance, target size, and number of trials of each session.

After the subjects were able to perform the four-step strategy on each trial of the skill for two consecutive sessions, the maintenance session began.

**Maintenance Phase**

Maintenance was defined as the extent to which the learner continued to perform the target behavior after a portion or all of the intervention was terminated (Cooper, et al, 1987). Within the present study, maintenance sessions were included to determine the degree to which participants could maintain performance following the end of training sessions. At the beginning of maintenance sessions, the four-step strategy and scoring posters remained on a wall and the experimenter queried subjects as to what was being learned. The experimenter said: “Do you remember what you have learned?” If the subject said “Yes,” the experimenter would say: “Now, perform the skill by using the strategy you have learned.” When the performance level of each subject was maintained or increased, the experimenter took the posters down and no reminders were given. The experimenter told the subject the sequence of skills which would be performed that day.
Then the subject went to the station and performed 10 trials for each skill without either visual or verbal reminders. When the reminders were removed, the performance level of each subject decreased. The experimenter provided a soft drink as a reinforcer to a subject when the subject did follow the four steps and provide score for each trial. The type of reinforcer was identified through indirect teacher questioning. Subjects were told to concentrate on using the strategy and then they would be given a soft drink.

**Generalization Phase**

Johnston and Penneypacker (1993) indicate that the goal of applied behavioral research is to develop techniques that will be effective in changing behavior under various conditions (i.e., across subjects, settings, people, behaviors, and time). Therefore, extending findings beyond maintenance is important. In this study, generalization sessions began after the last session of maintenance. The generalization phase was conducted in the gymnasium of the school. Subjects performed 10 trials for each of the three gross motor skills (basketball free throw, overhand softball throw, and dart throw) each session. There were total four to eight sessions for each subject during the generalization phase.

**Social Validity**

Preferences and opinions regarding the importance of the four-step strategy learning to students with mild MR (these students identified as developmental handicaps (DH) in Ohio) were obtained from the parents of the four subjects and from three teachers by answering a Likert-rated questionnaire at the end of the study. Their opinions on the importance of the three gross motor skills relative to participating in community
recreation programs were also included in the questionnaire. See Appendix L the questionnaire used.

**Data Collection**

Data were collected either on the site or through the use of videotape. The experimenter was also the primary investigator and recorded data during baseline, training, maintenance, and generalization phases. A camcorder was used for data collection and interobserver reliability purposes. Data collection sheets for each of the three skills were used (see Appendix L).

**Data Analysis**

Data was analyzed using visual inspection of graphs. Individual graphics were utilized for each of the three primary dependent variables (accuracy) across the three skills of basketball free-throw shooting, overhand softball throwing, and dart throwing. Data analysis also consisted of a trend analysis of data paths. According to Johnston and Penneypacker (1993), a trend is a relatively consistent change in the data set and path in a particular direction. As a result, the researcher was able to visually inspect the trend for each skill.
CHAPTER 4
RESULTS

This chapter presents the results of the effects a four-step (ready, look, do, and score) strategy on subjects’ performance of three gross motor skills: basketball free throw, overhand softball throw, and dart throw during baseline, training, maintenance, and generalization phases. The chapter is composed of the following main sections. The first section addresses reliability results while the second section addresses procedural integrity results. Sections three through eight provide data of the three gross motor skills on each of six subjects. The ninth section provides summary data for all six subjects across all three gross motor skills while the tenth section provides summary data by gender. The last section provides data on the social validity of the study.

Interobserver Agreement

Table 1 contains the interobserver reliability percentage for accuracy of three gross motor skills (basketball free throw, softball throw, and dart throw) across all six subjects. Session-by-session interobserver agreement data of basketball free throw accuracy were taken from 16 sessions (one baseline session, two training sessions, 11 maintenance sessions, and two generalization sessions) that were randomly selected for subjects 3, 4, and 5 (35% of total sessions), and 14 sessions (one baseline session, two training
Table 1: Interobserver agreement (percent agreement) for the basketball free throw, softball throw, and dart throw accuracy across subjects.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Free Throw</th>
<th>Softball Throw</th>
<th>Dart Throw</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (male)</td>
<td>100</td>
<td>99.6</td>
<td>100</td>
</tr>
<tr>
<td>2 (male)</td>
<td>99.7</td>
<td>99.9</td>
<td>100</td>
</tr>
<tr>
<td>3 (male)</td>
<td>99.9</td>
<td>100</td>
<td>99.8</td>
</tr>
<tr>
<td>4 (female)</td>
<td>99.8</td>
<td>100</td>
<td>99.9</td>
</tr>
<tr>
<td>5 (female)</td>
<td>99.3</td>
<td>100</td>
<td>99.6</td>
</tr>
<tr>
<td>6 (female)</td>
<td>100</td>
<td>99.3</td>
<td>100</td>
</tr>
<tr>
<td>Mean</td>
<td>99.8</td>
<td>99.8</td>
<td>99.9</td>
</tr>
</tbody>
</table>

sessions, nine maintenance sessions, and two generalization sessions) for subjects 1, 2, and 6 (33% of total sessions). Session-by-session interobserver agreement data of softball throw and dart throw accuracy were taken from 18 sessions (one baseline session, two training sessions, 13 maintenance sessions, and two generalization sessions) that were randomly selected for subjects 3, 4, and 5 (38% of total sessions), and 16 sessions (one baseline session, two training sessions, 11 maintenance sessions, and two generalization sessions) for subjects 1, 2, and 6 (35% of total sessions).

The mean interobserver agreement for the basketball free throw accuracy was 99.9% across the six subjects (range of 99.3%-100%). The mean interobserver agreement for softball throw accuracy was 99.8% (range of 99.3%-100%). The mean interobserver agreement for dart throw accuracy was 99.9% across the six subjects (range of 99.6%-100%).
Procedural Integrity

Procedural integrity for this study was established with the use of a Procedural Integrity Checklist consisting of 12 questions (see Appendix H). For each subject, procedural integrity data were obtained from six sessions (two training sessions, three maintenance sessions, and one generalization session).

A master’s level student obtained the procedure integrity data by watching the randomly selected videotape sessions. Table 2 shows that overall procedural integrity was 100% for Subject 1, 93% for Subject 2, 100% for Subject 3, and 93% for Subjects 4, 5, and 6. Across all subjects, procedural integrity was calculated at 95%.

Procedural integrity scores were lower during the training sessions than expected because subjects 1, 2 and 4 came into the experimental setting at the same time (as a group). Subjects 2 and 4 observed the experimenter’s demonstration of the four-step procedure to subject 1. Because subjects 2 and 4 already observed a demonstration they did not need the experimenter to demonstrate the procedure again. Therefore, the videotape did not show the demonstration for all three subjects. The same situation happened to subjects 3, 5, and 6. The experimenter demonstrated the four-step strategy to subject 3, and subjects 5 and 6 observed. However, overall procedure integrity showed 95% agreement.
Table 2: Procedural integrity by session (the values represent the percent of number of correct answers) across all six subjects during two training, three maintenance, and one generalization session.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Training Session</th>
<th>Training Session</th>
<th>Maintenance Session</th>
<th>Maintenance Session</th>
<th>Maintenance Session</th>
<th>Generalization Session</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
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<td>100</td>
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<tr>
<td>2</td>
<td>80</td>
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<td>6</td>
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<td>100</td>
<td>100</td>
<td>100</td>
<td>100</td>
<td>93</td>
</tr>
<tr>
<td>Grand Mean</td>
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Subject 1

Figure 1 shows that Subject 1 participated in 53 sessions for the basketball free throw, 49 sessions for the overhand softball throw, and 49 sessions for the dart throw. The performance accuracy of these three gross motor skills was compared during the baseline, training, maintenance, and generalization phases. This section presents data Subject 1 on each of three gross motor skills. Data are then summarized.

**Basketball Free Throw Accuracy**

Figure 1 shows that Subject 1 averaged 29.4 points per session (range of 25 -33 points) during baseline. During training, Subject 1 averaged 33.9 points per session which illustrates a 15% increase in performance from baseline (range of 29 -37 points). During maintenance, Subject 1 averaged 31.7 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal (“look at the poster and follow the four steps for each trial”) reminders were used (range of 29 -33 points), 26.3 points per session when no reminders (neither visual nor verbal) were used (range of 24-30 points), and 30.8 points per session when the reinforcer (soft drink) was used (range of 26-36 points). Respectively, these scores reflect a 6%, 22% and 9% decrease in performance when compared to training. During generalization, Subject 1 averaged 30.8 points per session which resulted in a 9% decrease when compared to training (range of 27-34 points).

**Overhand Softball Throw Accuracy**

Figure 1 shows that Subject 1 averaged 15.8 points per session (range of 12-20 points) during baseline. During training, Subject 1 averaged 25.5 points per session
Subject 1

Figure 1: Subject 1's performance during baseline, training (TR), maintenance, and generalization phases. Dashed horizontal lines show mean performance during each phase.
which shows a 63% increase in performance from baseline (range of 22-29 points).

During maintenance, Subject 1 averaged 16.8 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 8-22 points), 17.2 points per session when no reminders (neither visual nor verbal) were used (range of 10-22 points), and 18.1 points per session when the reinforcer (soft drink) was used (range of 13-24 points). Respectively, these scores reflected a 34%, 32% and 29% decrease when compared to training. During generalization, Subject 1 averaged 21 points per session which resulted in an 18% decrease compared to training (range of 14-27 points).

**Dart Throw Accuracy**

Figure 1 shows that Subject 1 averaged 8 points per session (range of 3-13 points) during baseline. During training, Subject 1 averaged 17.3 points per session which illustrates more than a 100% increase in performance from baseline (range of 15-21 points). During maintenance, Subject 1 averaged 16.2 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 10-22 points), 18.3 points per session when no reminders (neither visual nor verbal) were used (range of 14-25 points), and 19.4 points per session when the reinforcer (soft drink) was used (range of 17-30 points). When compared to training, these scores reflect a 6% decrease when reminders were used, a 5% increase when no reminders were used, and an 11% increase when the reinforcer was used. During generalization, Subject 1 averaged
15.3 points per session which resulted in an 11% decrease compared to training (range of 11-19 points).

**Summary**

Table 3 shows performance of Subject 1 on all three gross motor skills during baseline, training, maintenance, and generalization phases. Training resulted in increase in performance across the basketball free throw, the softball throw, and dart throw when compared to baseline scores. These scores resulted in performance increases of 15%, 63%, and 100%, respectively. Data also show a decrease in performance in the reminders phase when compared to the training phase for all three skills. These scores resulted in percentage decreases of 6%, 34%, and 5%, respectively. Subject 1's performance decreased when no reminders and reinforcement (soft drink) were used for the basketball free throw (22% and 9% respectively); and for the softball throw (32% and 29%, respectively). However, performance increased in dart throw performance in both the no reminder (5%) and reinforcement (11%) phases when compared to the training phase. During generalization, Subject 1's performance of the softball throw increased 18% when compared to training. However, basketball free throw and dart throw performance resulted in decreases of 11% and 9%, respectively.

**Subject 2**

Figure 2 shows that Subject 2 participated in 54 sessions for the basketball free throw, 47 sessions for the overhand softball throw and 47 sessions for the dart throw. The performance accuracy of these three gross motor skills was compared during the baseline, training, maintenance, and generalization phases. This section presents data
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Table 3: Performance accuracy of subject 1 for the basketball free throw, softball throw, and dart throw (average and range) during baseline, training, maintenance, and generalization.
from Subject 2 on each of three gross motor skills. Data are then summarized

**Basketball Free Throw Accuracy**

Figure 2 shows that Subject 2 averaged 30 points per session (range of 24-37 points) during baseline. During training, Subject 2 averaged 34.7 points per session which illustrates a 16% increase in performance from baseline (range of 21-43 points). During maintenance, Subject 2 averaged 34.1 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 25-41 points), 34.3 points per session when no reminders (neither visual nor verbal) were used (range of 31-36 points), and 39.1 points per session when the reinforcer (soft drink) was used (range of 34-44 points). When compared to training, these scores reflect a 2% decrease in performance when reminders were used, a 1% decrease when no reminders were used, and a 14% increase when the reinforcer was provided. During generalization, Subject 2 averaged 34.1 points per session which resulted in a 1% decrease compared to training (range of 29-39 points).

**Overhand Softball Throw Accuracy**

Figure 2 shows that Subject 2 averaged 12.6 points per session (range of 6-16 points) during baseline. During training, Subject 2 averaged 17.2 points per session which shows a 37% increase in performance from baseline (range of 7-28 points). During maintenance, Subject 2 averaged 17.5 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 14-23 points),
Subject 2

Figure 2: Subject 2's performance during baseline, training (TR), maintenance, and generalization phases. Dashed horizontal lines show mean performance during each phase.
12.8 points per session when no reminders (neither visual nor verbal) were used (range of 10-21 points), and 20.5 points per session when the reinforcer (soft drink) was used (range of 16-26 points). When compared to training these scores reflect a 2% increase when reminders were used, a 26% decrease when no reminders were used, and a 19% increase when the reinforcer was provided. During generalization, Subject 2 averaged 19.2 points per session which resulted in a 12% increase compared to training (range of 14-29 points).

**Dart Throw Accuracy**

Figure 2 shows that Subject 2 averaged 10.5 points per session (range of 6-14 points) during baseline. During training, Subject 2 averaged 13.3 points per session which illustrates a 27% increase in performance from baseline (range of 8-17 points). During maintenance, Subject 2 averaged 14 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 8-21 points), 14.8 points per session when no reminders (neither visual nor verbal) were used (range of 8-22 points), and 17.2 points per session when the reinforcer (soft drink) was used (range of 15-20 points). Respectively, these scores reflect a 5%, 11%, and 29% increase in performance when compared to training. During generalization, Subject 2 averaged 18.3 points per session which resulted in a 38% increase compared to training (range of 13-22 points).
Table 4 shows performance of Subject 2 on all three gross motor skills during baseline, training, maintenance, and generalization phases. Training resulted in increases in performance across the basketball free throw, the softball throw, and dart throw when compared to baseline scores. These scores resulted in performance increases of 16%, 37%, and 27%, respectively. When compared to training, data also show a 1% decrease in performance in the reminder phase of basketball free throw, and 5% and 2% increases for both the softball throw and dart throw, respectively. There were decreases in both the basketball free throw (1%), and softball throw (26%) when no reminders were used. There were 14% (free throw) and 19% (softball throw) increases when the reinforcer (soft drink) was used when compared to training. However, performance increased in dart throw performance in all three phases (reminder, no reminder, and reinforcement) when compared to the training phase. These scores resulted in percentage increases of 5%, 11%, and 29%, respectively. During generalization, Subject 2's performance on both the softball throw and dart throw increased 12% and 38%, respectively. However, Subject 2's basketball free throw performance resulted in a 1% decrease when compared to training.

Subject 3

Figure 3 shows that Subject 3 participated in 50 sessions for the basketball free throw, 47 sessions for the overhand softball throw, and 51 sessions for the dart throw. The performance accuracy of these three gross motor skills was compared during baseline, training, maintenance, and generalization phases. This section presents data from Subject 47
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Table 4: Performance accuracy of subject 2 for the basketball free throw, softball throw, and dart throw (average and range) during baseline, training, maintenance, and generalization.
3 on each of three gross motor skills. Data are then summarized.

**Basketball Free Throw Accuracy**

Figure 3 shows that Subject 3 averaged 27.2 points per session (range of 14-35 points) during baseline. During training, Subject 3 averaged 31.5 points per session which indicates a 16% increase in performance from baseline (range of 25-36 points). During maintenance, Subject 3 averaged 34.5 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 31-40 points), 29.8 points per session when no reminders (neither visual nor verbal) were used (range of 22-35 points), and 32.2 points per session when the reinforcer (soft drink) was used (range of 27-37 points). When compared to training, these scores reflect a 9% increase when reminders were used, a 5% decrease when no reminders were used, and a 2% increase when the reinforcer was used. During generalization, Subject 3 averaged 33.2 points per session which resulted in a 5% increase compared to training (range of 29-40 points).

**Overhand Softball Throw Accuracy**

Figure 3 shows that Subject 3 averaged 18.5 points per session (range of 10-26 points) during baseline. During training, Subject 3 averaged 19.8 points per session which shows a 7% increase in performance from baseline (range of 14-27 points). During maintenance, Subject 3 averaged 26.3 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 17-37 points),
Subject 3

Figure 3: Subject 3's performance during baseline, training (TR), maintenance, and generalization phases. Dashed horizontal lines show mean performance during each phase.
20.3 points per session when no reminders (neither visual nor verbal) were used (range of 17-25 points), and 27 points per session when the reinforcer (soft drink) was used (range of 20-33 points). These scores reflect 32%, 3%, and 36% increases, respectively when compared to training. During generalization, Subject 3 averaged 24.8 points per session which resulted in a 25% increase compared to training (range of 12-29 points).

**Dart Throw Accuracy**

Figure 3 shows that Subject 3 averaged 14.6 points per session (range of 10-21 points) during baseline. During training, Subject 3 averaged 17.3 points per session which illustrates a 18% increase in performance from baseline (range of 12-27 points). During maintenance, Subject 3 averaged 18.3 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 12-30 points), 16.6 points per session when no reminders (neither visual nor verbal) were used (range of 11-25 points), and 19.2 points per session when the reinforcer (soft drink) was used (range of 14-25 points). When compared to training, these scores reflect a 5% increase when reminders were used, a 4% decrease when no reminders were used, and an 11% increase when the reinforcer was provided. During generalization, Subject 3 averaged 19.8 points per session which resulted in a 14% increase compared to training (range of 16-23 points).

**Summary**

Table 5 shows performance of Subject 3 on all three gross motor skills during baseline, training, maintenance, and generalization phases. Training resulted in increases
in performance across the basketball free throw, the softball throw, and dart throw when compared to baseline scores. These scores resulted in performance increases of 16%, 7%, and 18%, respectively. Data also show an increase in performance in the reminders phase when compared to the training phase for all three skills. These scores resulted in performance increases of 9%, 32%, and 5%, respectively. When compared to training, there were decreases in both the basketball free throw (5%) and dart throw (4%) when no reminders were used. However, a 3% increase was observed for the softball throw when compared to training. Performance increased in all three gross motor skills when reinforcement was provided, 2%, 36%, and 11%, respectively. During generalization, as compared to training, Subject 3's performance level increased 5% for the basketball free throw, 25% for the softball throw, and 14% for the dart throw.

Subject 4

Figure 4 shows that Subject 4 participated in 47 sessions for the basketball free throw, 45 sessions for the overhand softball throw, and 47 sessions for the dart throw. The performance accuracy of these three gross motor skills was compared during the baseline, training, maintenance, and generalization phases. This section presents data from Subject 4 on each of three gross motor skills. Data are then summarized.

Basketball Free Throw Accuracy

Figure 4 shows that Subject 4 averaged 31.6 points per session (range of 21-38 points) during baseline. During training, Subject 4 averaged 32.7 points per session which illustrates a 3% increase in performance from baseline (range of 25-41 points). During maintenance, Subject 4 averaged 33.3 points per session when visual
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Table 5: Performance accuracy of subject 3 for the basketball free throw, softball throw, and dart throw (average and range) during baseline, training, maintenance, and generalization.
Figure 4: Subject 4's performance during baseline, training (TR), maintenance, and generalization phases. Dashed horizontal lines show mean performance during each phase.
(a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 25-41 points), 35.8 points per session when no reminders (neither visual nor verbal) were used (range of 25-41 points), and 36.0 points per session when the reinforcer (soft drink) was used (range of 31-41 points). When compared to training, these scores reflect a 2%, 9%, and 10% increase in performance, respectively. During generalization, Subject 4 averaged 38 points per session which resulted in a 16% increase compared to training (range of 32-41 points).

**Overhand Softball Throw Accuracy**

Figure 4 shows that Subject 4 averaged 11.2 points per session (range of 6-15 points) during baseline. During training, Subject 4 averaged 18.8 points per session which illustrates a 68% increase in performance from baseline (range of 14-25 points). During maintenance, Subject 4 averaged 16.4 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 12-23 points), 16.8 points per session when no reminders (neither visual nor verbal) were used (range of 15-18 points), and 20 points per session when the reinforcer (soft drink) was used (range of 14-26 points). When compared to training, these scores reflect a 13% decrease in performance when reminders were provided, an 11% decrease when no reminders were used, and a 6% increase when the reinforcer was used. During generalization, Subject 4 averaged 19.3 points per session which resulted in a 3% increase compared to training (range of 15-26 points).
Dart Throw Accuracy

Figure 4 shows that Subject 4 averaged 12.9 points per session (range of 6-18 points) during baseline. During training, Subject 4 averaged 19.3 points per session which illustrates a 49% increase in performance from baseline (range of 14-25 points). During maintenance, Subject 4 averaged 20.2 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 13-25 points), 15.8 points per session when no reminders (neither visual nor verbal) were used (range of 13-19 points), and 22 points per session when the reinforcer (soft drink) was used (range of 18-24 points). When compared to training, these scores reflect a 5% increase when reminders were used, an 18% decrease when no reminders were used, and a 14% increase when the reinforcer was provided. During generalization, Subject 4 averaged 19.5 points per session which resulted in a 1% increase compared to training (range of 10-28 points).

Summary

Table 6 shows performance of Subject 4 on all three gross motor skills during baseline, training, maintenance, and generalization phases. Training resulted in increases in performance across the basketball free throw, the softball throw, and dart throw when compared to baseline scores. These scores resulted in performance increases of 4%, 68%, and 49%, respectively. Data also show an increase in performance in the reminder phases compared to the training phase for both the basketball free throw and dart throw (2% and 5% respectively). There were decreases in softball throw performance during both the
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Table 6: Performance accuracy of subject 4 for the basketball free throw, softball throw, and dart throw (average and range) during baseline, training, maintenance, and generalization.
reminders and no reminders phases (13% and 11% respectively). When no reminders were used, Subject 4's dart throw score decreased 18%. However, when compared to training, subject 4's performance increased in all three gross motor skills when compared to training (10%, 6%, and 14%, respectively). During generalization, Subject 4's performance increased 16%, 3%, and 1%, respectively for three gross motor skills when compared to training.

**Subject 5**

Figure 5 shows that Subject 5 participated in 45 sessions for the basketball free throw, 45 sessions for the overhand softball throw, and 43 sessions for the dart throw. The performance accuracy of these three gross motor skills was compared during the baseline, training, maintenance, and generalization phases. This section presents data from Subject 5 on each of three gross motor skills. Data are then summarized.

**Basketball Free Throw Accuracy**

Figure 5 shows that Subject 5 averaged 28 points per session (range of 26-32 points) during baseline. During training, Subject 5 averaged 37.7 points per session which illustrates a 35% increase in performance from baseline (range of 33-44 points). During maintenance, Subject 5 averaged 31.1 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal (“look at the poster and follow the four steps for each trial”) reminders were used (range of 25-37 points), 30.3 points per session when no reminders (neither visual nor verbal) were used (range of 26-35 points), and 33 points per session when the reinforcer (soft drink) was used (range of 32-37 points). When compared to training, these scores reflect a 18%, 20%, and 12%
Figure 5: Subject 5's performance during baseline, training (TR), maintenance, and generalization phases. Dashed horizontal lines show mean performance during each phase.
decreases, respectively. During generalization, Subject 5 averaged 33.4 points per session which resulted in an 11% decreases compared to training (range of 28-40 points).

**Overhand Softball Throw Accuracy**

Figure 5 shows that Subject 5 averaged 12.9 points per session (range of 10-17 points) during baseline. During training, Subject 5 averaged 14.3 points per session which illustrates an 11% increase in performance from baseline (range of 8-21 points). During maintenance, Subject 5 averaged 18 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal (“look at the poster and follow the four steps for each trial”) reminders were used (range of 8-33 points), 14.5 points per session when no reminders (neither visual nor verbal) were used (range of 12-21 points), and 21.3 points per session when the reinforcer (soft drink) was used (range of 12-32 points). When compared to training, these scores reflect a 26%, 1%, and 49% increase in performance, respectively. During generalization, Subject 5 averaged 16.5 points per session which resulted in a 15% increase compared to training (range of 9-26 points).

**Dart Throw Accuracy**

Figure 5 shows that Subject 5 averaged 7.4 points per session (range of 3-14 points) during baseline. During training, Subject 5 averaged 14 points per session which illustrates a 89% increase in performance from baseline (range of 9-17 points). During maintenance, Subject 5 averaged 15 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal (“look at the poster and follow the four steps for each trial”) reminders were used (range of 10-25 points),
14.4 points per session when no reminders (neither visual nor verbal) were used (range of 10-21 points), and 17.5 points per session when the reinforcer (soft drink) was used (range of 14-22 points). When compared to training, these scores reflect a 7%, 2%, and 25% increase in performance, respectively. During generalization, Subject 5 averaged 13.8 points per session which resulted in a 1% decrease compared to training (range of 9-22 points).

**Summary**

Table 7 shows performance of Subject 5 on all three gross motor skills during baseline, training, maintenance, and generalization phases. Training resulted in performance increase across the basketball free throw, the softball throw, and dart throw when compared to baseline scores. These scores resulted in performance increases of 35%, 11%, and 89%, respectively. When compared to the training phase, data also revealed an increase in performance relative to all three maintenance phases (reminder - 26%, no reminder - 1%, and reinforcement - 49%) for the softball throw, and 7%, 2%, and 25% respectively for the dart throw. However, there were decreases in basketball free throw performance for all three maintenance phases (reminders - 18%, no reminders - 20%, and reinforcement - 12%). During generalization, Subject 5's performance decreased 11% for the basketball free throw, 1% for the dart throw when compared to training. However, a 15% increase was observed for the softball throw.
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Table 7: Performance accuracy of subject 5 for the basketball free throw, softball throw, and dart throw (average and range) during baseline, training, maintenance, and generalization.
Subject 6

Figure 6 shows that Subject 6 participated in 42 sessions for the basketball free throw, 42 sessions for the overhand softball throw, and 43 sessions for the dart throw. The performance accuracy of these three gross motor skills was compared during the baseline, training, maintenance, and generalization phases. This section presents data from Subject 5 on each of three gross motor skills. Data are then summarized.

Basketball Free Throw Accuracy

Figure 6 shows that Subject 6 averaged 29.6 points per session (range of 28-33 points) during baseline. During training, Subject 6 averaged 37.3 points per session which resulted in a 26% increase in performance from baseline (range of 32-40 points). During maintenance, Subject 6 averaged 33.6 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 28-36 points), 34.5 points per session when no reminders (neither visual nor verbal) were used (range of 28-38 points), and 33.4 points per session when the reinforcer (soft drink) was used (range of 29-41 points). When compared to training, these scores reflect a 9%, 7%, and 10% decrease in performance, respectively. During generalization, Subject 6 averaged 34.4 points per session which resulted in a 7% decrease compared to training (range of 30-39 points).

Overhand Softball Throw Accuracy

Figure 6 shows that Subject 6 averaged 12.3 points per session (range of 6-19 points) during baseline. During training, Subject 6 averaged 17.4 points per session which
Subject 6

Figure 6: Subject 6's performance during baseline, training (TR), maintenance, and generalization phases. Dashed horizontal lines show mean performance during each phase.
illustrates a 41% increase in performance from baseline (range of 13-26 points). During maintenance, Subject 6 averaged 17.8 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 14-24 points), 17 points per session when no reminders (neither visual nor verbal) were used (range of 12-22 points), and 18.3 points per session when the reinforcer (soft drink) was used (range of 12-22 points). When compared to training, these scores reflect a 2% increase when reminders were used, a 2% decrease when no reminders were used, and a 5% increase when the reinforcer was provided. During generalization, Subject 6 averaged 16.8 points per session which resulted in a 3% decrease compared to training (range of 11-19 points).

**Dart Throw Accuracy**

Figure 6 shows that Subject 6 averaged 7.4 points per session (range of 1-14 points) during baseline. During training, Subject 6 averaged 13.3 points per session which illustrates a 79% increase in performance from baseline (range of 9-21 points). During maintenance, Subject 6 averaged 12.7 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 10-15 points), 10.4 points per session when no reminders (neither visual nor verbal) were used (range of 6-14 points), and 12.8 points per session when the reinforcer (soft drink) was used (range of 8-17 points). When compared to training, these scores reflect a 4%, 21%, and 4% decrease in performance, respectively. During generalization, Subject 6 averaged 13.3 points per session which resulted in no change when compared to training (range of 8-19
Table 8 shows the performance of Subject 6 on all three gross motor skills during baseline, training, maintenance, and generalization phases. Training resulted in increases in performance across the basketball free throw, the softball throw, and dart throw when compared to baseline scores. These scores resulted in performance increases of 26%, 41%, and 79%, respectively. When compared to training, data also revealed a decrease in performance relative to all three maintenance phases (reminders - 9%, no reminders - 7%, and reinforcement - 10%) for the basketball free throw and for the dart throw (4%, 21%, and 4%, respectively). However, there were increases in softball throw performance during both the reminders (2%) and the reinforcement (5%) phases, and a 2% decrease was observed when no reminders were provided. During generalization, Subject 6 decreased the performance level in both the basketball free throw (7%) and the softball throw (3%) when compared to training. For the dart throw, there was no change in performance when compared to training.

Summary Performance Across the Three Gross Motor Skills for all Six Subjects

Basketball Free Throw Accuracy

Table 9 shows the basketball free throw performance of all subjects during baseline, training, maintenance, and generalization phases. During baseline, subjects averaged 29.3 points per session (range of 14-38 points). During training, subjects averaged 34.6 points per session which resulted in a 18% increase in performance from baseline (range of 21-44 points). During maintenance, subjects averaged 33.1 points per session when
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Table 8: Performance accuracy of subject 6 for the basketball free throw, softball throw, and dart throw (average and range) during baseline, training, maintenance, and generalization.
Table 9: Performance accuracy for the basketball free throw (average and range) for all subjects during baseline, training, maintenance, and generalization.

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Table 9: Performance accuracy for the basketball free throw (average and range) for all subjects during baseline, training, maintenance, and generalization.
visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 25-41 points), 31.8 points per session when no reminders (neither visual nor verbal) were used (range of 22-41 points), and 34.1 points per session when the reinforcer (soft drink) was used (range of 26-44 points). When compared to training, these scores reflect a 4%, 8%, and 1% decrease in performance. During generalization, subjects averaged 34 points per session which resulted in less than a 2% decrease in performance when compared to training (range of 27-41 points).

**Overhand Softball Throw Accuracy**

Table 10 shows the overhand softball throw performance of all subjects during baseline, training, maintenance, and generalization phases. During baseline, subjects averaged 13.8 points per session (range of 6-26 points). During training, subjects averaged 18.8 points per session which illustrates a 36% increase in performance from baseline (range of 7-29 points). During maintenance, subjects averaged 18.8 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 8-37 points), 16.4 points per session when no reminders (neither visual nor verbal) were used (range of 10-25 points), and 20.9 points per session when the reinforcer (soft drink) was used (range of 12-33 points). When compared to training, these scores reflect no change in performance when reminders were provided, a 13% decrease in performance when no reminders were used, and an 11% increase in performance when the reinforcer was used. During the generalization, subjects averaged 69
Table 10: Performance accuracy for the softball throw (average and range) for all subjects during baseline, training, maintenance, and generalization.
19.6 points per session which resulted in a 4% increase in performance when compared to training (range of 11-29 points).

**Dart Throw Accuracy**

Table 11 shows the dart throw performance of all subjects during baseline, training, maintenance, and generalization phases. During baseline, subjects averaged 10.1 points per session (range of 1-21 points). During training, subjects averaged 15.8 points per session which shows a 56% increase in performance from baseline (range of 8-27 points). During maintenance, subjects averaged 16.1 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 8-30 points), 15.1 points per session when no reminders (neither visual nor verbal) were used (range of 6-25 points), and 18 points per session when the reinforcer (soft drink) was used (range of 8-30 points). These scores reflect a 3% increase in performance when reminders were provided, a 6% decrease in performance when no reminders were provided, and a 12% increase in performance when the reinforcer was provided. During generalization, subjects averaged 16.7 points per session which resulted in approximately a 4% increase when compared to training (range of 8-23 points).

**Summary Data by Gender for the Three Gross Motor Skills**

**Summary Performance of Male Subjects**

Table 12, 13, and 14 present data for the three male subjects on the basketball free throw, the overhand softball throw, and dart throw skills. The performance accuracy of these three gross motor skills was compared during the baseline, training, maintenance,
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<th>Maintenance No Reminder Average</th>
<th>Maintenance No Reminder Range</th>
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Table 11: Performance accuracy for the dart throw (average and range) for all subjects during baseline, training, maintenance, and generalization.
Basketball Free Throw Accuracy

Table 12 shows the basketball free throw performance of the three male subjects during the baseline, training, maintenance, and generalization phases. During baseline, subjects averaged 28.9 points per session (range of 14-37 points). During training, subjects averaged 33.4 points per session which illustrates a 16% increase in performance from baseline (range of 21-43 points). During maintenance, subjects averaged 33.4 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 25-41 points), 30.1 points per session when no reminders (neither visual nor verbal) were used (range of 24-36 points), and 34 points per session when the reinforcer (soft drink) was used (range of 26-44 points). When compared to training, these scores reflect no change when reminders were used, a 10% decrease in performance when no reminders were used, and a 2% increase in performance when the reinforcer was used. During generalization, subjects averaged 32.7 points per session which resulted in a 2% decrease in performance when compared to training (range of 27-40 points).

Overhand Softball Throw Accuracy

Table 13 shows the overhand softball throw performance of three male subjects during the baseline, training, maintenance, and generalization phases. During baseline, subjects averaged 15.6 points per session (range of 6-26 points). During training, subjects averaged 20.8 points per session which illustrates a 33% increase in performance from
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Table 12: Performance accuracy for the basketball free throw (average and range) for male subjects during baseline, training, maintenance, and generalization.
Table 13: Performance accuracy for the softball throw (average and range) for male subjects during baseline, training, maintenance, and generalization.
baseline (range of 7-29 points). During maintenance, subjects averaged 20.2 points per session when visual (a wall poster identified both the four-step strategy and point system), and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 8-37 points), 16.8 points per session when no reminders (neither visual nor verbal) were used (range of 10-25 points), and 21.9 points per session when the reinforcer (soft drink) was used (range of 16-33 points). When compared to training, these scores reflect a 2% decrease in performance when reminders were provided, a 19% decrease in performance when no reminders were used, and a 5% increase in performance when the reinforcer was provided. During generalization, subjects averaged 21.6 points per session which resulted in a 4% increase in performance when compared to training (range of 12-29 points).

**Dart Throw Accuracy**

Table 14 shows the dart throw performance of three male subjects during the baseline, training, maintenance, and generalization phases. During baseline, subjects averaged 11 points per session (range of 3-21 points). During training, subjects averaged 16 points per session which resulted in a 45% increase in performance from baseline (range of 8-27 points). During maintenance, subjects averaged 16.2 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 8-30 points), 16.6 points per session when no reminders (neither visual nor verbal) were used (range of 8-25 points), and 18.6 points per session when the reinforcer (soft drink) was used (range of 14-30 points). When compared to training, these scores
Table 14: Performance accuracy for the dart throw (average and range) for male subjects during baseline, training, maintenance, and generalization.
reflect a 1%, 3%, and 16% increase in performance. During generalization, subjects averaged 17.8 points per session which resulted in a 10% increase in performance when compared to training (range of 11-23 points).

**Summary Performance of Female Subjects**

Table 15, 16, and 17 present data for the three female subjects on the basketball free throw, the overhand softball throw, and dart throw skills. The performance accuracy of these three gross motor skills was compared during the baseline, training, maintenance, and generalization phases.

**Basketball Free Throw Accuracy**

Table 15 shows the basketball free throw performance of the three female subjects during the baseline, training, maintenance, and generalization phases. During baseline, subjects averaged 29.1 points per session (range of 21-38 points). During training, subjects averaged 35.9 points per session which illustrated 23% increase in performance from baseline (range of 25-44 points). During maintenance, subjects averaged 32.6 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal (“look at the poster and follow the four steps for each trial”) reminders were used (range of 26-41 points), 33.5 points per session when no reminders (neither visual nor verbal) were used (range of 26-41 points), and 34.1 points per session when the reinforcer (soft drink) was used (range of 29-41 points). When compared to training, these scores reflect a 23%, 6%, and 5% decrease in performance, respectively. During generalization, subjects averaged 35.2 points per session which resulted in a 2% decrease in performance when compared to training (range of 28-41 points).
Table 15: Performance accuracy for the basketball free throw (average and range) for female subjects during baseline, training, maintenance, and generalization.
Overhand Softball Throw Accuracy

Table 16 shows the overhand softball throw performance of the three female subjects during the baseline, training, maintenance, and generalization phases. During baseline, subjects averaged 12.1 points per session (range of 6-19 points). During training, subjects averaged 16.8 points per session which illustrates a 39% increase in performance from baseline (range of 8-26 points). During maintenance, subjects averaged 17.4 points per session when visual (a wall poster identified both the four-step strategy and point system), and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 8-33 points), 16.1 points per session when no reminders (neither visual nor verbal) were used (range of 12-22 points), and 20 points per session when the reinforcer (soft drink) was used (range of 12-32 points). When compared to training, these scores reflect a 4% increase in performance when reminders were provided, a 4% decrease in performance when no reminders were used, and a 19% increase in performance when the reinforcer was used. During generalization, subjects averaged 17.5 points per session which resulted in a 4% increase in performance when compared to training (range of 9-26 points).

Dart Throw Accuracy

Table 17 shows the dart throw performance of three female subjects during the baseline, training, maintenance, and generalization phases. During baseline, all three subjects averaged 9.2 points per session (range of 1-18 points). During training, subjects averaged 15.5 points per session which illustrates a 68% increase in performance from
### Table 16: Performance accuracy for the softball throw (average and range) for female subjects during baseline, training, maintenance, and generalization.

<table>
<thead>
<tr>
<th>Subject</th>
<th>Baseline</th>
<th>Training</th>
<th>Maintenance</th>
<th>Generalization</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average</td>
<td>Range</td>
<td>Reminder</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>Range</td>
<td>Nu Reminder</td>
<td>Reinforcement</td>
</tr>
<tr>
<td></td>
<td>Average</td>
<td>Range</td>
<td>Average</td>
<td>Range</td>
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<td>Average</td>
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<td></td>
<td></td>
<td>Average</td>
<td>Range</td>
</tr>
<tr>
<td>4</td>
<td>11.2</td>
<td>6-15</td>
<td>18.8</td>
<td>14-25</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>16.4</td>
<td>12-23</td>
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<td>16.8</td>
<td>15-18</td>
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<td></td>
<td>20</td>
<td>14-26</td>
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<tr>
<td>5</td>
<td>12.9</td>
<td>10-17</td>
<td>14.3</td>
<td>8-21</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>18.0</td>
<td>8-33</td>
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<td></td>
<td></td>
<td></td>
<td>14.5</td>
<td>12-21</td>
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<td></td>
<td>21.3</td>
<td>12-32</td>
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<tr>
<td>6</td>
<td>12.3</td>
<td>6-19</td>
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<td>13-26</td>
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<td>17.8</td>
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<td></td>
<td></td>
<td></td>
<td>18.3</td>
<td>12-22</td>
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<tr>
<td>Total</td>
<td>12.1</td>
<td>6-19</td>
<td>16.8</td>
<td>8-26</td>
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<tr>
<td></td>
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<td>16.1</td>
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<td></td>
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<td></td>
<td>20</td>
<td>12-32</td>
</tr>
</tbody>
</table>

- Average values represent the mean performance accuracy.
- Range values indicate the variability in performance accuracy.
Table 17: Performance accuracy for the dart throw (average and range) for female subjects during baseline, training, maintenance, and generalization.
baseline (range of 9-25 points). During maintenance, subjects averaged 16 points per session when visual (a wall poster identified both the four-step strategy and point system) and verbal ("look at the poster and follow the four steps for each trial") reminders were used (range of 10-25 points), 13.5 points per session when no reminders (neither visual nor verbal) were used (range of 6-21 points), and 17.4 points per session when the reinforcer (soft drink) was used (range of 8-24 points). When compared to training, these scores reflect a 3% increase in performance when reminders were provided, a 13% decrease in performance when no reminders were used, and a 12% increase in performance when the reinforcer was provided. During generalization, subjects averaged 15.5 points per session which resulted in essentially the same performance when compared to training (range of 8.0-28.0 points).

Social Validity

A Likert scale questionnaire on social validity was used for obtaining the opinions of the teachers and the parents of subjects regarding the importance of the four-step strategy (see Appendix L). The questionnaire was completed by three teachers (one physical education teacher and two special education teachers) and four parents. The questionnaire was initially given to six parents, but two parents did not return the questionnaire. The Likert scale was composed of the following responses: strongly agree, agree, undecided, disagree, and strongly disagree.

Four of seven respondents strongly agreed with the statement that teaching learning strategies to students with mental retardation (MR) is important whereas two respondents agreed and one respondent disagreed with this statement. Three respondents strongly
agreed that basketball free throw shooting skill is an important gross motor skill for students with MR to learn in terms of participation in community recreation programs whereas four respondents agreed. One respondent strongly agreed that overhand softball throwing is an important gross motor skill for students with MR to learn in terms of participation in community recreation programs whereas six respondents agreed. Six respondents strongly agreed that a dart throw is an important gross motor skill for students with MR to learn in terms of participation in community recreation programs whereas one respondent was undecided. One respondent strongly agreed that basketball free throw is an important gross motor skill for students with MR to learn in terms of participation in regular education programs whereas five respondents agreed and one respondent was undecided. One respondent strongly agreed that a softball throw is an important gross motor skill for students with MR to learn in terms of participation in regular education programs whereas five respondents agreed and one respondent was undecided. Six respondents agreed that a dart throw is an important gross motor skill for students with MR to learn in terms of participation in regular education programs whereas one respondent disagreed. Six respondents agreed with the statement that learning the four-step strategy is important for improving basketball free throw performance whereas one respondent disagreed. Five respondents agreed with the statement that learning the four-step strategy is important for improving softball throw performance whereas two respondents were undecided. Five respondents agreed with the statement that learning the four-step strategy is important for improving dart throw performance whereas two respondents were undecided. Six respondents agreed that the
type of strategy used in this study is important to the physical education of students with MR whereas one respondent was undecided.
CHAPTER 5
DISCUSSION

This chapter provides a discussion of the results of using the four-step strategy on the training, maintenance, and generalization of three closed gross motor skills by adolescents with mild mental retardation. The three gross motor skills used in this study were the basketball free throw, the overhand softball throw and the dart throw. The discussion will focus on each of the five research questions, perceived limitations of the study, implications for practice, and suggestions for future research. Finally, a summary of the study will be presented.

Research Questions

Data generated from this study are used to discuss each of the five research questions.

Question 1: Does training individuals with mild mental retardation to use a four-step learning strategy with three closed gross motor skills (basketball free throw, overhand softball throw, and dart throw) affect performance?

During the baseline phase, the average points earned (performance accuracy) by all six subjects on basketball free throws, overhand softball throws, and dart throws was 29.3, 13.8, and 10.1, respectively. The maximum score for any session was 50 points.
During training, the average points earned for all subjects were 34.6, 18.8, and 15.8, respectively. When compared to baseline, these scores reflect increases of 18%, 36%, and 56%, respectively. All subjects increased their scores on all three gross motor skills during training. The results of training support the notion that individuals with mental retardation (MR) are able to acquire and use selected strategies for improving motor skill performance (e.g., Deener & Horvat, 1995; Surburg, 1991; Surburg, Porretta, & Sutlive, 1995; Yang, 1995). Results also support the Zeaman and House’s attention theory (1963) and related study findings (Clinton & Evans, 1972; Evans, 1968; Gruen & Berg, 1973) that reducing the number of irrelevant dimensions on a learning task may enhance the learning of individuals with MR. For example, in this study the four-step strategy directed the subject to focus on selected meaningful cues in order to focus greater attention to the task. These results are similar to the findings of Singer and his colleagues (e.g., Singer & Suwanthada, 1986; Singer, Flora, & Abourezk, 1989b; Singer, et al., 1989a; Singer, Lidor, & Cauraugh, 1994) with normal subjects. The Singer et al. studies found that beginners and skilled subjects improved their performance because they performed the act without focusing significant attention to numerous internal and external details. Rather, they focused greater effort on one meaningful cue at a time.

**Question 2:** Are individuals with mild mental retardation able to continue using the four-step learning strategy with three closed gross motor skills (basketball free throw, overhand softball throw, and dart throw) after training has been terminated?

The maintenance phase of the study included three sub-phases: reminders, no reminders, and reinforcement. When reminders were presented (both visual and verbal)
the points earned (performance accuracy) by all six subjects on basketball free throws, overhand softball throws, and dart throws were 33.1, 18.8, and 16.1, respectively. When compared to the training phase, the data illustrate a minimal decrease (4%) for basketball free throw performance; the same score was obtained for softball throw performance (18.8 vs. 18.8); and a closely score was obtained for dart throw performance (16.1 vs. 15.8). However, this change was not permanent. Upon withdrawal of the reminders (visual and verbal), the average performance scores gradually decreased for all three skills (8% for the basketball free throw, 13% for the softball throw, and 6% for the dart throw). There may be several reasons for this results. For example, memory for retaining learned information may have been a factor for those individuals because they needed to be reminded to rehearse while performing the task (Lobb, 1974). Once the information had been stored in long-term memory, loss of information is minimal. Subjects in this study may not have been able to place the information in long-term memory.

Another reason may be the lack of intrinsic motivation. According to Vallerand and Reid (1990), motivation behavior can be categorized into three main types: intrinsic, extrinsic, and amotivation. Intrinsic motivation is thought to be the pleasure and satisfaction derived from performance (Deci, 1971). Extrinsic motivation occurs when the behavior is externally regulated. Amotivated behavior is considered nonmotivated (neither intrinsic nor extrinsic). Amotivated behavior occurs when individuals perceive a lack of contingency between their behaviors and the outcomes. In the present study, participation was voluntary but the physical education teacher was also involved in checking the attendance of subjects. If subjects felt constrained, their performance may
have been affected. The decrease of performance during the removal of the reminders may have been due to the amotivation because the subjects may have experienced an obligation to behave in a certain way and the behavior change was not maintained. This situation may be why most of the subjects exhibited common signs of boredom (forgot to score after each trial, off task more often, asked when this would be over), especially after several sessions without reminders (verbal and visual). This also could have been due to subjects being very familiar with the skills. Especially the basketball free throw and the softball throw. These are commonly used skills in physical education and therefore could have contributed to the performance. Furthermore, the skills may have been viewed by subjects as not being new or novel and therefore once the strategy was acquired the skill itself became boring.

With respect to data and site observation, the experimenter decided to use reinforcement to increase positive behavior (performance accuracy). Fisher and Zeaman (1973) found that reinforcement was more effective if tied directly to a specific dimension. This procedure was applied to the current study because the experimenter made a clear statement in terms of what subjects needed to accomplish before receiving the reinforcer. Hall and Hall (1980) noted that selecting and using an appropriate reinforcer is a basic step. This can be accomplished in a number of ways: by direct questioning (ask subjects), indirect questioning (e.g., ask parent, teacher, peer), structured observation (provide sample of reinforcers), and natural observation (watch subjects during various activities and find their preference). A soft drink was selected as the reinforcer for this study which was identified through indirect teacher questioning.
All subjects were told that they would obtain a drink if they concentrated on the strategy while performing each of the tasks. The reinforcement seemed effective in performance of the three skills for all subjects. Subjects' basketball free throw, softball throw, and dart throw accuracy increased 7%, 27%, and 19%, respectively, from the no-reminders phase. When compared to training, the basketball free throw performance remained the same while the softball throw performance and the dart throw increased 11% and 12%, respectively. These data are in agreement with a number of studies (e.g., Deener & Horvat, 1995; Owlia, et al, 1995; Croce & Horvat, 1992) in which individuals with MR improved motor skill performance when provided with reinforcement.

Question 3: Will individuals with mild mental retardation be able to use the four-step learning strategy with each of the three gross motor skills (basketball free throw, overhand softball throw, and dart throw) in a different setting?

During the generalization phase, subjects were moved from a weight-room to the main gymnasium. Although the rooms in which the three gross motor skills took place were different (weight room vs gymnasium), the equipment and tasks remained the same. This situation seems to correspond with Singer's position (1986) that the transfer of a strategy is more likely to occur when the transfer task involves limited changes from initial training. The average basketball free throw score for all subjects during generalization remained essentially at training levels whereas the softball throw and dart throw each increased 4%. These findings support Singer's notion (1986, 1988) that strategy training has positive transfer (generalization) effects and transfer will occur when related tasks are to be accomplished in very similar situations (using similar
equipment in the same school but in different setting). It must be noted, however, subjects were already familiar with the generalization environment in that they played basketball in the gymnasium prior to this study. Familiarity with the environment could have positively influenced generalization performance. Nevertheless, subjects never practiced the softball throw or the dart throw in the gymnasium. Therefore, these findings may indicate, in part, that individuals with mild MR may able to transfer the strategy they have learned if a limited change is made from the initial setting.

**Question 4: Is there a performance change between male and female individuals with mild mental retardation across three closed gross motor skills (basketball free throw, overhand softball throw, and dart throw) following experimental intervention (four-step strategy)?**

During the baseline phase, the average points earned (performance accuracy) by male subjects for basketball free throws, overhand softball throws, and dart throws were 28.9, 15.6, and 11 points, respectively. The average points earned by female subjects for basketball free throws, overhand softball throws, and dart throws were 29.1, 12.1, and 9.2 points, respectively. These scores reflect little difference between male and female subjects on basketball free throw performance. During baseline, males possessed softball throw scores which were 22% greater than females and possessed dart throw scores which were 16% higher than females. During training, both genders increased performance on all three gross motor skills when compared to baseline. Overall, data show meaningful behavior changes for both genders when the four-step strategy was introduced. Belmont, Butterfield, and Borkowski (1978) state that strategy training
programs may be effective because with training, some aspects of the selected strategy may be able to be executed automatically, thereby freeing mental resources to other aspects of the task. However, the performance level of male subjects did not increase as much as that exhibited by female subjects during training. The female subjects’ average performance increase was 21% for basketball free throw whereas male subjects increased only 16%. For the softball throw, the increase for female and male subjects was 39% vs. 33%, respectively, and for the dart throw was 68% for females and 45% for males.

After the completion of training, female subjects exhibited a greater decrease (9%) in basketball free throw performance. However, the female subjects slightly increased their performance on both the softball throw and the dart throw (4% and 3%, respectively) when reminders were presented. Male subjects maintained their performance level on the basketball free throw, exhibited a small decrease (2%) in softball throw performance, and almost no change (1% increase) in dart throw performance when reminders were presented. According to results, these reminders (visual and verbal) may have stimulated the individuals to retrieve the strategy that was taught during training sessions (Single, 1986). These reminders may also be considered, in part, as visual and verbal model for subjects observing and imitating (Butterfield, Wambold, & Belmont, 1973). Moreover, the present findings correspond to Litrownik’s finding that individuals with MR facilitate learning and retention better when they immediately perform the observed behaviors. With respect to the performance of females on the basketball free throw (9% decrease), one factor that might have contributed to the decrease was a reduced number of training sessions. Two out of three subjects had six
sessions and one (subject 6) had only three sessions (see Figure 6). The short training period may have influence the results. A number of researchers have found that the greater number of practice trials performed the greater opportunity subjects have in terms of enhancing the performance levels (Del Rey & Stewart, 1989; Porretta, 1982; Porretta & O’Brien, 1991). Additional training sessions may have provided subjects a greater opportunity to acquire and retain the strategy. This may be more important for lesser skilled subjects.

When the reminders were withdrawn, female subjects demonstrated a 4% to 12% decrease in performance level on all three skills. Whereas male subjects demonstrated a 10% and 19% decrease in performance level on both the basketball free throw and softball throw respectively, and slight increase (3%) in performance level on the dart throw. Single (1986) indicated that “the absence of reminders or limited frequency may result in an insufficient degree of strategy use” (p.206). Other studies from both cognitive and motor domains have shown that individuals with MR exhibit deficits in the secondary memory processes because they fail to use active rehearsal strategy spontaneously (Butterfield et al, 1973; Ellis, 1970; Reid, 1980a). The notion of rehearsal strategy deficiency may be another possible explanation for the present results during the no reminders phase.

When reinforcer was provided, both genders increased their performance 10%-20% across the three skills. An exception was observed however for female subjects relative to the basketball free throw (2% increase). Male subjects demonstrated a 2%, 5%, and 16% increase in performance on the basketball free throw, softball throw, and dart throw,
respectively. Female subjects demonstrated a 19% increase in performance on the softball throw, a 12% increase on the dart throw, and a 5% decrease on the basketball free throw. Essentially, there are no meaningful difference between genders. The positive results of using reinforcement is in line with the findings demonstrated in previous studies (cited on p.4).

Both genders remained at almost the same performance level during generalization when compared to training. This finding may relate to the “general” nature of the four-step strategy. Singer (1988) emphasized that a “general” strategy that addressed commonalities of behaviors required for achievement in all types of closed skills is helpful for enhancing performance. Thus, the “general” strategy used in this study may not only help the learner to improve a skill but also be generalized to other settings in which the skill is being utilized.

Question 5: What is the social value of the four-step strategy as viewed by parents and teachers relative to enhancing subjects’ acquisition, maintenance, and generalization of the three gross motor skills?

Overall, the results of the social validity questionnaire support the importance of teaching learning strategies to students with mental retardation (MR). However, one parent disagreed that teaching learning strategies to students with MR was important. Results illustrate that skills utilized in this study (basketball free throw, softball throw, dart throw) are important for students with MR to learn and improve upon in order to participate successfully in physical education and community recreation programs (100% agreement in all three skills except one undecided for dart throw skill). Furthermore,
most teachers and parents indicated that the learning of the basketball free throw, softball throw, and dart throw skills are necessary and important for students with MR in order to successfully participate in regular physical education programs. One possible reason for this opinion could be that two of these three skills (basketball free throw and softball throw) have been included in the regular physical education curriculum of those subjects. According to the social validity results, the dart throw skill may need to be included in the curriculum so that students are able to participate successfully in community recreation programs. Finally, five of the seven respondents indicated that learning the four-step strategy is important for improving the basketball free throw, softball throw, and dart throw performance of the students.

**Limitations of the Study**

**Subject Characteristics**

This study was limited to three male and three female high school students (16-18 years of age) with mild MR. Subjects was from a urban school district and therefore did not represent a cross section of various school districts. It may will be the case that students with different characteristics ages would repond differently to the training.

**Setting**

The setting for this study was a weight room of an inner-city high school in a large Midwest city. The effects of the four-step strategy could have been different if an outside basketball court or other environment rather than the weight room was used.
Timing of the Experiment

Sessions were conducted in the early morning (8:00 am - 9:30 am) and the study lasted for approximately three months (about 50 sessions). Some subjects came in with breakfast in hand and some had no breakfast at all. The time during which data were collected could have been affected performance. Also, the study was conducted during the Spring (from late March to June). The weight room tended to be hot in late April, May, and part of June. As a result, room temperature may have affected subjects’ performance.

Subject Matter

The skills used in this study consisted of the basketball free throw, overhand softball throw, and dart throw. The effects of the four-step strategy in other closed skills such as the volleyball serve, tennis serve, etc.. were not studied, and as a result the affects of strategy acquisition are yet to be determined. All subjects in this study had previous experience with the basketball free throw and softball throw. As a result, these two skills could have been affected performance levels.

Dependent Variable

Performance accuracy of the basketball free throw, softball throw, and dart throw was the dependent variable for this study. A five-point system was used for scoring and the maximum number of points for ten trials are 50. The scoring process for both the softball throw and the dart throw were clear. however, the basketball free throw scoring process seemed confusing to subjects. For example, the subject received 3 points if the shot was missed but the ball hit the rim and backboard; the subject received 2 points if the
shot was missed but the ball hit the rim and the subject received 1 point if the shot was missed and the ball only hit the backboard. During the study, subject 1 asked: "why do I need to use different scores? If I missed, it is no point." The use of a different scoring system could have affected performance.

Implications for Practice

This study shows that the basketball free throw, softball throw, and dart throw performance of all subjects increased during four-step strategy training. There was a slight decrease in performance after training, especially when reminders (visual and verbal) were removed. However, there was an increase in performance when a reinforcer was utilized (soft drink). Furthermore, the majority of subjects (4 out of 6) were able to generalize the strategy and maintain their performance level across all three skills (basketball free throw, softball throw, and dart throw).

This experimental study demonstrated that it is practical for teachers/coaches to teach a four-step strategy to students with mild MR. Subjects with mild MR in this study were able to acquire and use the four-step strategy to improve their motor skill performance. The four-step strategy has several advantages for the learning and generalizing of closed motor skills. The four-step strategy is a combination strategy that includes cognitive and motor domains. It could help learners to use their senses (thinking and moving) for accomplishing skills. The four-step strategy is similar to Singer’s five-step strategy which emphasizes the use of cognition prior to, during, and completion of the movement. The strategy can be easily modified and adopted for students with disabilities when learning various gross motor skills.
The four-step strategy is simple, requires no involvement of preparation time and special equipment. It is very similar to the everyday teaching process that includes teacher's demonstration → student practice → teacher feedback → student practice. The teacher/coach can present the four-step strategy in written form and then demonstrate the process. Students can then follow the demonstration and perform the skill immediately. There is no need for audiovisual equipment (e.g., VCR and monitor).

Teachers/coaches need to have an appropriate length of training in order for students to fully acquire and internalize the strategy. Strategy training should be continued even when students exhibit performance increases over a number of sessions. This is because, according to Johnston and Pennypacker (1992), an increase in performance in a few early sessions may only be temporary.

Based on the results of this study, teachers/coaches may need to initially allocate more time explaining to beginners how to focus on attention instead of spending an inordinate amount of time teaching the entire strategy (Singer et al., 1993). Furthermore, the last step of the four-step strategy, the scoring system, may need to be revised. This step may need to be simplified for the basketball free throw.

Suggestions for Future Research

1. Replicate the study with additional number of subjects.

2. Use subjects with more severe forms of MR, such as individuals with moderate and severe disabilities.

3. Conduct additional studies using other skills (e.g., tennis serve, volleyball serve, golf putting).
4. Examine the effects of the four-step strategy on acquisition (training) and maintenance by providing addition sessions within each phase in order for subjects to fully acquire and internalize the strategy.

5. Examine the effects of the four-step strategy in a game or tournament to determine if subjects are able to use the strategy in a competitive setting.

Summary

The purpose of this study was to investigate the effects of a four-step strategy on the acquisition, maintenance, and generalization of three closed gross motor skills (basketball free throw, overhand softball throw, and dart throw) by adolescents with mild mental retardation. A multiple baseline across skills design was used to examine the effects of four-step strategy on the training, maintenance, and generalization. The four-step strategy consisted of: ready, look, do, and score.

During the baseline phase, subjects were told to do their best in performing each skill. They were given 10 consecutive trials in each of the three skills. The skills were randomly ordered for each session to control for potential sequence effects. After steady state responding was established for each skill under baseline conditions, the four-step strategy was introduced individually to each subject for each particular skill. Therefore, the length of the baseline phase differed among the subjects depending upon their personal baseline data.

During the training phase, the investigator introduced and demonstrated the four-step strategy in a step-by-step fashion. In the meantime, visual posters (four-step strategy and a five-point scale scoring system) were placed on a wall so students could see and read it.
After the demonstration, the subject was asked to actually model the four-step strategy demonstration. Criteria for subjects successfully completing the training were: 1) the ability to perform the four-step strategy on each trial of the skill for two consecutive sessions; and 2) the ability to observe improved performance on all three skills.

While the subjects were in the process of meeting criteria, the visual posters remained on the wall and the investigator verbally reminded subjects to use the four-step strategy. However, no demonstration was given. After subjects established acceptable stable skill performance, the visual and verbal reminders were removed.

A positive increase in performance was observed during the training phase. Except for subject 4 (4% on the free throw) and subject 3 (7% on the softball throw), all subjects increased their performance level significantly on the three gross motor skills (11% to 100% increase). Among the three skills, the greatest increase in performance was dart throw (18%-100% increase). Four of the six subjects maintained or increased their performance level at an acceptable level (2-5% of increase or decrease) when reminders were available. Unfortunately, five of the six subjects decreased their performance level when reminders were removed with the exception of subject 4 who increased her performance level on the basketball free throw. When reinforcement was introduced, all subjects increased their performance level on all three gross motor skills when compared to the removal of reminders phase. Moreover, four of the six subjects increased their performance level on all three motor skills when compared to training. The other two subjects (subject 5 and 6) increased their performance level on the softball throw (26% and 2%, respectively), but decreased their performance on the basketball free throw.
(12% and 10%, respectively) when compared to training. For the softball throw, the subject 5 increased performance level by 7% and the subject 6 decreased performance level by 5%.

Still, the performance of subjects on the three gross motor skills was variable during the maintenance phase. Subjects exhibited stable performance when reminders (visual and verbal) were presented. However, when the reminders were withdrawn, performance decreased. When the reinforcer was introduced, performance gradually increased. There may be several reasons for the variability of performance. The decreases in performance level during the removal of reminders may have been due to memory retaining learned information by individuals with MR (Lobb, 1974) and lack of intrinsic motivation (Vallerand & Reid, 1990). Performance increases during the reinforcement phase seem to indicate that reinforcement is an effective means to increase the gross motor performance of individuals with MR. This is not to say that a soft drink should be continually used. Eventually social and verbal praise should used in programming.

Furthermore, results illustrate that subjects were able to generalize the four-step strategy to another setting. Five of the six subjects maintained their performance level during the generalization phase when compared to the training phase. According to Singer (1986, 1988), strategy training has a positive transfer (generalization) effect. Generalization will occur when related tasks are accomplished in similar situations (Livesey & Laszlo, 1979). However, the effects of the four-step strategy also need to be examined in other settings, especially, in competitive situations.
with the notion proposed by Singer and his colleagues (1989) in that the Singer five-step strategy can be easily modified and adopted for all levels of learners for closed gross motor skills. The findings of this study also support various gross motor learning strategy studies dealing with individuals exhibiting mental retardation (e.g., Deener & Horvat, 1995; Surburg, 1991; Porretta & Surburg, 1995; Surburg, Porretta, & Sultive, 1995; Yang, 1995).
REFERENCES


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Appendix A

Sample of Singer’s Five-step Strategy
Singer’s Five-step Strategy

Readying:
1. Get comfortable physically.
2. Attain an optimal mental-emotional state.
3. Attempt to do things in preparation that are associated with previous personal best performance.
4. Try to be consistent in attaining the preparatory state for the act.

Imaging:
1. Mentally picture yourself performing the act as it should be done, from the result of the act to the initiation of the movement.
2. Think positive and feel confident.
3. Feel the movement.

Focusing:
1. Concentrate intensely on one relevant feature of the situation, such as the seams of the tennis ball to be hit.
2. Think only of this cue, which will block out all other thoughts.

Executing:
1. Do it!
2. Do not think of anything about the act itself or the possible outcomes.

Evaluating:
1. If time permits, learn from available feedback information.
2. Assess the performance outcome and the effectiveness of each step in the routine.
3. Adjust any procedure next time.
Appendix B

Human Subjects Review Approval
With regard to the employment of human subjects in the proposed research protocol:

95B0347 THE USE OF A FIVE-STEP STRATEGY IN LEARNING GROSS MOTOR SKILL FOR INDIVIDUALS WITH MILD MENTAL RETARDATION, David Porretta, Jin Jin Yang, Health Physical Education and Recreation

THE BEHAVIORAL AND SOCIAL SCIENCES REVIEW COMMITTEE HAS TAKEN THE FOLLOWING ACTION:

- APPROVED
- DISAPPROVED
- APPROVED WITH CONDITIONS*
- WAIVER OF WRITTEN CONSENT GRANTED

* Conditions stated by the Committee have been met by the Investigator and, therefore, the protocol is APPROVED.

It is the responsibility of the principal investigator to retain a copy of each signed consent form for at least three (3) years beyond the termination of the subject's participation in the proposed activity. Should the principal investigator leave the University, signed consent forms are to be transferred to the Human Subjects Review Committee for the required retention period. This application has been approved for the period of one year. You are reminded that you must promptly report any problems to the Review Committee, and that no procedural changes may be made without prior review and approval. You are also reminded that the identity of the research participants must be kept confidential.

Date: December 15, 1995
Signed: Patricia M. Kramer

(Chairperson)
Appendix C

Permissions from Columbus Public School. Principal and Teacher
January 17, 1996

Dear Administrator:

I write this letter to introduce Jin Jin Yang, a researcher from The Ohio State University. His research proposal titled "The Use of a Five-step Strategy in Learning Gross Motor Skill for Individuals with Mild Mental Retardation" has been reviewed and approved by the Research Proposal Review Committee.

This letter does not obligate you to participate in the study. Rather, it serves as an introduction and official notification that the researcher has followed established procedures and has been granted permission to solicit subjects to participate in the study.

If you have any questions or concerns, please contact my office.

Sincerely,

[Signature]

Lucretia Williams
Assistant Superintendent.
March 14, 1996

Jin Jin Yang
The Ohio State University
School of Health, Physical Education and Recreation
Adapted Physical Education Department
337 West 17th Avenue
Columbus, Ohio 43210-1284

Dear Ms. Yang,

I met with you on Tuesday, March 12, 1996 to discuss your involvement with both the developmentally handicapped program and our physical education program. Your planned activities are in agreement with the administration, teachers, and students.

We look forward to working with you and The Ohio State University as you pursue your PhD study. If you have any questions, please feel free to contact me at 365-5583.

Sincerely,

E. Leslie Briggs
Principal
March 14, 1996

Jin Jin Yang
The Ohio State University
School of Health, Physical Education and Recreation
Adapted Physical Education Department
337 West 17th Avenue
Columbus, Ohio 43210-1284

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Sincerely,

Mary L. Henninger
Physical education Teacher
Appendix D

Sample Consent Form
INFORMED CONSENT

Investigator: Jin Jin Yang
Research Project: The Use of a Five-step Strategy in Learning Gross Motor Skills for Individuals with Mild Mental Retardation.

The proposed study is to investigate a five-step learning strategy which includes reading, imaging, focusing, executing, and evaluating for enhancing gross motor skill learning and performance. This strategy has been documented as an effective approach to learning motor tasks. Moreover, this strategy has the potential to enable persons to attain reasonable proficiency more rapidly and transfer it to other related skills. Students who are developmentally handicapped are thought to have difficulty in recalling and organizing information. This learning strategy may assist individuals with DH in better learning motor skills.

If you decide to allow participation, your son/daughter will participate bowling, overhand throwing, and basketball foul shooting activities. He/she will participate in a maximum of 30 sessions. Each session will require about 20-30 minutes and be scheduled 3-4 times per week. Students will be trained on a one-to-one basis, and all activities be conducted at their school (except for generalization sessions what will be held in a bowling alley and recreation center near to your child’s school). Generalization sessions will be conducted on weekends. It would be appreciated if you can transport your child to the site. The investigator will pay for the gas and cover the costs of bowling.

Participating in this study will in no any harm your son/daughter. Names will not be associated with results. Please note that your child may withdraw from the study at anytime without consequences. Nonparticipating in this study will in no way affect your child’s placement a grades.
I do hereby voluntarily consent to allow my daughter/son ______________________ (Participant) to participate in the study as explained above.

Signed ______________________  
(Student)  
Date ______________

Signed ______________________  
(Parent or Guardian)  
Date ______________

Signed ______________________  
(Investigator)  
Date 3/15/96
Appendix E

Training Protocol
TRAINING PROTOCOL

First Training Session.

When the subject walks into the weight room, the experimenter will explain the purpose of the study. The statement will be “Today I am going to help you perform motor skills better. In order to do this, I have four steps to help you do this. Here is a poster (on the wall) that shows the four steps. These four steps are: ready, look, do, and score. “Ready” means that you get ready to perform the skill. “Look” means that you look at the target or basket. “Do” means that you actually perform the skill. “Score” means that you tell me the number of point(s) you earned for each throw or shot. I will tell you how to score when we do each skill. We are now going to walk to the first skill station so you can practice the steps on the poster.” Then, the experimenter walks with the subject to the first skill station (will be different each day according to a random schedule). The subject will practice the 4 steps by following the training procedures detailed below for each of the three skills (Dart throwing, Overhand softball throwing, and Basketball free-throw shooting).

Basketball Foul Shooting:

At the basketball foul shooting station, the experimenter will say:

First, I will demonstrate the 4 steps for you. The first step is to get into the ready position. You do this by holding the ball with your shooting hand and stand behind the line, facing the basket (see Appendix P).

The second step is to look at the basket.

Third step is to shoot the ball and try to make a basket. Now, I say the score out loud (fourth step).
The experimenter says to the subject:

Now, look at the scoring poster. If you make a basket, the score is 3 points, if you miss it but not an airball (hit rim or board, or both rim and board), the score is 1 point, and if you shoot an airball, you get no points. You are to score out loud after each shot so that I can hear it.

Following the demonstration, the experimenter will say: “Now, I want you to shoot the ball using the 4 steps. Remember what I just showed you.”

“Now, get ready.” If the subject has proper ready position (like the illustration in the Appendix P), the subject is considered to be “ready”. The experimenter will say: “Good, you are ready. Now, look at the basket.” If the subject does not have the ready position, the experimenter will say: “Your position is not quite right. I am going to show you the proper position again. Watch carefully (demonstration). Now, try again.” If the subject assumes the proper position, the experimenter will say: “Good. Now, look at the basket.”

If the subject looks at the basket, and focuses on it, the subject is considered to be ready for the third step. The experimenter will say:

“Good, you are focusing on the basket. Now, shoot the ball and try to make a basket.” If the subject does not look the basket, the experimenter will say: “Look at the basket.” If the subject does so, the experimenter will say: “Good. Now, shoot the ball and try to make a basket.” If the subject still does not look at the basket, the experimenter will demonstrate this step again and tell the subject again to “shoot the ball and try to make a basket.”

After the shooting, the experimenter will say:

“Now, tell me your score. You can look at the score poster to help you determine your score.” If the subject gives the correct score, the experimenter will say; “Good.” If the subject fails to provide a score verbally, the experimenter will say: “Look at the score poster and tell me what the number of points for your shot.” If the subject gives the correct score, the next trial will begin.

At the second trial, the experimenter will say: “Now, shoot the ball using the four steps on your own. Remember to use the same procedure that you just did.” However, if the
subject does not perform a specific step properly, the experimenter will demonstrate that step and then, ask the subject to try again. This procedure will be utilized for subsequent trials. Ten attempts will be provided to the subject for practicing the 4-step strategy before going to next skill station.

**Second Session**

At the beginning of the second session, the purpose of the study will not be repeated. The experimenter will review the four steps with the subject by using the poster (it will remain on the wall). Other than that, all procedures will remain exactly the same as the first session.

**Third and Subsequent Sessions**

At the beginning of the third session, the experimenter will review the four steps with the subject by using the poster. Then, the experimenter will ask the subject:

"Do you understand the four steps?" If the subject says "Yes", the experimenter will walk with the subject to the first skill station (follow the random selected schedule) and ask the subject to perform the skill using the four steps.

If the subject has proper grip and stance (like the illustration in the Appendix P), the subject is considered to be "ready". The experimenter will say:

"Good, you are ready. Now, do the second step." If the subject is looking at the basket, the statement will be: "Good. Now, shoot the ball. After the shooting, if the subject tells the score, the experimenter will say: "Good job, you have got all four steps right. Keep using the four steps for rest of trials."

If the subject misses any step or use it incorrectly, the experimenter will ask the subject to discontinue the performance. The experimenter will repeat the specific procedure verbally.
For example, if the subject fails to perform the second step, the experimenter will say: "Remember to look the basket before you shoot the ball. Now, try again." If the subject assumes the appropriate step, the experimenter will say: "Good. Now, shoot the ball."

The training session will be continued till the subject is able to follow the four steps four times in a row for consecutive 2 sessions for basketball foul shooting.

**Overhand Softball Throwing:**

At the softball throwing station, the experimenter will say:

First, I will demonstrate the 4 steps for you. **First step** is to get into the ready position. You do this by holding a softball with your throwing hand, stand behind the line, and face the target (see Appendix O).

**The second step** is to look at the center of the target, it is also called "Bull’s-eye."

**The third step** is to throw the dart and try to hit the center of the target (Bull’s-eye). Now, I say the **score** out loud (fourth step).

The experimenter says to the subject:

Now, look at the scoring poster. If you hit the **Yellow** circle (Bull’s-eye), the score is **5 points**; if you hit the **Red** circle, the score is **4 points**, **Blue** counts for **3 points**, **Black** counts for **2 points**, **White** counts for **1 point**, and if the ball does not hit the target you get **no points**. You are to score out loud after each throw so that I can hear it.

Following the demonstration, the experimenter will say: “Now, I want you to throw the softball using the 4 steps. Remember what I just showed you.”

“Now, get ready.” If the subject has proper ready position (like the illustration in the Appendix O), the subject is considered to be “ready”. The experimenter will say: “Good, you are ready. Now, look at the bull’s-eye.” If the subject does not have the ready position, the experimenter will say: “Your position is not quite right. I am going to show you the proper position again. Watch carefully (demonstration). Now, try again.” If the subject assumes the proper position, the experimenter will say: “Good. Now, look at the bull’s-eye.”
If the subject looks at the target, and focuses on it, the subject is considered to be ready for the third step. The experimenter will say:

"Good, you are focusing on the target. Now, throw the softball and try to hit the bull's-eye." If the subject does not look the target, the experimenter will say: "Look at the center of the target." If the subject does so, the experimenter will say: "Good. Now, throw the ball and try to hit the bull's-eye. If the subject still does not look at the target, the experimenter will demonstrate this step again and tell the subject again to "throw the ball and try to hit the bull's-eye".

After the throw, the experimenter will say:

"Now, tell me your score. You can look at the score poster to help you determine your score." If the subject gives the correct score, the experimenter will say; "Good." If the subject fails to provide a score verbally, the experimenter will say: "Look at the score poster and tell me what color your ball hits and the number of points for it." If the subject gives the correct score, the next trial will begin.

At the beginning of the second trial, the experimenter will say: "Now, throw the softball using the four steps on your own. Remember to use the same procedure that you just did." However, if the subject does not perform a specific step properly, the experimenter will demonstrate that step and then, ask the subject to try again. This procedure will be utilized for subsequent trials. Ten attempts will be provided to the subject for practicing the 4-step strategy before going to next skill station.

Second Session

At the beginning of the second session, the purpose of the study will not be repeated. The experimenter will review the four steps with the subject by using the poster (it will remain on the wall). Other than that, all procedures will remain exactly the same as the first session.
**Third and Subsequent Sessions**

At the beginning of the third session, the experimenter will review the four steps with the subject by using the poster. Then, the experimenter will ask the subject: “Do you understand the four steps?” If the subject says “Yes”, the experimenter will walk with the subject to the station and ask the subject to perform the skill using the four steps. If the subject has ready position (like the illustration in the Appendix O), the subject is considered to be “ready”. The experimenter will say:

> “Good, you are ready. Now, do the second step.” If the subject’s eyes are focusing on the target, the statement will be: “Good. Now, throw the ball and try to hit the bull’s-eye.” After the throw, if the subject tells the score, the experimenter will say: “Good job, you have got all four steps right. Keep using the four steps for rest of trials.”

If the subject misses any step or use it incorrectly, the experimenter will ask the subject to discontinue the performance. The experimenter will repeat the specific procedure verbally.

For example, if the subject fails to perform the second step, the experimenter will say: “Remember to look the target before you throw. Now, try again.” If the subject assumes the appropriate step, the experimenter will say: “Good. Now, throw the ball.”

The training session will be continued till the subject is able to follow the four steps four times in a row for consecutive 2 sessions for softball throwing.


**Dart Throwing**

**Demonstration**

At the dart throwing station, the experimenter will say:

First, I will demonstrate the 4 steps for you. The first step is to get into the ready position (see Appendix M). You do this by holding a dart like this with your throwing hand (see Appendix N), standing behind the line, and facing the target.

The second step is to look at the center of the target like this. It is also called Bull’s-eye.

The third step is to throw the dart and try to hit the center of the target (Bull’s-eye) like this.

The fourth step, after the throw, Now, I say the score out loud.

The experimenter says to the subject:

Now, look at the scoring poster. If the dart lands on yellow (Bull’s-eye), the score is 5 points, if the dart lands on Red, the score is 4 points. Blue counts for 3 points. Black counts for 2 points. White counts for 1 point, and if the dart does not hit the target you get no points. You are to score out loud after each throw so that I can hear it.

**Subject Practice (First Trial)**

Following the demonstration, the experimenter will say: “Now, I want you to throw the dart using the 4 steps. Remember what I just showed you.”

“Now, get ready.” If the subject has proper grip and stance (like the illustrations in Appendices M&N), the subject is considered to be “ready”. The experimenter will say: “Good, you are ready. Now, look at the bull’s-eye.” If the subject does not have the proper grip and/or ready position, the experimenter will say: “Your grip and/or position is not quite right. I am going to show you the proper grip (or position) again. Watch carefully (demonstration). Now, try again.” If the subject has the proper position, the experimenter will say: “Good, now, look at the bull’s-eye.”

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If the subject looks at the target, and focuses on it, the subject is considered to be ready for the third step. The experimenter will say:

“Good, you are looking at the target. Now, throw the dart and try to hit the bull’s-eye.” If the subject does not look the target, the experimenter will say: “Look at the center of the target.” If the subject does so, the experimenter will say: “Good. Now, throw the dart and try to hit the bull’s-eye. If the subject still does not look at the target, the experimenter will demonstrate this step again and tell the subject again to “throw the dart and try to hit the bull’s-eye”.

After the throw, the experimenter will say:

“Now, tell me your score. You can look at the score poster to help you determine your score.” If the subject gives the correct score, the experimenter will say; “Good.” If the subject fails to provide a score verbally, the experimenter will say: “Look at the score poster and tell me what color your dart hit and the number of points for it.” If the subject gives the correct score, the next trial will begin.

Second - Tenth Trials

At the beginning of the second trial, the experimenter will say: “Now, throw the dart using the four steps on your own. Remember to use the same procedure that you just did.” If the subject does not perform a specific step properly, the experimenter will demonstrate that step and then, ask the subject to try again. The same procedure will be followed as in the first practice trial. The subject will practice the 4-step strategy 10 times before going to next skill station.

Second Session

At the beginning of the second session, the experimenter will review the four steps with the subject by using the poster (it will remain on the wall). However, the purpose of the study will not be repeated. Other than that, all procedures will remain exactly the same as
the first session.

**Third and Subsequent Sessions**

At the beginning of the third and subsequent sessions, the experimenter will verbally read the four steps to the subject by using the poster. Then, the experimenter will ask the subject:

“Do you understand the four steps?” If the subject says “Yes”, the experimenter will walk with the subject to the first skill station (following the random selected schedule) and ask the subject to perform the skill using the four steps.

For example, at the dart throwing, if the subject has the proper grip and stance (like the illustrations in the Appendices M&N), the subject is considered to be “ready”. The experimenter will say:

“Good, you are ready. Now, do the second step.” If the subject’s eyes are focusing on the target, the statement will be: “Good. Now, throw the dart and try to hit the bull’s-eye.” After the throw, if the subject tells the score, the experimenter will say: “Good job, you have got all four steps right. Keep using the four steps for rest of trials.”

If the subject misses any step or perform it incorrectly, the experimenter will stop the subject. The experimenter will then repeat the specific procedure verbally.

For example, if the subject fails to perform the second step, the experimenter will say: “Remember to look the target. Now, start from the first step.” If the subject has the appropriate step, the experimenter will say: “Good. Now, throw the dart.”

The training session will be continued till the subject is able to execute the four steps four times in a row for consecutive 2 sessions for dart throwing.
Appendix F
Sample of the Wall Poster
Four-step Strategy

Ready

Look

Do

Score
Appendix G

Sample of 5-point Scoring Systems
BASKETBALL SCORE

SWISH = 5
IN BUT THE BALL HIT RIM OR BOARD = 4
MISS BUT THE BALL HIT RIM AND BOARD = 3
MISS BUT THE BALL HIT RIM = 2
MISS BUT THE BALL HIT BOARD = 1
AIRBALL = 0
SOFTBALL AND DART THROW SCORE SYSTEM

YELLOW = 5
RED = 4
BLUE = 3
BLACK = 2
WHITE = 1
OUT = 0
Appendix H

Procedural Integrity Checklist
Procedural Integrity Checklist

Subject:______________ Checker:_____________ Date:______________

1. During the training phase, did the experimenter explain the purpose of the study to the subject?
   Yes ____________ No ___________

2. During the training phase, did the experimenter verbally explain the 4-step strategy to the subject?
   Yes ____________ No ___________

3. During the training phase, did the experimenter demonstrate the 4-step strategy to the subject?
   Yes ____________ No ___________

4. During the training phase, did the subject practice the 4-step strategy (ready, look, do, score) as trained by the experimenter?
   Yes ____________ No ___________

5. During the training phase, did the subject perform 10 trials per skill per session (total 30 trials)?
   Yes ____________ No ___________

6. During the maintenance phase, did the experimenter have the poster visible for subjects to view?
   Yes ____________ No ___________

7. During the maintenance phase, did the experimenter verbally prompt the subject to use the strategy?
   Yes ____________ No ___________

8. During the maintenance (no-reminders) phase, were the posters unavailable to the subjects?
   Yes ____________ No ___________

9. During the maintenance (reinforcement) phase, did the experimenter explain the reinforcement procedure to the subjects?
   Yes ____________ No ___________

10. During the maintenance phase, did the subject perform 10 trials per skill per session (total 30 trials)?
    Yes ____________ No ___________
11. During the generalization phase, did the experimenter not provide visual (posters) and/or verbal reminders to subjects? 
   Yes ___________ No ________________

12. During the generalization phase, did the subject perform 10 trials per skill per session (total 30 trials)? 
   Yes ___________ No ________________
Appendix I

Activity Schedule Chart
<table>
<thead>
<tr>
<th>DAY</th>
<th>ORDER OF ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Dart throw, Overhand throw, Free-throw (10 trials)</td>
</tr>
<tr>
<td>2</td>
<td>Overhand throw, Free-throw, Dart throw (10 trials)</td>
</tr>
<tr>
<td>3</td>
<td>Free-throw, Dart throw, Overhand throw (10 trials)</td>
</tr>
<tr>
<td>4</td>
<td>Overhand throw, Dart throw, Free-throw (10 trials)</td>
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<tr>
<td>5</td>
<td>Dart throw, Free-throw, Overhand throw (10 trials)</td>
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<tr>
<td>6</td>
<td>Free-throw, Overhand throw, Dart throw (10 trials)</td>
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<td>7</td>
<td>Dart throw, Overhand throw, Free-throw (10 trials)</td>
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<td>8</td>
<td>Overhand throw, Free-throw, Dart throw (10 trials)</td>
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<td>Free-throw, Dart throw, Overhand throw (10 trials)</td>
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<td>10</td>
<td>Overhand throw, Dart throw, Free-throw (10 trials)</td>
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<td>11</td>
<td>Dart throw, Free-throw, Overhand throw (10 trials)</td>
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<td>12</td>
<td>Free-throw, Overhand throw, Dart throw (10 trials)</td>
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<td>13</td>
<td>Dart throw, Overhand throw, Free-throw (10 trials)</td>
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<td>15</td>
<td>Free-throw, Dart throw, Overhand throw (10 trials)</td>
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<td>16</td>
<td>Overhand throw, Dart throw, Free-throw (10 trials)</td>
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<tr>
<td>17</td>
<td>Dart throw, Free-throw, Overhand throw (10 trials)</td>
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<tr>
<td>18</td>
<td>Free-throw, Overhand throw, Dart throw (10 trials)</td>
</tr>
</tbody>
</table>
Appendix J

Sample of Softball Throw Target
Appendix K

Sample of Dart Throw Target
Appendix L

Social Validity Questionnaire
Social Validity Questionnaire

Definition: A learning strategy refers to the use of a number of thinking processes by students that help them understand and perform skills.

Directions: Please circle the response which best describes your level of agreement or disagreement regarding each question.

1. It is important to teach learning strategies to students with developmental handicaps (DH).

   Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree

2. Basketball free-throw shooting is an important gross motor skill for students with DH to learn in terms of participation in community recreation programs.

   Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree

3. Softball throwing is an important gross motor skill for students with DH to learn in terms of participation in community recreation programs.

   Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree

4. Dart throwing is an important gross motor skill for students with DH to learn in terms of participation in community recreation programs.

   Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree

5. Basketball free-throw shooting is important gross motor skill for students with DH to learn in terms of participation in regular physical education programs.

   Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree

6. Softball throwing is an important gross motor skill for students with DH to learn in terms of participation in regular physical education programs.

   Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree

7. Dart throwing is an important gross motor skill for students with DH to learn in terms of participation in regular physical education programs.

   Strongly Agree   Agree   Undecided   Disagree   Strongly Disagree
8. It is important for students with DH to learn the 4-step strategy (ready, look, do score) used in this study and described in the consent form in order to improve basketball free-throw shooting performance.

   Strongly Agree  Agree  Undecided  Disagree  Strongly Disagree

9. It is important for students with DH to learn the 4-step strategy (ready, look, do score) used in this study and described in the consent form in order to improve softball throwing performance.

   Strongly Agree  Agree  Undecided  Disagree  Strongly Disagree

10. It is important for students with DH to learn the 4-step strategy (ready, look, do score) used in this study and described in the consent form in order to improve dart throwing performance.

   Strongly Agree  Agree  Undecided  Disagree  Strongly Disagree

11. The type of strategy used in this study is important to the physical education of students with DH?

   Strongly Agree  Agree  Undecided  Disagree  Strongly Disagree
Appendix M

Sample Data Collection Sheets
Basketball free throw data collection sheet

<table>
<thead>
<tr>
<th>Name</th>
<th>Swish (5)</th>
<th>In r/b (4)</th>
<th>Miss hit R &amp; B (3)</th>
<th>Miss but hit R (2)</th>
<th>Miss but hit B (1)</th>
<th>Airball (0)</th>
<th>Total</th>
</tr>
</thead>
</table>

Swish = 5  
In but the ball hit rim or board = 4  
Miss but the ball hit rim and board = 3  
Miss but the ball hit rim = 2  
Miss but the ball hit board only = 1  
Airball = 0
Softball throw data collection sheet

<table>
<thead>
<tr>
<th>Name</th>
<th>Yellow (5)</th>
<th>Red (4)</th>
<th>Blue (3)</th>
<th>Black (2)</th>
<th>White (1)</th>
<th>Miss (0)</th>
<th>Total</th>
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Yellow (5 points): The Bull's eye.
Red (4 points): The Second circle.
Blue (3 points): The Third circle.
Black (2 points): The Fourth circle.
White (1 point): The Fifth circle.
Miss (0 point): Miss the target.
Note: If the ball hit the line, count for the higher score circle.
Dart throw data collection sheet

<table>
<thead>
<tr>
<th>Name</th>
<th>Yellow (5)</th>
<th>Red (4)</th>
<th>Blue (3)</th>
<th>Black (2)</th>
<th>White (1)</th>
<th>Miss (0)</th>
<th>Total</th>
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Yellow (5 points): The Bull's eye.
Red (4 points): The Second circle.
Blue (3 points): The Third circle.
Black (2 points): The Fourth circle.
White (1 point): The Fifth circle.
Miss (0 point): Miss the target.
Note: If the ball hit the line, count for the higher score circle.