THE EFFECTS OF VARIED TARGET SIZE
ON BASEBALL PITCHING ACCURACY

A thesis submitted in partial satisfaction of the requirements for the degree of Master of Arts in
Physical Education

by

Terry Sobel

June, 1972
This thesis of Terry Sobel is approved:

California State University, Northridge
June, 1972
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>LIST OF TABLES</td>
<td>v</td>
</tr>
<tr>
<td>LIST OF FIGURES</td>
<td>vi</td>
</tr>
<tr>
<td>ABSTRACT</td>
<td>vii</td>
</tr>
<tr>
<td>Chapter</td>
<td></td>
</tr>
<tr>
<td>1. INTRODUCTION</td>
<td>1</td>
</tr>
<tr>
<td>The Problem</td>
<td></td>
</tr>
<tr>
<td>Statement of the Problem</td>
<td>3</td>
</tr>
<tr>
<td>Statement of the Purpose</td>
<td>3</td>
</tr>
<tr>
<td>Hypothesis</td>
<td>3</td>
</tr>
<tr>
<td>Importance of the Study</td>
<td>3</td>
</tr>
<tr>
<td>Scope and Limitations</td>
<td>4</td>
</tr>
<tr>
<td>Definition of Terms</td>
<td>5</td>
</tr>
<tr>
<td>Organization of the Remaining Chapters</td>
<td>5</td>
</tr>
<tr>
<td>2. REVIEW OF LITERATURE</td>
<td>7</td>
</tr>
<tr>
<td>Accuracy Related to Motor Learning</td>
<td>7</td>
</tr>
<tr>
<td>Other Factors Related to Accuracy</td>
<td>8</td>
</tr>
<tr>
<td>Specificity and Transfer of Learning</td>
<td>14</td>
</tr>
<tr>
<td>Implication for the Present Study</td>
<td>15</td>
</tr>
<tr>
<td>3. PROCEDURES AND EXPERIMENTAL DESIGN</td>
<td>17</td>
</tr>
<tr>
<td>Preliminary Investigation</td>
<td>17</td>
</tr>
<tr>
<td>Selection of Subjects</td>
<td>18</td>
</tr>
<tr>
<td>Chapter</td>
<td>Page</td>
</tr>
<tr>
<td>------------------------------------------------------------------------</td>
<td>------</td>
</tr>
<tr>
<td>Apparatus and Equipment</td>
<td>19</td>
</tr>
<tr>
<td>Design of the Study</td>
<td>21</td>
</tr>
<tr>
<td>Practice Procedure</td>
<td>22</td>
</tr>
<tr>
<td>Testing Procedure</td>
<td>25</td>
</tr>
<tr>
<td>Motivation</td>
<td>26</td>
</tr>
<tr>
<td>Statistical Design</td>
<td>27</td>
</tr>
<tr>
<td><strong>4. FINDINGS AND INTERPRETATION OF THE DATA.</strong></td>
<td>28</td>
</tr>
<tr>
<td>Reliability of the Test</td>
<td>29</td>
</tr>
<tr>
<td>Significance of Difference Between Groups</td>
<td>30</td>
</tr>
<tr>
<td>Significance of Difference Within Groups</td>
<td>34</td>
</tr>
<tr>
<td>Discussion</td>
<td>36</td>
</tr>
<tr>
<td>Summary of Major Findings</td>
<td>40</td>
</tr>
<tr>
<td><strong>5. SUMMARY, CONCLUSION, AND RECOMMENDATIONS</strong></td>
<td>42</td>
</tr>
<tr>
<td>Summary</td>
<td>42</td>
</tr>
<tr>
<td>Conclusion</td>
<td>43</td>
</tr>
<tr>
<td>Recommendations for Future Studies</td>
<td>44</td>
</tr>
<tr>
<td><strong>LIST OF REFERENCES</strong></td>
<td>47</td>
</tr>
<tr>
<td><strong>APPENDIXES</strong></td>
<td>50</td>
</tr>
<tr>
<td>Appendix A</td>
<td>51</td>
</tr>
<tr>
<td>Appendix B</td>
<td>53</td>
</tr>
</tbody>
</table>
# LIST OF TABLES

<table>
<thead>
<tr>
<th>Table</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pearson Reliability Coefficients of the Baseball Pitching Task on the Pre-test and the Post-test, Using Odd Versus Even Scores</td>
<td>30</td>
</tr>
<tr>
<td>2. A Comparison of the Three Experimental Groups on the Pre-test.</td>
<td>31</td>
</tr>
<tr>
<td>3. Significance of Difference Between the Three Experimental Groups on the Pre-test, Using Mean Scores</td>
<td>32</td>
</tr>
<tr>
<td>4. Significance of Difference Between the Three Experimental Groups on the Mid-test, Using Mean Scores</td>
<td>33</td>
</tr>
<tr>
<td>5. Significance of Difference Between the Three Experimental Groups on the Post-test, Using Mean Scores</td>
<td>34</td>
</tr>
<tr>
<td>6. Significance of Difference Within the Three Experimental Groups Between the Pre-test, and Post-test, Using Mean Scores</td>
<td>35</td>
</tr>
</tbody>
</table>
## LIST OF FIGURES

<table>
<thead>
<tr>
<th>Figure</th>
<th>Description</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Target Dimensions</td>
<td>20</td>
</tr>
<tr>
<td>2.</td>
<td>Diagram of the Practice and Testing Area</td>
<td>24</td>
</tr>
<tr>
<td>3.</td>
<td>Performance Levels of the Three Experimental Groups on the Pre-test, Mid-test, and Post-test</td>
<td>36</td>
</tr>
</tbody>
</table>
ABSTRACT

THE EFFECTS OF VARIED TARGET SIZE ON BASEBALL PITCHING ACCURACY

by

Terry Sobel

Master of Arts in Physical Education

June, 1972

The purpose of this study was to determine the effects of practice on rectangular shaped targets of different measurements upon baseball pitching accuracy. The practice targets measured either nine by fifteen inches, seventeen by thirty inches, or twenty-five by forty-five inches. Baseball pitching accuracy was measured using a target with the dimensions of seventeen by thirty inches. Twenty-four eighth grade boys were assigned to either a large target practice group, a regular target practice group, or a small target practice group.

The subjects were assigned to their experimental groups on the basis of scores achieved on a pre-test. A regular sized target measuring seventeen by thirty inches was used for the pre-test. Assignment of subjects to experimental groups resulted in groups of equal ability with respect to baseball pitching accuracy. Subsequently, subjects were given eight days of practice on their respective
respective targets, a mid-test on a regular target, followed by eight more group practice sessions. A post-test on regular targets was administered at the conclusion of the study.

The null hypothesis was postulated and stated that no difference in baseball pitching accuracy would exist among or between groups practicing on targets of nine by fifteen inches, seventeen by thirty inches, or twenty-five by forty-five inches.

The null hypothesis was accepted when comparing small with medium size targets, or medium with large size targets, but was rejected when comparing small with large size targets.
Chapter 1
INTRODUCTION

If winning baseball contests is a goal of coaches and athletes, a team effort must be made to score as many runs as possible while allowing the opposing team as few runs as possible. A team which allows its opponents to score more than it does can not be a winner.

Baseball authorities unanimously agree that good pitching is the most important factor in preventing the opposing team from scoring runs. This view was supported by Mann when he claimed that experienced baseball managers and players regard pitching, "... as responsible for anywhere from 60 to 85 percent of a team's chances of winning a single game, or pennant." (24:23)

Pitching is the most important facet of defensive baseball, and control or accuracy of throwing is the most important ingredient of effective pitching. It makes little difference how hard a ball is thrown, or how devious its flight toward homeplate, unless it consistently passes through some portion of the strike zone. Lew Watts observed that,

... control is the main essential in successful pitching. Without it the most overpowering of hurlers can not rise above mediocrity. (35:12)
One should realize that there are varying degrees of control. In youth leagues, a youngster who can regularly pitch the ball through any portion of the strike zone is said to have good control. As skill levels of competition progress, so much a pitcher's control. At the ultimate level of baseball competition, the major leagues, most pitchers are able to consistently pitch to spots or zones within the strike zone itself, with a variety of pitches.

Tom Seaver, an outstanding performer in the major leagues, stated, according to Weiskopf, that,

Control means more than just throwing the ball into the strike zone. It means moving the ball around, in and out, up and down, keeping the batter constantly off balance. (36:60)

With this same end in mind, thousands of baseball coaches are attempting to improve their pitchers' control. They are aided in their task by a number of baseball articles (5, 14, 34, 35, 36) which suggest various methods of improving pitching accuracy. The mechanics of pitching, (including photographic analysis of excellent performers), pitching psychology, and pitching drills are the topics most often covered.

Many people associated with baseball, such as Edwards (14), Watts (35), and Weiskopf (36), have concerned themselves with improvement of pitching accuracy. This investigation was undertaken to further the search for a method of developing and improving pitching control.
Statement of the Problem

The problem under investigation in this study is that not enough is known regarding effective ways to develop accuracy in baseball pitching.

Statement of the Purpose

The purpose of this investigation was to determine the effects of practice on rectangular shaped targets of different measurements upon baseball pitching accuracy. The targets measured either nine by fifteen inches, seventeen by thirty inches, or twenty-five by forty-five inches.

Hypothesis

No difference in baseball pitching accuracy exists between the scores of groups practicing on targets of different dimensions: nine by fifteen inches, seventeen by thirty inches, or twenty-five by forty-five inches.

Importance of the Study

The study was designed to deal with an area of interest to a large number of athletes and physical educators. Many articles have been written on pitching accuracy, but the majority of these have dealt with the mechanics of the skill. Little research has been conducted for the purpose of determining the effect of target size on pitching accuracy. If increasing or decreasing the target size during pitching practice can improve the pitching accuracy
of a player, then training regimens could be established which would be of great help to all baseball programs.

The study might also aid investigators in the area of task difficulty as related to transfer of learning. If small-target practice assists performers in throwing accurately to regular targets, one small piece of evidence would be added to support the claim that there is more positive transfer from the relatively difficult to the relatively easy than from the relatively easy to the relatively difficult.

Scope and Limitations

The study involved twenty-four eighth grade junior high school boys ranging in age from twelve through fourteen years. The subjects were chosen only for their ability to meet the testing schedule. Skills and motivation were not factors in the initial selection of the subjects. All of the subjects practiced at the same time of day for each practice session and were all given the same basic instructions in the same manner.

The study was limited to practice during twenty-four consecutive school days. No controls were placed on outside throwing practice. Rubber soled shoes were the only specific dress requirement, although it was suggested that subjects remove any cumbersome shirts or coats which might inhibit task performance. The baseballs, while not
new, were all suitable for the study. The seams and stitches were intact throughout the study. More subjects should have been used in each group and the practice period could have been extended beyond 16 days.

**Definition of Terms**

The following terms are defined in order to clarify meanings of terminology used in this study:

**Baseball pitching accuracy.** The total score achieved in twenty-four throws at the target designed for the practice sessions and the tests.

**Pitching mark.** A chalk mark drawn in asphalt pavement measuring eighteen by six inches served as a pitching mark. The front edge of the mark was forty-five feet from the face of the target.

**Regular target.** A target constructed of three quarter inch plywood covered with fiberboard. The rectangular target was divided into four equal sections and spray painted yellow, blue, white, and brown. The target was attached to a chain linked fence by means of a metal snap clipped through eye bolts in the back of the target.

**Organization of the Remaining Chapters**

This study is organized into five chapters. The following explanation is included to indicate the steps
taken to complete the study.

Chapter 2 contains a review of the literature related to the improvement of baseball pitching accuracy. Chapter 3 describes the procedures and techniques by which the study was conducted. Chapter 4 contains the statistical analysis and the interpretation of the findings. Chapter 5 summarizes the investigation, presents the conclusion, and offers recommendations for future research.
Chapter 2

REVIEW OF LITERATURE

At the turn of the nineteenth century, Robert Woodworth observed that, "... it is the accuracy of a movement that makes it purposive." (37:466) Literature written since Woodworth's statement contains a number of articles dealing with the improvement of movement accuracy in a variety of tasks. However, little has been done in the way of research to determine the effects of target size on throwing accuracy. Literature related to this study is organized into the following sections: (1) accuracy as related to motor learning; (2) other factors related to accuracy; (3) the specificity of more learning.

Accuracy Related to Motor Learning

One factor which determines the accuracy of a performance is the degree of motor ability achieved by the performer prior to the performance itself. During the early stages of learning, the learner must be continually aware of the mechanics of the activity. It is only after specific movement patterns can be relegated to subconscious levels and concentration focused on refining the movement.
Karpovich stated that,

In the beginning, careful thought must be given to every detail of the action. By practice, these details are eventually executed almost unconsciously, and, in the end, the cerebral cortex learns how to correlate all the necessary muscular requirements to a nicety. After sufficient practice, muscular reactions that were once conscious are made almost automatic and probably, become conditioned reflexes. (19:34)

Cratty concurred when he stated that,

During the initial stages of learning, a mobilization of the higher mental processes seems involved in the learning of a motor task. This dependence upon central controlling mechanisms seems to elicit a pattern of generalized tension in the form of muscle stiffness. It is as though the motor commands from the nervous system were diffused, resulting not only in a lack of precision movement but also in general inefficiency. Upon repetition of the skill, a reorganization of feedback control, first involving the higher mechanisms, and then progressively lower and lower mechanisms, until the act becomes an organized self-regulating activity. (10:62)

While some degree of learning probably occurred after the first performance of a task, Kingsley (20) noted that repetition is necessary to achieve the higher degrees of learning. He warned, however, that "... without attention, interest, meaning, and goal, repetition is apt to be useless." (20:75)

Other Factors Related to Accuracy of Performance

A number of variables have been investigated to determine if they have a significant relationship to movement accuracy. These variables will be discussed as they have been reported in the literature.
The influence of target size on accuracy has been investigated to a slight degree. Alley (2) reported that basketball shooting accuracy of skilled college freshmen was improved when practice was taken on smaller than regulation baskets.

In a recent study involving junior high school boys, Cassidy (8) concluded that practice at regulation baskets was more beneficial than practice at a smaller target or a combination of small and regular basket practice.

Bethel (5) noted that Satchel Paige, a now retired major league pitcher renown for his pitching accuracy, developed his special ability by practicing pitching using a matchbox for a target.

Scannel designed a study, . . . to determine the effects of practice, under conditions in which the size of the practice target was varied, on accuracy in selected motor skills which involved throwing a missile at a target. (28:342)

The study involved throwing softballs and darts at circular targets measuring either one, two, or three feet in diameter. The 128 subjects, averaging nineteen years of age, threw for eight days with twenty-five throws taken each day. Scannell concluded that no positive statement favoring smaller target size could be made.

Several investigators have attempted to demonstrate improvement in accuracy by increasing or decreasing the weight of the object being thrown. Egstrom, Logan, and
Wallis reported that practice with a very light object improved accuracy when a heavier object was thrown during a test. (16:420) The authors speculated that perhaps heightened sensitivity of the kinesthetic process occurred by practicing with the lighter ball.

Brose (7) attempted to demonstrate improved baseball pitching accuracy through practice with weighted baseballs. His investigation included twenty-one college males throwing to a target thirty-five feet away. He concluded that practice with the heavier balls did not significantly improve pitching accuracy.

Maron concluded from his investigation that an increase in the weight of the projectile (to the point of manipulation) resulted in an increase in basketball shooting accuracy. (25:62)

Findings reported by Solley (31), Fulton (17), and Lockhart (21), indicated that when both speed and accuracy are desired in the final performance, practice should place equal emphasis on both. Cratty, after reviewing studies related to speed and motor learning, stated,

... when tasks are presented to children in which both speed and accuracy are equally emphasized, children below the age of eight react only to the "speed stress," while at age nine, children attempting to integrate the accuracy components performed more slowly. By the age of ten, however, the children were able to integrate both the accuracy and speed components of the task into successful performance. (11:122)
Studies (12, 18, 30) dealing with the transfer of learning between difficult and easy tasks have yielded inconclusive results. After studying the accuracy of a pursuit tracking task, Holding observed that,

... difficulty is not a useful category for the prediction of transfer of efficiency, and that the solution lies in examining the skills involved. (18:397)

Day, in review of three experiments involving difficulty summarized that,

In three experiments involving greater initial task difficulty produced by changing the target dimensions did not give rise to greater amount of transfer than when the initial task was relatively less difficult than the final task. (12:162)

In another study, Singer concluded that archery practice at distances over and under twenty-five yards did not improve shooting accuracy at a distance of twenty-five yards. (30:538)

The ability to move accurately most certainly depends on the performer's perceptive abilities. Morehouse indicated that,

Accuracy involves coordination of eye and muscle, proprioceptive sensibility, and integration of the touch receptors, the inner ear, and the other organs of balance and positioning. Eye muscle coordination is the dominant feature in learning a skill. This serves to establish the relationship of the target object to the body so as to guide the movement directly to the target. (26:64)

Drowatzky also noted the importance of visual perception in motor learning situations. He observed that,
Apparently, the more complex the motor pattern elicited, the more dependence there is upon sensory modification of neuromuscular activity. (13:378)

The effects of warm-up on throwing accuracy have also been studied. Van Huss (34) conducted an investigation involving fifty subjects throwing a baseball a distance of thirty feet. He found that overload warm-up activities yielded poor initial scores (later scores continued to rise) on a baseball throwing test. Skubic and Hodgkins (29) found that light warm-up sessions of a general nature did not improve accuracy on a basketball free throw test.

Warm-up should never be carried to the point of fatigue, as this condition adversely affects movement accuracy. After studying a pursuit rotor training program, Alderman (1) stated that fatigue produced a negative effect on the accuracy scores of rotor pursuit tasks.

Malina reported that when warm-up is used the amount should be left up to the individual performer. He noted that,

Although the literature suggests that warm-up may favorably affect throwing distance and velocity, its effects on throwing accuracy are not conclusive. The evidence, on the other hand, indicates variability in individual responses to warm-up. (23:150)

The ability to move accurately depends to some degree on the performer's ability to concentrate and deal psychologically with the testing or competitive situation. Edwards (14) claimed that a pitcher must concentrate on an exact spot in order to throw accurately. Broer (6) reported
that accuracy may be affected by the emotional aura of the situation. A performer may begin to pay more attention to the audience or the significance of the contest than to the task at hand, with a resulting decrease in the efficiency with which that task is performed.

Further, in the area of social facilitation, Cratty stated that,

Onlookers may attempt to encourage or discourage performance in direct ways. They may also, by their very presence, influence another's efforts without any obvious attempts to do so. (11:160)

In an investigation into the effects of competition on basketball shooting accuracy, Bassin (4) found that boy high school basketball players made a higher percentage of their free throws in highly stressful situations (such as a close score late in the contest) than in relatively low stress situations.

The mechanics of an activity may affect accuracy. Movement accuracy depends a great deal on efficient use of the body's musculoskeletal system. When kinesiological principles are grossly violated, accuracy of movement suffers. Edwards (15) found that changing stride length and/or foot position on the pitching rubber did not change the ability to throw accurately. In another study, Thurman (33) found that pitching control was improved by placing the foot at a forty-five degree angle on the pitching rubber.
A variety of variables influence the accuracy of a motor performance. The more a teacher and performer are aware of those variables, and to the extent they can deal with them, accuracy of motor performance can be improved.

**Specificity and Transfer of Learning**

Each motor skill or activity requires a unique blend of bodily responses. There are those who believe that transfer of learning becomes proportionally better as the tasks become more similar. In particular, studies by Namikas and Archer (27) and Lordahl and Archer (22) indicated that each learning situation is so unique that practice is most efficient when the skill practiced is, as near as possible, identical to the skill to be performed.

Namikas and Archer (27) cited a previous study by Lordahl and Archer (22) which suggested that the subject "... learns a given set of motor components for performing a particular task." When the task is changed even slightly, the motor components required to perform the task must also be adjusted. (27:112)

In support of this position, reference is made to investigations by Cassidy (8), Scannell (28), Holding (18), Day (12), and Singer (30), previously mentioned in this chapter. Specifically, each of these investigators concluded that practice at other than the precise skill to be performed did not improve performance significantly.
Bachman (3) conducted a study which offered further credence to the above position. He had subjects perform two balance type tasks. There was no significant relationship between groups in the rate or amount of learning. He concluded that, "... the results substantiate the theory of task specificity of motor abilities." (3:11)

To summarize the findings found in the literature reviewed, accuracy of motor performance certainly depends on the degree of motor ability achieved by the performer prior to the performance. The skilled performer will perform more accurately than the unskilled performer.

In summary, factors which have been studied in relation to their effect on the accuracy of performance include target size, the weight of the projectile to be thrown, the performer's perceptive abilities, warm-up prior to performance, the emotional aura surrounding the performance, and the mechanics of the specific activity to be performed. Generally, it appeared that practice was most efficient when it very nearly or exactly represented the task to be performed. When a practice task deviates even slightly from the criterion test, a slightly different set of neuromuscular responses is also elicited.

Implication for the Present Study

It is generally believed by teachers, coaches, and athletes that accuracy in throwing performance, such as
baseball pitching accuracy, can be improved. While a variety of factors seem to affect throwing accuracy, no complete training program has yet been devised to significantly improve a pitcher's control.

A review of the literature revealed that some authors and investigators believe accuracy can be improved by imposing increased demands during practice sessions such as manipulating the weight of the object to be thrown or decreasing the size of the target. Others believe that the best practice conditions are those which most exactly duplicate the performance conditions. There is no conclusive evidence to support or refute the position that varying the practice-target size is an effective means of improving baseball pitching control. This study provided an opportunity to study the effects of varied target size on baseball pitching accuracy.
Chapter 3

PROCEDURES AND EXPERIMENTAL DESIGN

The purpose of this investigation was to determine the effects of practice on varied target size on baseball pitching accuracy. Included in this chapter will be the discussion of the preliminary procedures, the selection of the subjects, the apparatus used, the practice and testing procedures, the design of the study, and the treatment of the data.

Preliminary Investigation

Ten eighth grade subjects participated in a preliminary study. The purposes of the study were to: (1) develop the test and the testing apparatus, (2) refine practice and testing procedures, and (3) refine procedures for collection of the data. The pilot study consisted of three sessions. On the first day, the subjects were introduced to the testing procedure, shown proper throwing form, and were allowed to practice throwing to one another. It was the opinion of this investigator that each of the ten subjects possessed sufficient throwing skill to continue with the pilot study. On the second day, each subject took a test of twenty-eight throws on a regular sized target. On the third day of the pilot study, the
same ten subjects were again tested on the regular targets. At the conclusion of the pilot study, the target and the testing and practice procedures were evaluated. The target was found to be plainly visible to the subjects (according to their subjective evaluation) and withstood the test with no deterioration. It was concluded that the targets which had been designed for the study well satisfied the criteria of durability and visibility.

The test and practice procedures proved to be efficient and the data were collected accurately, objectively, and without undue confusion. The scores from the first test were correlated with the scores of the second test by means of rank order correlation and the scores were found to be a fairly reliable measure of baseball throwing ability. The reliability of twenty-eight throws at the regular targets proved to be .767. A rho of .648 was required to be significantly reliable at the five percent level of confidence.

Selection of Subjects

The subjects selected for participation in this investigation were twenty-four boys in an eighth grade physical education class at Mount Vernon Junior High School in Los Angeles. Factors which limited the number of subjects were "restrictive" medical classifications, and poor attendance records in school. An earthquake of considerable
magnitude which occurred six weeks before the study began forced closure of some of the school's facilities and many resultant schedule changes for the students. The relatively small size of the physical education class used in the study was a result of those necessary changes in schedule.

Apparatus and Equipment

The apparatus developed and tested in the pilot study proved to be suitable for the study.

Targets. The targets were constructed of three-quarter inch plywood covered with fiberboard. The rectangular targets were divided into equal sections spray painted yellow, blue, white, and brown (see Figure 1.). The targets were attached to a chain link fence by means of a metal snap clipped through an eye bolt placed in the back of the target.

- Small target. This target measured nine by fifteen inches.
- Regular target. This target measured seventeen by thirty inches.
- Large target. This target measured twenty-five by forty-five inches.

Baseballs. Three dozen Spaulding baseballs were used during the practices and tests. While the balls were
not new, they were equal to the extent that all seams and stitches were in good repair.

Design of the Study

The study was in progress for twenty-four consecutive school days. Before the program began, the subjects attended an introductory session where the purpose of the study was explained, the test design was briefly discussed, and the testing apparatus was introduced. Three boys were chosen to serve as scorers for the study. They were shown how to score and were given an opportunity to practice scoring before the study began. Since these boys were not being tested, and had proved to be efficient, it was believed that their efforts were impartial, reliable, and accurate.

Subjects were directed to the field on the first day and shown the exact procedures to be used for the test and practice. On the second day, proper throwing form (which included maintaining visual contact with the target, gripping the ball properly, applying correct summation of forces, and proper follow through) was demonstrated to the subjects. Each of the subjects was then allowed to practice throwing to a partner at a distance of no more than sixty feet.

On the third day of the study, a pre-test was administered to each subject on a regular sized target. The
The fourth day was reserved for and used by any subjects who had missed the pre-test the day before.

With the scores of the pre-test placed in rank order, the subjects were assigned to one of three equated groups. Group A was the small target group, Group B was the regular target group, and Group C was the large target group. Each subject was assigned in order until each of the subjects had been assigned to one of the three experimental groups: A, B, or C Group. To clarify, the subject with the highest score was placed in Group A, the second highest score was placed in Group B, and the third highest score was placed in Group C. The fourth highest score was also placed in Group C, the fifth highest score was placed in Group B, and the sixth best score was placed in Group A. This assignment of subjects to groups by the rank order of scores was continued until each of the twenty-four subjects had been placed in one of the experimental groups.

Practice Procedure

Once equated testing groups had been established, subjects began eight consecutive school days of practice. The subjects reported to class on practice days and participated in three minutes of light stretching exercises in order to allow for some degree of general warm-up. These exercises included toe touching, trunk bending, jumping, and arm rotation. The subjects then went to their assigned groups and began practice. The practice involved rotation
of the subjects within their respective areas (see Figure 2.) A subject was first a thrower, then a ball retriever on the left side of the target, than a ball retriever on the right side of the target. At the conclusion of the group practice for the day, each subject was sent to another playing area to work on one of several softball drills and games. It should be noted that as subjects were sent from the area upon completion of their practice, fewer and fewer subjects remained on the waiting bench. With an ever decreasing number of "spectators" sitting on the waiting bench, any effects from audience presence or participation would not have been equal for each student. However, subjects remained in the testing area on test days and there was no set order for throwing on a given day so that any effects of unequal audience presence were most probably distributed throughout the sample during the study.

During the practice and test periods, subjects stood forty-five feet from the target and threw to zones painted on the target. The upper left quarter of the target was painted brown, the upper right quarter was painted yellow, the lower right quarter was painted blue, and the lower left quarter zone was painted white.

The scorers always made the upper right hand quarter zone the target for the first throw for each subject. Each throw after the first throw was to be aimed at the next zone in the clockwise position. This rotation of zones was
A. Pitcher  
B. Retriever  
C. Retriever  
D. Subjects waiting  
E. Scorer

Figure 2

Diagram of the Practice and Testing Area
followed whether or not the previous throw had struck its mark.

Each subject was given twenty-four throws during the practice and the tests. When a subject completed his turn, the members of his experimental group rotated to their new positions. This procedure continued for the duration of the period (approximately thirty-six minutes).

Testing Procedure

The test procedure was the same as the practice procedure except that the subjects remained in the area when finished with their test and a score was kept for their throws. On test days, subjects reported to class and were read the following instructions:

1. When your turn arrives to be tested, give your name to the scorer before you begin throwing.

2. Each of you is allowed two and only two practice throws before you begin your test.

3. Once you have begun the test, continue throwing as accurately as possible for twenty-four throws.

4. The object of the test is to hit the zone on the target which the scorer will designate before each throw.

5. Scorers, score each ball as it strikes the face of the target. Count "liners" as being designated on target. Total the score at the end of each subject's test.
6. Scorers, call out the zone to be hit with the ball on each throw. Begin with the zone in the upper right hand quarter and rotate the zones to be hit clockwise about the target on each throw, whether or not the previous throw struck the zone indicated.

Scoring was graded in the following manner: One point was granted for a hit anywhere on the target, plus one point if the zone indicated by the scorer, including its boundary line, was struck. A throw which failed to strike any portion of the target face was zero.

Motivation

Optimum motivation of the learner to achieve a goal is one of the most important factors in learning a motor skill. The study was designed to provide what this investigator felt were highly desirable goals for junior high school boys to achieve. First, the baseballs were used as incentives. One ball was given to the subject with the best score in each group for the pre-test, the mid-test, and the post-test. Balls were also given for the most improvement for each group after the mid-test and the post-test. In addition, the subject's pitching scores on the post-test were to be included when grades for the semester were calculated.

Boys this age often display a great desire to better their peers in physical activities and stunts. Therefore
the testing situation offered each student the possible intrinsic motivation to perform well on the tests, as well as the extrinsic incentives cited above.

Statistical Design

The subjects were assigned to equated experimental groups on the basis of their pre-test scores. They were then tested after eight practice sessions, and tested again at the conclusion of the study. The groups were examined for differences in learning by using the t ratio. The group mean scores of the three experimental groups were compared to determine the significance of difference between the groups at the conclusion of the study. The group mean scores of each experimental group on the pre-test, and the post-test were also analyzed to determine the significance of difference within the experimental group.

Chapter 4 will present the statistical analysis of the data as well as the major findings of the study.
Chapter 4

FINDINGS AND INTERPRETATION OF THE DATA

This study was conducted to determine the effects of varied target size during practice on baseball pitching accuracy. Specifically, subjects practiced on targets measuring nine by fifteen inches, seventeen by thirty inches, or twenty-five by forty-five inches. Subjects were tested for their baseball pitching ability by throwing to a target measuring seventeen by thirty inches. The subjects were assigned to one of three experimental groups by rank order determined by their pre-test scores. Group A practiced exclusively on small targets, Group B practiced only on regular targets, and Group C practiced exclusively on large targets. The study consisted of practice and tests for twenty-four consecutive school days. The purpose of this chapter is to present an analysis of the data collected.

The data of the study were analyzed to determine (1) if the baseball pitching test designed for the study was a reliable measure of baseball pitching ability, (2) if the groups were equal in throwing ability at the onset of the study, and (3) if significant differences occurred within the experimental groups or between the experimental groups as a result of the imposed experimental variables.
This chapter concludes with a summary of the major findings of the investigation.

Reliability of the Baseball Pitching Test

The reliability of the baseball pitching test was determined from data collected during the preliminary investigation and the pre-test and the post-test. In the former it was determined by the use of the rank-difference method of correlation. Clarke suggested this method be used when,

... the scores are arranged as ranks, when the number of cases is small, and when it would be cumbersome and impractical to use the more detailed product moment method described above. (9:422)

The rank-difference was calculated during the preliminary investigation for two tests on regular targets. Ten subjects were involved in the preliminary investigation. The reliability of twenty-five throws at the regular target proved to be .767. A rho of .648 was required for the five percent level of confidence and a rho of .794 was required for significance at the one percent level of confidence. (32:237)

The reliability of the pitching test was also measured on the pre-test and the post-test by the use of the split halves method. Pearson's product moment correlation coefficients were calculated between odd and even scores for all twenty-four subjects on both the pre-test
and the post-test. The data appear in Table 1.

<table>
<thead>
<tr>
<th>Test</th>
<th>Number of Subjects</th>
<th>r</th>
<th>Level of Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre-test</td>
<td>24</td>
<td>.681</td>
<td>.01</td>
</tr>
<tr>
<td>Post-test</td>
<td>23</td>
<td>.892</td>
<td>.01</td>
</tr>
</tbody>
</table>

Reliability of twenty-four throws during the pre-test, using odd versus even scores was .681. Reliability needed for significance at the one percent level of confidence was .515. (32:36) Reliability of twenty-four throws during the post-test, again using odd versus even scores, was .892. Reliability needed significance at the one percent level of confidence was .526. (32:236)

Significance of Difference Between Groups

After administering the pre-test to the entire group of subjects, and then assigning the subjects to one of the three experimental groups on the basis of their rank score achieved on the pre-test, it was necessary to determine the performance equality of the three groups with respect to baseball pitching ability.
Table 2

A Comparison of the Three Experimental Groups on the Pre-Test

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean Score</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>A (small target)</td>
<td>10.6</td>
<td>5.84</td>
</tr>
<tr>
<td>B (reg. target)</td>
<td>10.4</td>
<td>5.58</td>
</tr>
<tr>
<td>C (large target)</td>
<td>10.5</td>
<td>5.00</td>
</tr>
</tbody>
</table>

Table 2 shows that the means and standard deviations of the three experimental groups, when compared with one another, were very similar. According to Clarke, groups, "... which have very similar measures of central tendency and a similar scatter of scores about the mean can be accepted as being equated." (9:405)

The results of the t test, also used to determine if significant differences existed between the groups after the pre-test, are shown in Table 3.
Table 3
Significance of Difference Between the Three Experimental Groups on the Pre-Test, Using Mean Scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Group</th>
<th>Mean</th>
<th>Diff.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10.6</td>
<td>B</td>
<td>10.4</td>
<td>.2</td>
<td>.08</td>
</tr>
<tr>
<td>B</td>
<td>10.4</td>
<td>C</td>
<td>10.5</td>
<td>.1</td>
<td>-.05</td>
</tr>
<tr>
<td>A</td>
<td>10.6</td>
<td>C</td>
<td>10.5</td>
<td>.1</td>
<td>.05</td>
</tr>
</tbody>
</table>

Note: None of the groups was significantly different from any of the other groups.

No comparison of groups yielded a $t$ score near the required 2.15 for significance of difference at even the five percent level of confidence. (32:235) It was concluded that there were no significant differences between the groups formed on the basis of scores made on the pre-test.

The pitching scores of the experimental groups were then examined for differences between the groups after the mid-test. The data are presented in Table 4.
Table 4

Significance of Difference Between the Three Experimental Groups on the Mid-Test, Using Mean Scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Group</th>
<th>Mean</th>
<th>Diff.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>13.0</td>
<td>B</td>
<td>12.9</td>
<td>.1</td>
<td>.06</td>
</tr>
<tr>
<td>B</td>
<td>12.9</td>
<td>C</td>
<td>9.5</td>
<td>3.4</td>
<td>1.25</td>
</tr>
<tr>
<td>A</td>
<td>13.0</td>
<td>C</td>
<td>9.5</td>
<td>3.5</td>
<td>1.52</td>
</tr>
</tbody>
</table>

Note: None of the groups was significantly different from any of the other groups.

No comparison of groups yielded a t near the required 2.16 for significance of difference at the five percent level of confidence. (32:235) It was concluded that no significant differences existed between the experimental groups subsequent to the mid-test. However, Group A and Group B were both able to improve somewhat on their pre-test score while Group C actually scored lower on the mid-test than they did on the pre-test.

Upon completion of the post-test, the group scores were again analyzed for differences between the groups. Table 5 reports the results.
Table 5

Significance of Difference Between the Three Experimental Groups on the Post-Test Using Mean Scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Mean</th>
<th>Group</th>
<th>Mean</th>
<th>Diff.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>15.8</td>
<td>B</td>
<td>11.3</td>
<td>4.5</td>
<td>1.89</td>
</tr>
<tr>
<td>B</td>
<td>11.3</td>
<td>C</td>
<td>9.8</td>
<td>1.5</td>
<td>.59</td>
</tr>
<tr>
<td>A</td>
<td>15.8</td>
<td>C</td>
<td>9.8</td>
<td>6.0</td>
<td>2.45*</td>
</tr>
</tbody>
</table>

*Significant at the five percent level of confidence

Table 5 shows that Group A continued their improvement from the mid-test and concluded the study with a mean score of 15.8. Group B declined slightly from its mid-test performance level and Group C remained very near its mid-test level. While there was no significant difference between Group A and Group B, or between Group B and Group C, the difference in mean scores between Group A and Group C resulted in a t score of 2.45, which was significant at the five percent level of confidence. (32:235)

Significance of Difference Within Groups

In addition to determining the differences between the groups, the differences within the groups during the course of the study were also calculated. Table 6 includes the results of the t tests which were used to determine if significant differences existed within experimental groups.
Table 6
The Significance of Difference Within the Experimental Groups Between the Pre-Test, and Post-Test, Using Mean Scores

<table>
<thead>
<tr>
<th>Group</th>
<th>Pre-test</th>
<th>Post-test</th>
<th>Diff.</th>
<th>t</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>10.6</td>
<td>15.8</td>
<td>5.2</td>
<td>1.73</td>
</tr>
<tr>
<td>B</td>
<td>10.4</td>
<td>11.3</td>
<td>.9</td>
<td>.35</td>
</tr>
<tr>
<td>C</td>
<td>10.5</td>
<td>9.8</td>
<td>.7</td>
<td>.26</td>
</tr>
</tbody>
</table>

Note: No significant differences existed within any of the groups when the mean scores of the pre-test were compared with the mean score of the post-test.

Although Group A performed better than either Group B or Group C on the post-test, the differences in the group's performances were not great enough to be considered statistically significant. Figure 3 presents the learning curves graphically.
Discussion

Evaluation of data revealed that the testing procedure was a reliable measure of baseball pitching ability and the experimental groups were found to be equal at the onset of the investigation. The significance of differences between and within the groups have also been presented.
Group A, which practiced exclusively on small targets, displayed a trend of improvement which showed no sign of declining. However, one should note that improvement levels from the pre-test to the mid-test, from the mid-test to the post-test, or from the pre-test to the post-test, were not significant.

Group B, which practiced only on regular targets, displayed an improving trend up to the mid-test, after which they began to decline in performance. Like Group A, this group did not significantly improve its baseball pitching ability during the course of the study.

Group C, which practiced exclusively on large targets, evidenced a slight decline in pitching performance between the pre-test and the mid-test, and evidenced only a slight improvement of performance between the mid-test and the post-test.

There was a significant difference between the mean scores of Group A and Group C on the post-test at the five percent level of confidence. This was the only significant difference between groups or within groups, which was encountered in the study.

The differences between the experimental groups, while not statistically significant except for the difference between Group A and Group C on the post-test, were still great enough to cause question. An answer to why
Group A and Group B were successful to some degree, while Group C clearly declined in accuracy, may be found in the psychological foundations of motor performance. It was observed by this investigator that the groups felt, shortly after the investigation began, that the small target group would score better than the other two groups because they were placed in a more demanding situation during practice. At no time did this investigator suggest this possibility to any one of the groups. The feeling was spontaneous, drawn from the a priori knowledge of junior high school boys.

The feeling that practice on the smaller targets provided an advantage perhaps made Group A more confident than Group B, and Group B more confident than Group C. If this were so, the added confidence may have given Group A psychological advantage over Group B, and Group B an advantage over Group C. Scores on the mid-test seemed to confirm this hypothesis. Group A was performing better than Group C and might do better than Group B with just a little more time. Group A's feeling that they would do better because they were practicing on smaller targets was reinforced on the mid-test. Similarly, Group C's feeling that they were at a disadvantage because of the over-sized targets used for practice were also reinforced by the mid-test results. The initial feelings regarding practice as re-
lated to pitching accuracy, coupled with the mid-test scores, may have given a psychological advantage to the groups practicing on the smaller targets. Cratty, comment-ering on the psychological effects of past experiences, stated that past success will,

... tend to make an individual less likely to lower aspiration upon encountering momentary failure, while past failure will make an individual more likely to lower his future performance when encountering failure. (11:28)

On the post-test, Group C again scored low, perhaps due to lack of concentration and/or motivation, while Group B failed to improve. Only Group A, which perhaps was the only group which felt itself capable of more improvement, actually did so.

The hypothesis that Group A performed slightly more accurately due to the success experiences gained on the mid-test is inconsistent with findings by Cassidy (8) if success during the tests is considered. If one views success as experiences gained during practice, as does Cassidy, then the large target group (Group C) would have been more highly motivated than either the regular or small target groups, for the large target group was able to hit the target far more often during practice than either of the other two groups.

Perhaps, intermittent success experiences, such as the mid-test for Group A, were capable of sustaining confidence in ability. Periods when success was not experi-
enced could be rationalized away as being due only to the
difficult demands of the practice situation.

Summary of Major Findings

The following is a summary of the major findings of
this investigation.

1. The rho of reliability, using rank-order cor-
relation, was .767 for the test during the preliminary in-
vestigation. A rho of .645 was required for significance
at the five percent level of confidence.

2. The coefficient of correlation of reliability
(r.), using odd versus even scores, was .681 on the pre-
test and .892 on the post-test. Both tests were reliable
at the one percent level of confidence.

3. The small target group was able to display the
greatest within group difference when the mean scores on
the pre-test were compared with mean scores on the post-
test. However, even the 1.73 t value obtained by comparing
Group A's pre-test scores with their post-test scores was
not statistically significant.

4. The t test used to analyze post-test differ-
ences between Group A and Group B resulted in a non-
significant t value of 1.89.

5. No significant difference in mean scores ach-
ieved on the post-test was found between Group B and Group
C. The t test revealed a critical rate of .59.
6. A significant difference in mean performance scores achieved on the post-test was found between Group A and Group C. The $t$ test used to analyze the difference between the two groups yielded a $t$ value of 2.45, which was significant at the five percent level of confidence.
Chapter 5

SUMMARY, CONCLUSION, AND RECOMMENDATIONS

Summary

This chapter contains a summary of the investigation, the conclusion of the study, implications for teaching, and recommendations for further study.

The purpose of this study was to determine the effects of varied target size on baseball pitching accuracy. The practice targets measured nine by fifteen inches, seventeen by thirty inches, or twenty-five by forty-five inches. Baseball pitching accuracy was measured by the score achieved on a target measuring seventeen by thirty inches.

The pitching test involved taking twenty-four throws at a rectangular target forty-five feet away. A score for accuracy was accorded each throw and a total score was obtained at the conclusion of the twenty-four throws.

Twenty-four boys from an eighth grade physical education class at Mount Vernon Junior High School were used in the study. Each subject was tested for baseball throwing accuracy, then assigned by the rank of his score to one of three experimental groups. Group A practiced exclusively on the small target, Group B practiced exclusively on the
regular target, and Group C practiced only on the large target. All groups were given a mid-test on regular targets after eight daily practice sessions. The subjects were then given eight more practice sessions before the post-test, which was also taken on regular targets.

To determine the reliability of the baseball pitching test, the rank-difference correlation method was used on the scores from the preliminary investigation. The reliability of the pitching test was also measured on the pre-test and the post-test by the use of the split halves method. Pearson's product moment correlation coefficients were calculated for odd versus even scores for all twenty-four subjects on both the pre-test and the post-test. Within group and between group differences in pitching performance were evaluated by using t-tests.

Conclusion

Within the limitations of this study, it is concluded that when tested on medium size targets, there is no advantage to practicing on smaller or larger targets. However, when comparing the results of the group which practiced on the small target with the group which practiced on the large target, it would appear that practicing at the small target results in more accurate throwing. Therefore, the null hypothesis is accepted regarding differences between small and medium targets, or between medium and large
targets, but is rejected regarding differences between
small and large targets.

**Recommendations for Future Studies**

As a result of this study, the following recommendations are made for future study:

1. Since the small target group evidenced a continually rising learning curve, future studies might investigate learning curves in a longer time study to determine differences in performance beyond sixteen sessions.

2. In view of the possible great effects of level of aspiration on the accuracy of a performance, future investigation might be directed toward the effect of this factor upon motor performance.

3. The study could be repeated using more highly skilled performers. In such a study, subjects might consider the possible improvement of their pitching accuracy as more of a motivating incentive. Such an intrinsic goal may serve to stimulate a more concentrated effort than the extrinsic rewards of baseballs and grades.

4. A future study could better control the motivation factor by isolating the groups so that they have no knowledge of the existence of the performance of other groups.

5. A future study should use more sophisticated statistical analysis by performing an analysis of variance
(f test) prior to investigating differences between selected groups.
LIST OF REFERENCES


APPENDIXES
APPENDIX A

SAMPLE DATA COLLECTION FORM
FOR THE PRACTICE SESSIONS
SAMPLE DATA COLLECTION FORM
FOR THE PRACTICE SESSIONS

<table>
<thead>
<tr>
<th>Group</th>
<th>Phone</th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Age</td>
</tr>
<tr>
<td>H. R.</td>
<td></td>
</tr>
</tbody>
</table>

Pre-test Score ____
1. Practice ____  9. Practice ____
2. Practice ____  10. Practice ____
3. Practice ____  11. Practice ____
4. Practice ____  12. Practice ____
5. Practice ____  13. Practice ____
6. Practice ____  14. Practice ____
7. Practice ____  15. Practice ____
8. Practice ____  16. Practice ____

Mid-test Score ____  Post-test Score ____

# of practice days ____  Pre-test, Mid-test diff. ____
Pre-test score ____  Mid-test, Post-test diff. ____
Mid-test score ____  Pre-test, Post-test diff. ____
Post-test score ____
APPENDIX B

INDIVIDUAL RAW SCORES
INDIVIDUAL RAW SCORES - GROUP A
SMALL TARGET GROUP

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre-test</th>
<th>Mid-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>A.M.</td>
<td>22</td>
<td>16</td>
<td>23</td>
</tr>
<tr>
<td>D.M.</td>
<td>16</td>
<td>13</td>
<td>15</td>
</tr>
<tr>
<td>K.S.</td>
<td>15</td>
<td>20</td>
<td>21</td>
</tr>
<tr>
<td>G.G.</td>
<td>9</td>
<td>13</td>
<td>13</td>
</tr>
<tr>
<td>A.B.</td>
<td>9</td>
<td>14</td>
<td>10</td>
</tr>
<tr>
<td>F.R.</td>
<td>6</td>
<td>9</td>
<td>8</td>
</tr>
<tr>
<td>W.Q.</td>
<td>5</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>G.H.</td>
<td>3</td>
<td>7</td>
<td>20</td>
</tr>
</tbody>
</table>
INDIVIDUAL RAW SCORES - GROUP B

REGULAR TARGET GROUP

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre-test</th>
<th>Mid-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>C.C.</td>
<td>18</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>J.T.</td>
<td>16</td>
<td>24</td>
<td>14</td>
</tr>
<tr>
<td>I.J.</td>
<td>13</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>T.F.</td>
<td>11</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>B.C.</td>
<td>9</td>
<td>11</td>
<td>15</td>
</tr>
<tr>
<td>L.F.</td>
<td>7</td>
<td>18</td>
<td>13</td>
</tr>
<tr>
<td>K.M.</td>
<td>5</td>
<td>7</td>
<td>14</td>
</tr>
<tr>
<td>D.M.</td>
<td>4</td>
<td>10</td>
<td>5</td>
</tr>
</tbody>
</table>
## INDIVIDUAL RAW SCORES - GROUP C

**LARGE TARGET GROUP**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Pre-test</th>
<th>Mid-test</th>
<th>Post-test</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.S.</td>
<td>17</td>
<td>11</td>
<td>*</td>
</tr>
<tr>
<td>L.A.</td>
<td>17</td>
<td>12</td>
<td>11</td>
</tr>
<tr>
<td>W.M.</td>
<td>13</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td>R.M.</td>
<td>12</td>
<td>19</td>
<td>9</td>
</tr>
<tr>
<td>A.J.</td>
<td>8</td>
<td>6</td>
<td>5</td>
</tr>
<tr>
<td>M.S.</td>
<td>7</td>
<td>--*</td>
<td>--*</td>
</tr>
<tr>
<td>W.Y.</td>
<td>5</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>A.H.</td>
<td>4</td>
<td>6</td>
<td>12</td>
</tr>
</tbody>
</table>

* Subject was dropped from the study due to poor attendance.