# EFFECTS OF RIGHT AND LEFT HANDED INSTRUCTIONS ON THE LEARNING AND MOTOR PERFORMANCE OF RIGHT AND LEFT HANDED SUBJECTS



by

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# CHAPTER I

## INTRODUCTION

Motor skill learning is thought of as a relatively permanent change in behavioral potential which occurs as a result of reinforced practice. When knowledge and correct performance of the task can be demonstrated, motor skill learning has occured. Understanding how motor skill is learned involves an examination of at least three identifiable stages (15). The first stage is termed the exploratory stage. The important features of this phase include the understanding of the task requirements and familiarization with the component parts of the skill. Performance at this level is related more to the cognitive ability. If the learner is given misinformation, or too much input, a state of confusion may result.

The second phase of motor skill learning, the fixation stage, consists of practicing what was perceived in phase one. Spatial and temporal organization play an important role while the learner attempts to organize and control consecutive orders of movement. In order to complete the second stage, the learner must be given appropriate feedback. If inappropriate feedback is given, the learner will be unable to determine where he erred and interference in the learning process may occur.

The third stage is termed automation and is characterized by a high degree of overlearning. The student is able to perform the skill

without conscious effort. In addition, the student is able to perform the task under conditions of distraction (2). Some learners may never reach the automative stage because of failure to understand the movements involved in the skill or because of inappropriate feedback.

The unsuccessful performance of the learner may be directly related to the instructional technique which was used by the instructor. Instructional techniques are an essential part of the process of skill learning by the student. Methods of teaching should not be limited to traditional methods of instruction. There is an awareness that instructional techniques must be applied to meet the needs of the student so the most effective learning can occur. Physical educators can play a major role in the learning of skills by giving the best type of instruction so that the learner will understand and perform at his best.

Research has been performed related to the effects of various types of instruction on the learning and the motor performance of the student. Researchers have explored the use of verbal versus nonverbal, massed versus distributed, whole versus part, and feedback versus no feedback as methods of instructing. As a result, conclusions have been drawn concerning what type of instruction should be given for the various activities and motor skills (11, 12, 21, 38, 42, 43, 45, 46).

One area in which literature is limited concerns the effects of right handed instructions on the left handed subject and left handed instructions on the right handed subject. Traditionally, the physical educator has used one instructional model for the entire class. Consequently, some subjects have received opposite handed instructions while

others have received same handed instructions. The subjects who have received opposite handed information have viewed and listened to mirror type instructions. According to the identifiable stages of motor skill learning, these subjects may have received misinformation in the cognitive phase, and in some cases, inappropriate feedback in the fixation stage. As a result, some of these subjects may never attain the automatic execution of the skill or may attain incorrect automatic execution inhibiting relearning of the correct skill.

## NEED FOR THE STUDY

Normally, the right handed instructor explains or demonstrates the proper techniques for throwing, batting, and kicking while the left handed subject is required to interpret or adapt this technique to the opposite side of the body. The left handed subject is surrounded by right handed subjects. The left handed subject must move and work in a right handed world. Teaching methods of motor skill and most equipment for everyday living are designed for the right handed. Literature related to the techniques of teaching team and individual sports which involve a decision on handedness give instructions for the right handed subject (6, 33). While some opposite handed subjects are capable of adjusting to this technique others are very resistive (19).

Kerr (25), Burt (9), and Durost (14) studied the advantages to being right handed. The investigators concluded that the right handed subject compared to the left handed subject seemed less apt to be clumsy in motor coordination; better in writing; and less apt to have

reading, speech, and spatial orientation difficulties. It has been suggested that incorrect learning of motor skills involving handedness results in awkwardness, poor musculature, and poor coordination. Some have gone so far as to suggest that handedness and motor skill problems may relate to slow thinking, stuttering, and feelings of inferiority (16).

The left handed subject belongs to a minority group. Approximately five percent of the American population is left handed and it seems to be twice as common among males as females. Males seem to be less concerned with conformity in handedness. Females are more concerned and seem to have difficulty in performing when given opposite handed instructions (27, 44).

The fact that left handed subjects are a minority group living in a right handed world caused the investigator to recognize the need to design a study which delved further into the area of teaching techniques and their effects on the learner. Specifically, this study was designed to evaluate the effects of opposite handed instruction on the learning and motor performance of right and left handed subjects. Information gained from such a study could have practical applications in actual teaching situations for the physical educator.

## STATEMENT OF THE PROBLEM

The purpose of this study was to determine the effects of instruction (right and left handed) on the learning and motor performance of subjects (right and left handed) as measured by scores on a

novel ball tossing test. More specifically, it was the purpose of the study to determine:

a. The effect of instructions (right versus left handed) on the learning and skill performance of right handed and left handed subjects.

b. The effect of instruction (right versus left handed) on the learning and skill performance of male and female subjects.

c. The differences in performance of a motor task after each successive day of practice.

d. The effect of days with and days without instructions on the learning and skill performance of right handed and left handed subjects.

## LIMITATIONS OF THE STUDY

Certain limitations were present in this study and should be pointed out to the reader:

a. The subjects were given no feedback as to whether they were correctly performing the technique of the skill.

b. The instructions were audio-visual tape recorded so as to standardize the method of instruction. As a result, only a two dimensional demonstration was given as opposed to a three dimensional situation.

c. Fifty-six male and female subjects, ages 18-21, attending Kansas State University, served as subjects.

d. The period of experimentation was limited to four weeks in length.

e. The criterion used to determine lateral dominance was handedness.

f. Subjects were scheduled for a ten-minute testing period during the day, either on Monday and Wednesday or Tuesday and Thursday for a period of four weeks.

## DEFINITION OF TERMS

In order to give a full understanding of this study, certain terms require definition:

a. Motor Learning--Motor Learning is a relatively permanent change in behavior potential which occurs as a result of reinforced practice (26).

b. Motor Performance--Motor Performance is a translation of learning into behavior. Observed motor performance is considered a relative estimate of learning (26).

c. Lateral Dominance--Lateral Dominance refers to the habitual use, in unilateral motor tasks, of one hand, foot, or eye in preference to the opposite member (37).

# CHAPTER II

## REVIEW OF THE LITERATURE

This chapter presents a review of literature pertinent to this study. The review will include a discussion of the various types of sensory input available to the learner.

## FORMS OF SENSORY INPUT

Instructional techniques which are used in helping the student learn can be considered forms of sensory input. The sensory information which is given to the learner can either facilitate or hinder performance. Therefore, the form of instruction, whether it be verbal, nonverbal, demonstrative, whole, part, opposite handed or the same handed can either hasten or interfere with the learning of a skill.

Some forms of sensory information given to the learner can be relatively controlled by the instructor. Those forms which can be controlled are the methods of communication with the learner and the feedback given to the learner. The form of sensory input of concern in this study was communication. More specifically, this study was concerned with the effects of right and left handed verbal instructions and visual guidance on the learning of right and left handed subjects. In the literature reviewed, no information was found related to right and left handed instructions as a form of communication. Therefore, a general discussion on the types of communication available to the motor learner is presented.

Communication

One of the main objectives of a physical educator is to communicate to the subject. Communication must be in the terms of the domains of learning which are related to the purpose of the skill, the forms of the movement, and the knowledge and understanding of rules and strategy. Research related to communication generally falls into the two major categories of verbal instruction and visual guidance.

Verbal instruction. Verbal instruction refers to pretraining oral instructions which help to transmit the mechanical principles of the task. This type of instruction may facilitate performance and help in analyzing the task. Also involved are detailed explanations of the motor skill and concepts related to the mechanical principles. In reviewing the literature concerning verbal instruction as a form of sensory input, it was found that a variety of studies exist.

Judd (22) gave instructions to boys on the principles of light refraction and then asked them to hit an underwater target with a bow and arrow. The subjects who had instructions were more accurate in hitting the target as the depth of the water was changed when compared to the students who were required to rely on the trial and error method.

Miskell (34) investigated the effects of mechanical principles centered instruction on the acquisition of badminton skill. There was no significant difference between the experimental group which was taught to apply the mechanical principles and the control group. In a similar study, Broer (7) used college women of low motor ability as subjects to measure the effect of verbal pretraining. The experimental group completed instructions in mechanical principles before partici-

pating in sports activities. The control group received no instruction in mechanical principles. The subjects with previous instruction were superior to those who had not received the instructions. In another investigation, the effects of analytic instruction on the learning of a motor skill was studied. Verbal instructions were the means used to teach the principles. The experimental group learned the principles underlying the skill while the control group simply learned the task. The results showed no significant difference between groups. This suggests that one may be aware of the mechanical principles but may not possess the ability to apply them during performance (13).

When Mohr and Barrett (35) taught an experimental group to understand and apply mechanical principles to the performance of the front crawl, back crawl, side and elementary back strokes, the experimental group made significant greater improvement. Exposing students to an understanding and application of mechanical principles seemed to facilitate learning.

Before practicing on a discrimination problem involving matching the correct switch to a light stimulus, subjects received verbal training. The groups which had verbal training trials did not show evidence of significant transfer to motor performance (3). Baltig (4) performed a similar study by measuring the transfer from verbal pretraining to motor performance as a function of motor task complexity. Verbal training facilitated performance on the simpler motor tasks but no benefit was shown from the pretraining on the complex tasks.

Another investigation involving the effects of various kinds of relevant verbal pretraining on subsequent motor performance was conducted by McAllister (32). The investigator found that verbal pretraining facilitated a task in which subjects were required to move a rod to various star points when confronted with colored stimuli. The verbal pretraining seemed to reduce errors.

When Lundgate (30) and Koch (27) gave manual guidance upon maze learning, it was found to be more beneficial than trial and error learning. However, it was found that manual guidance was more effective during the early stages of learning before incorrect habits were formed. Carr (10), on the other hand, found that the effectiveness of manual guidance decreased with the amount given. Also, it was most effective after the subjects had explored the maze on their own.

When the effects of verbal instructions of speed and accuracy upon the learning of a motor skill were investigated, it was concluded that the verbal instructions directly affected performances. The subjects responded according to what was emphasized, speed or accuracy. The investigators suggested that a more detailed explanation of the principles be given while instructing (40).

Similar results were confirmed when Woods (45) studied the effects of varied emphasis on speed and accuracy in learning the tennis forehand drive. The subjects trained in one of three treatments which involved imitated instruction related to accuracy and later instruction in velocity; imitated instruction related to attainment of velocity and later instruction related to accuracy; equal and simultaneous emphasis on speed and accuracy. The results indicated that equal emphasis on

speed and accuracy produced the best results. Also, initial emphasis on accuracy was less desirable than initial emphasis on velocity.

Visual guidance. Various forms of visual guidance can be provided for the subject to aid in the acquisition of a skill. Investigators have studied the effectiveness of visual guidance upon skill learning.

Twitmeyer (41) presented evidence that visual guidance allows the subject to view expert performance and was effective for early acquisition of skill. Anderson (1) further emphasized the benefits of visual guidance in basketball shooting. A significant difference in performance was found in favor of the subjects learning the backboard spot aiming technique over the group not using the spots.

The effectiveness of daylight projection loop films on badminton playing ability was studied by Gray and Brumback (18). Subjects were taught badminton in classes that met three times per week for ten weeks. Two of the four classes had their instructions supplemented by viewing loop films of seven basic strokes. Midterm testing showed the experimental group had made significant improvement. The final test showed that both groups had made significant improvement. The investigators concluded the viewing of the films appeared to hasten the learning of the experimental group. In another study, no significant difference existed between the groups (28).

The effect of daylight projection loop film as the teaching medium in perceptual motor skill training was investigated by Murnin and Hays (36). College males learned tumbling with and without loop films. The film taught classes were taught by an inexperienced teacher

who could not perform the tumbling skills. The other group was taught by an experienced instructor who used all of the conventional teaching methods except film. The classes taught by the experienced instructor scored better on the final performance test. Although the film groups learned the skill, it was concluded that live teaching was a better method. A subsequent study measured the progress of tumbling class taught with and without the use of motion pictures. The result showed that the experimental class made more progress than did the control class (8). Lockhart (29) also found a definite value in using motion pictures as a visual guide.

Combination and comparison. Research concerning comparisons and combinations of various methods of sensory input have been reviewed.

Zuckerman (47) investigated the effect of variations in commentary upon the learning of perceptual motor tasks from sound motion pictures. The results showed that sound leading a film demonstration was more important than sound following it.

In a study concerning the learning of selected motor skill, those subjects receiving instruction through motion pictures showed most improvement. Subjects receiving oral instruction improved more than subjects receiving no instructions (39).

Karlin (23) compared the relative effectiveness of visual and verbal cues upon learning of a crank turning task. The verbal cue group was significantly superior in final training trials to the control group. In a similar study, it was found that visual and verbal cues were more effective together than verbal cues alone (24).

The effectiveness of oral directions along with demonstration has been reported by Goodenough and Brian (17). These researchers trained three groups of subjects to throw rings over a post. The group that received demonstration and comments had to follow definite patterns of performance improved more than the group who received less instruction.

Jarvis (20) investigated the effects of self instructive materials in learning selected motor skills. Analysis of data indicated that subjects using self instructive materials improved significantly in all areas tested.

A study was conducted to determine if there was any difference in a structured program of motor skill as compared to a combination of low organization. The experimental group was instructed in volleyball and basketball skills while the control group was given no specific instruction. The findings indicated that there was a significant difference between the two methods of instruction in development of motor performance. The method of skill instruction was found to be superior (31).

## SUMMARY

In summarizing the literature review, it is evident that many generalizations can be drawn. Certain recommendations may be suggested to serve as guidelines for the physical educator in planning learning experiences. The following generalizations have been concluded:

a. Knowledge of mechanical principles may increase learning.

b. An understanding of what is expected of the learner seems to be necessary.

c. Manual guidance seems to be more effective than trial and error.

d. Loop films and motion pictures are good aids but can not replace an experienced instructor.

e. The proficiencies of the instructor should be evaluated in choosing a method of communication.

The assumptions derived from the literature reviewed concerning communication methods can be applied to the physical education class. Whatever method the instructor uses, it should be centered around the needs of the subject and the abilities of the instructor.

A larger amount of learning may occur if concise and accurate instructions are given to the subject. The subject must receive correct sensory information in the early stage of learning in order to avoid a state of confusion in the later stages.

An improved learning situation will be present if the subject, right or left handed with high or low motor ability, understands the learning behavior that is expected; the proficiency level expected; and the means by which the behavior is to be measured (15).

Because the left handed subject often is exposed to opposite handed confrontations, it is possible that the left handed subject has not received concise and accurate sensory information. As a result, misinformation or inappropriate feedback may prevent the occurance of the automatic stage of skill development.

# CHAPTER III

## PROCEDURES

The purposes of this investigation were to determine the effect of instruction (right and left handed) on the learning and skill performance of right handed and left handed subjects; to determine the effect of instruction (right and left handed) on the learning and skill performance of male and female subjects; to determine the differences in performance of a motor task after each successive day of practice; and to determine the effect of days with instruction and days without instruction on the learning and skill performance of right and left handed subjects.

## SELECTION OF SUBJECTS

One hundred eight subjects (33 right and 22 left handed males, and 33 right and 20 left handed females) attending Kansas State University volunteered for this study. Fifty-six subjects were randomly selected from the volunteers to participate in the investigation. The subjects were freshmen and sophomores enrolled in physical education classes. Subjects ranged from 18 to 21 years of age with 14 being right handed males, 14 being left handed males, 14 being right handed females, and 14 being left handed females.

The subjects were assigned to one of four instructional groups on the basis of random placement. As Table I indicates, seven right

TABLE I

ASSIGNMENT OF SUBJECTS TO CELLS

| | Right Handed Subjects | Left Handed Subjects |
|---|---|---|
| Right Handed Instructions | Seven Males<br>Seven Females | Seven Males<br>Seven Females |
| Left Handed Instructions | Seven Males<br>Seven Females | Seven Males<br>Seven Females |

handed males and seven right handed females were assigned to practice after being given right handed instructions; seven right handed males and seven right handed females were to practice after being given left handed instructions; while seven left handed males and seven left females were to practice after being given right handed instructions; and seven left handed males and seven left handed females were to practice after being given left handed instructions.

## SELECTION OF TESTS

The test of skill used to measure performance was a novel ball toss which Bell (5) used in a previous study. The toss as shown in Figure 1, required an unfamiliar arm movement across the front of the body. The required projection of the toss had a high point between seven and eight feet from the ground and a horizontal distance of twenty feet. A target area placed on the floor served to measure the performance. Ropes seven and eight feet high ran perpendicular to the line of

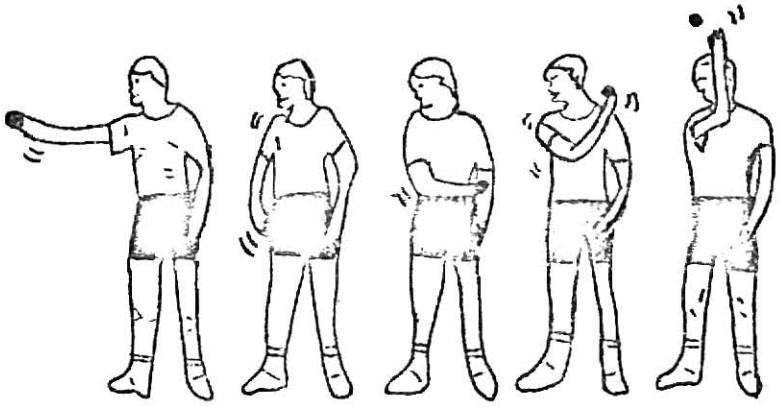

Figure 1. The Novel Handball Toss

flight at a horizontal distance of 6-1/2 feet from the starting point. Figure 2 contains a diagram of the apparatus used in the performance of the task.

The object of the task was to use the correct arm movement to toss the ball between the ropes and to hit the target. If the ball failed to go between the ropes or if it missed the target area, the subject received no point for the trial. Each subject was given twenty trials for every testing period. Therefore, each subject was credited with a score ranging from zero through twenty for each of eight days of testing.

## METHOD OF PRACTICE

Subjects were scheduled for a ten minute practice period two times a week for four weeks in either a Monday and Wednesday or a Tuesday and Thursday sequence. Sony videocorder AV3650, Sony videomonitor CVM 1924, and Sony videocamera AVC 3210 equipment was used for audio-visual taping of the instructions so as to standardize the procedures. On the first day of the two days of each week, audio-visual taped instructions were given before the subject performed. Each subject was informed to view and listen to the audio-visual taped instructions and to do exactly as told. After viewing the instructions, the subject performed the toss. No instructions were given on the second day of each week.

Instructions included a verbal explanation and a demonstration of the task to be performed. The experimenter demonstrated and explained the novel task for the right handed and the left handed subjects receiving

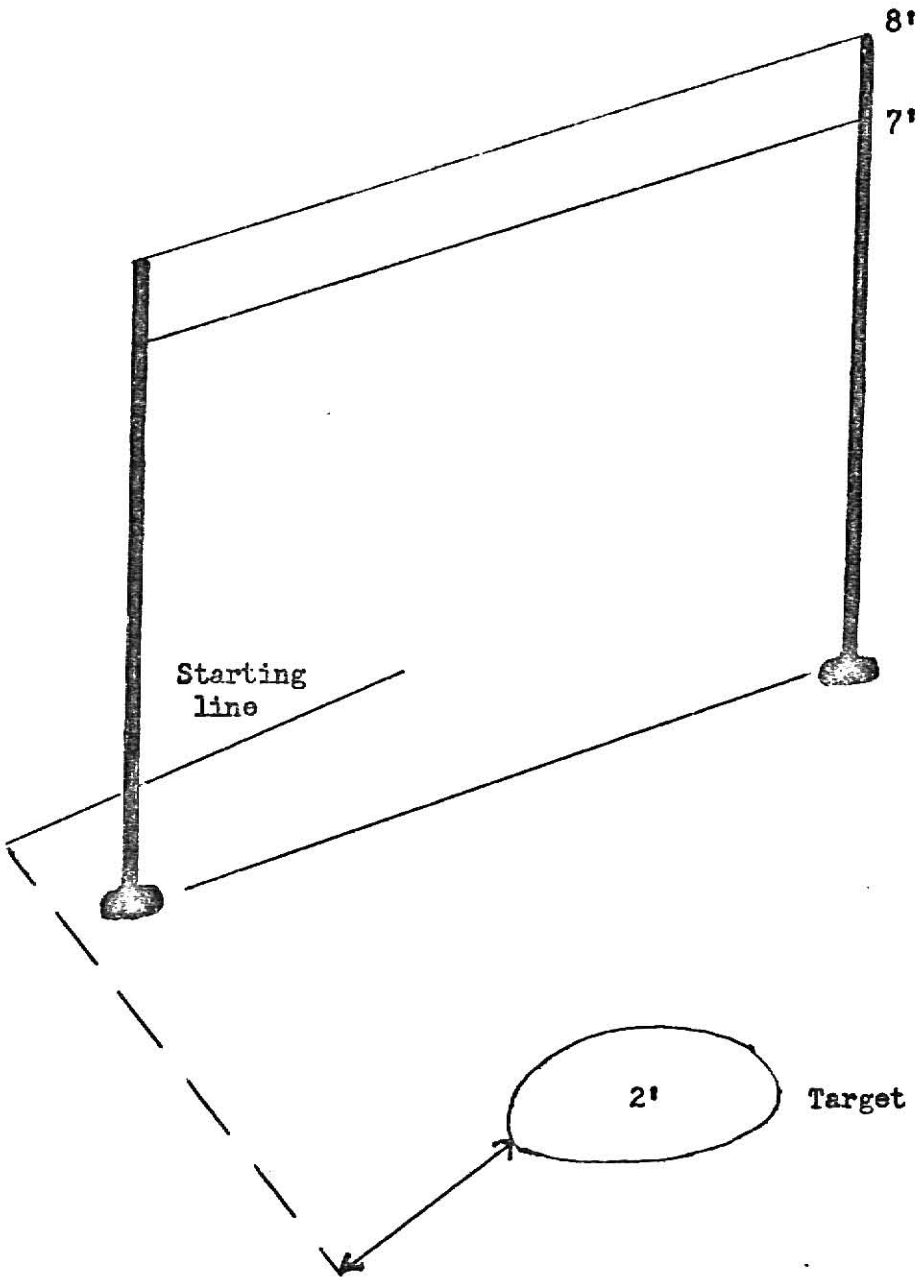


Figure 2. The Apparatus

right handed instructions. While a left handed demonstrator with equal talent performed and explained the task for right handed and left handed subjects receiving left handed instructions. The experimenter's judgement was used to determine the similarity between instructions. Appendix A contains the verbal procedures which were used to instruct each subject.

## COLLECTION OF THE DATA

The performance of the subject during practice was measured using a point system. The subject had to use the correct arm movement to toss the ball between the ropes and hit the circle. If the ball failed to go between the ropes or if it missed the target area, the subject received no points for the trial. Each subject was given twenty trials and could earn up to twenty points for every test period.

Each subject was tested eight times and all testing was completed within a four week period. Audio-visual taped instructions were given on the first, third, fifth, and seventh days while no instructions were given on the second, fourth, sixth, and eighth days.

After the data was collected, the scores were recorded on a data sheet which was chosen for the purpose of evaluating the effect of the instructions on performance. Furthermore, the effects of the days with instruction as compared to the days without instruction were assessed. Appendix B contains the individual daily scores that were recorded for use in the evaluation.

## DESIGN

Subjects performed the novel toss according to the conditions assigned the cell of which they were a member. One of the following testing conditions was assigned to each cell:

a. Seven right handed males and seven right handed females were given right handed instructions.

b. Seven right handed males and seven right handed females were given left handed instructions.

c. Seven left handed males and seven left handed females were given left handed instructions.

d. Seven left handed males and seven left handed females were given right handed instructions.

Subjects were scheduled for a ten minute testing period during the day, either on Monday and Wednesday or Tuesday and Thursday for a period of four weeks. Subjects performed the novel toss under the condition assigned to their particular cell a total of eight times.

## ANALYSIS OF DATA

A 2x2x2 factoral analysis of variance with an analysis for repeated measures was used to treat the data. Main effect mean differences (type of instruction, handedness, and sex) were tested. Interactions between the variables were also tested. The F values were tested for significance at the .05 level.

A separate t-Test was calculated to determine if performance on instructional days differed from performance on non-instructional

days. The t was corrected for the slope of the learning curve for the eight days of practice.

Least Squared Difference analysis was used to determine if differences existed between multiple means when a significant F was found.

# CHAPTER IV

## ANALYSIS AND PRESENTATION OF DATA

The data collected during this investigation is presented in the following section. Presentation of the statistical analysis is included and discussed in order that conclusions may be drawn.

The purposes of this investigation were to determine the differences in the performance of a motor task between right and left handed instructions; right and left handed subjects; after each successive day of practice; and days with and days without instruction on the learning and skill performance of subjects.

## DATA COLLECTION

The selection and the assignment of subjects into treatment conditions were carried out in accordance with the procedures discussed in Chapter III. The data was statistically treated by a 2x2x2 factoral analysis of variance with an analysis for repeated measures. Main effect mean differences (type of instruction, handedness, and sex) were tested. Interactions between these variables were also measured. This technique was also applied to demonstrate that the pretest means did not differ significantly and that random placement of subjects to the four cells was successful. The F values were tested for significance at the .05 level.

## PRESENTATION OF DATA

A 2x2x2 factoral analysis of variance was performed to measure the possible effect of and the interactions between the four groups for the following variables: instructions; subject handedness; sex; instruction and subject handedness; instruction and sex; subject handedness and sex; and instruction, subject handedness and sex. The analysis of variance summary is presented in Table II.

TABLE II

ANALYSIS OF VARIANCE SUMMARY

| Source of Variation | Degrees of Freedom | Mean Square | F-Ratio |
|---|---|---|---|
| Instruction (I) | 1 | .502230048 | .0127 |
| Subject Handedness (S) | 1 | .377233963 | .0096 |
| Sex (X) | 1 | 827.859375000 | 21.2650[a] |
| IS | 1 | .645081937 | .0166 |
| IX | 1 | 18.484375000 | .4747 |
| SX | 1 | 60.770065308 | 1.7560 |
| ISX | 1 | 4.930796623 | .1215 |
| R (Within) | 48 | 38.932235718 | |

[a]significant at the .05 level
repeated measures of analysis of variance can be seen in Table VI

As shown in Table II, there was no significant difference reported when subjects were instructed by a right handed teacher versus

a left handed teacher ($F=.0127 < .05$). The mean scores for both types of instruction are shown in Table III. These scores indicated that all subjects learned at approximately the same rate whether they were given right or left handed instructions.

TABLE III

MEAN SCORES FOR INSTRUCTION

| Right Handed Teacher | Left Handed Teacher |
|---|---|
| 5.397320747 | 5.330356598 |

When the differences between right and left handed subjects was measured, no significance was found ($F=.0096 < .05$). Table IV shows the mean scores for right and left handed subjects. The results implied that both right and left handed subjects in all four groups learned and performed at similar rates of improvement.

TABLE IV

MEAN SCORES FOR HANDEDNESS

| Right Handed Subject | Left Handed Subject |
|---|---|
| 5.392856598 | 5.334820747 |

As shown in Table V, the greatest difference was found when comparing the performance of male and female subjects ($F=21.2650 > .05$).

TABLE V

MEAN SCORES FOR SEX

| Male | Female |
|---|---|
| 6.723213196 | 4.004463196 |

Males seemed to perform better than females from day one through day eight. The difference between the performance of the sexes was consistent throughout the testing period. This can be noted by studying the learning curve in Figure 3.

The ANOVA yielded no significant interactions between type of instruction, handedness, and sex. The interactions all seemed to be independent of each other. The lack of any significance showed that the males' learning rate was no better under one learning condition than the females' learning rate, neither did right handed subjects learn better than left handed subjects. The mean scores for each of these interactions of variables can be found in Appendix C.

## REPEATED MEASURE ANALYSIS OF VARIANCE

A repeated measure of analysis of variance concerning the effects and the interactions of the days with instruction, subject handedness, and sex are shown in Table VI. The results indicated that there were no significant differences between the groups concerning the interactions of the testing days with instruction ($F=1.1164 < .05$); subject handedness ($F=.1822 < .05$); sex ($F=.6624 < .05$); instruction

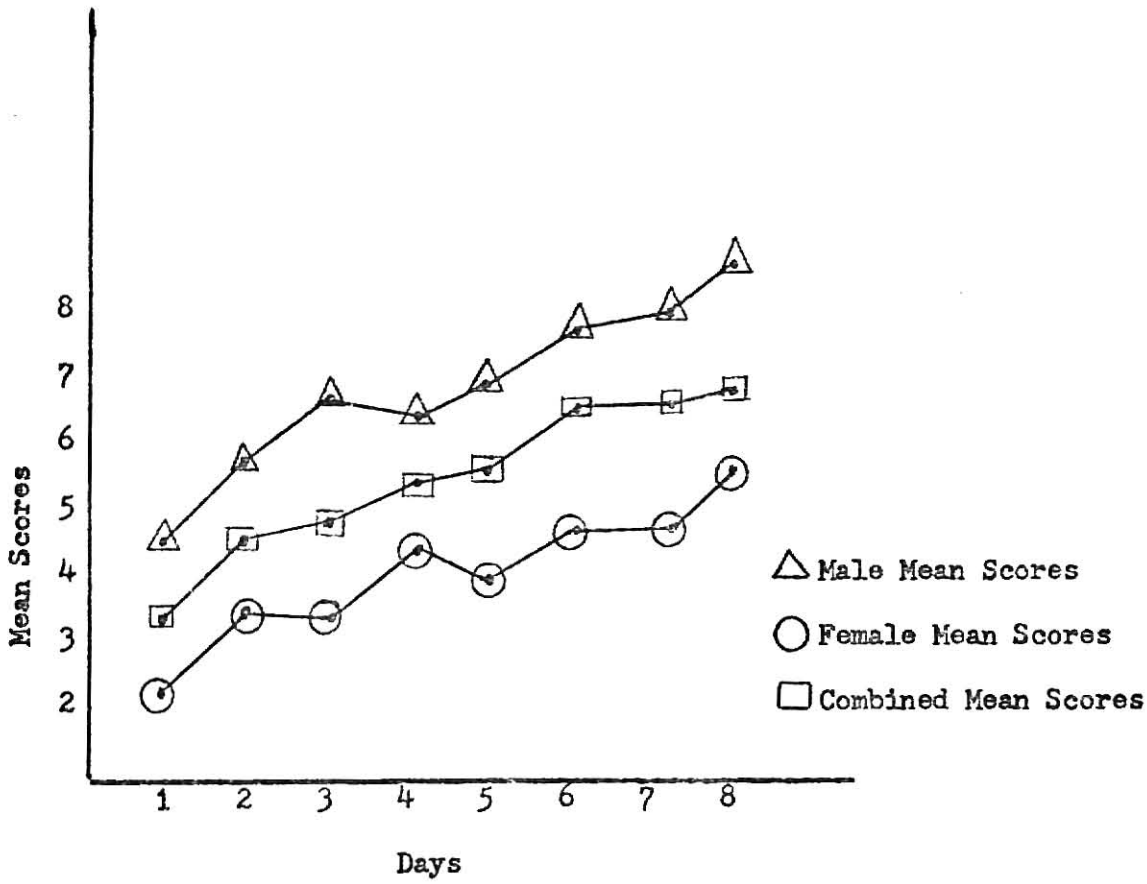


Figure 3. Learning Curve of the Groups

and subject handedness ($F=1.2968 < .05$); subject handedness and sex ($F=1.2601 < .05$); or instruction, subject handedness and sex ($F=.8684 < .05$).

TABLE VI

REPEATED MEASURE ANALYSIS OF VARIANCE SUMMARY

| Source of Variation | Degrees of Freedom | Mean Square | F-Ratio |
|---|---|---|---|
| Day (D) | 7 | 71.744522095 | 16.2730[a] |
| ID | 7 | .502228737 | 1.1164 |
| SD | 7 | .805801749 | .1822 |
| XD | 7 | 2.920590401 | .6624 |
| ISD | 7 | 5.716504097 | 1.2968 |
| IXD | 7 | 5.555779547 | 1.2601 |
| SXD | 7 | 2.331331226 | .5287 |
| ISXD | 7 | 3.828732491 | .8684 |
| ERROR | 336 | 4.408866882 | |
| TOTAL | 447 | | |

[a]significant at the .05 level
main effects summary can be seen in Table II

However, significant improvement in performance for all groups was reported when the mean scores from day one through day eight were compared. The mean difference was determined by use of LSD at the .05 level of significance ($LSD_{.05}=.786$). As shown in Table VII, the mean scores for testing days seemed to have a cascading effect. The performance scores for days two, three, and four comprised the first

series of learning while scores for days three, four, and five made up the second sequence. The progression is continued with days five, six, and seven comprising the third step. The final sequence consisted of days six, seven, and eight with little difference being noted between days five, six, seven, and eight. The learning curve, as indicated in Figure 3, shows the series of the learning progression.

TABLE VII

MEAN SCORES FOR DAYS
(Mean Differences Determined by LSD)

| Day | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
| Mean Score | 3.03 | 4.57 | 4.92 | 5.26 | 5.48 | 6.14 | 6.30 | 6.91 |

Underlined means statistically the same at the .05 level of significance.

As observed in Figure 3, a linear learning curve resulted after eight days of practice. The scores for non-instructional days appeared to be better than scores for the instructional days. However, this can be attributed to the fact that a non-instructional day followed an instructional day throughout the testing period. This situation allowed the subjects an extra day of practice on the non-instructional days. Therefore a separate t-test was calculated to determine whether performance on instructional days differed from performance on non-instructional days. The t-test was corrected for the slope of the learning curve for

the eight days of practice. The calculated t of 1.33 at the .05 level of significance showed no significant difference in the average amount of learning between the days with and days without instruction.

## DISCUSSION OF RESULTS

In order to meet the specific objectives of this investigation, fifty-six subjects were tested following the procedures outlined in Chapter III. The specific objectives were to determine the effect of right and left handed instructions on the learning and skill performance of right and left handed subjects; to determine the effect of instructions on the learning and skill performance of male and female subjects; to determine the differences in performance of a motor task after each successive day of practice; and to determine the effect of days with instruction and days without instruction on the learning and skill performance of right and left handed subjects. Differences in performance were determined using a 2x2x2 factoral analysis of variance with repeated measures.

It was assumed prior to the collection of data that the performance of subjects receiving opposite handed instructions would be significantly different from those subjects receiving same handed instructions. However, as reported earlier in this chapter, there were no significant differences between the four groups in reference to learning and performance at the beginning, during, or end of the investigation.

Males were superior to females in performing this task. Males began the experiment at a higher level of performance and continued at

a higher level throughout the testing period. The mean scores, as plotted in Figure 3, show that the sexes seemed to keep the same amount of difference between each other throughout the investigation.

Also assumed prior to collection of data was that all groups would improve in their performance of this task. The mean scores indicated that from day one through day eight learning and improvement did occur. Although no significance was observed when comparing the improvement in performance between the groups. All seemed to have progressed at similar rates of improvement. This can be seen by studying the raw data for each subject in Appendix B and the group means in Table VI.

It was thought that right handed subjects might learn better from right handed instructors and left handed subjects might learn better from left handed instructors. Had this been the case the ANOVA would have yielded a significant interaction between these variables (see Table VI). No such interaction existed. In fact there was no interaction between type of instruction, handedness, sex, or day.

Because no significant interaction existed between instruction, subject handedness, sex, or day, it appeared that the variables were independent of each other. The lack of significance indicated that under any one learning condition the males' learning rate was no better than the learning rate of the females. Neither did the right handed subjects learn better than did the left handed subjects.

The experimenter anticipated that the subjects' performance of the novel motor task on non-instructional days would be better than on instructional days. When mean scores of non-instructional days were

compared to instructional days a significance was found. This significance can be accounted for by taking into consideration that the non-instructional days followed the instructional days. The difference is a normal learning curve characteristic. As a result, subjects performed better on day two than day one, day four than day three, day six than day five, and day eight than day seven. As shown on the linear curve, it appeared that performance was better the day after instruction as compared to the day of instruction. However, there was no significant difference reported between instructional days and non-instructional days when the t-test was corrected for the slope of the learning curve for the eight days of practice.

# CHAPTER V

## SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this study was to determine the effect of instruction (right and left handed) on the learning and motor performance of subjects (right and left handed); to determine the effect of being right and left handed on the learning and motor performance of subjects; to determine the effect of being male or female on the learning and motor performance of subjects; to determine the difference in performance of a motor task after each successive day of practice; and to determine the effect of days with and days without instruction on the learning and motor performance of subjects.

Fifty-six male and female subjects at Kansas State University between the ages of 18 and 21 served as subjects for this investigation. All subjects were volunteers from the physical education classes offered during the fall semester, 1973. All subjects were classified in one of four cells. These cells consisted of right handed instructions and right handed subjects (seven right handed males and seven right handed females); right handed instructions and left handed subjects (seven left handed males and seven left handed females); left handed instructions and left handed subjects (seven left handed males and seven left handed females); and left handed instructions and right handed subjects (seven right handed males and seven right handed females).

The experiment was conducted four times a week for four weeks. Each subject was tested two times a week either on Monday and Wednesday

or Tuesday and Thursday for a total of eight times. During testing days one, three, five, and seven the procedure was conducted as follows. The subject was told by the experimenter to stand behind a line which was five feet in front of the audio-visual taped instructions. The subject was informed to view and to listen to the instructions and to perform the task exactly as instructed. Fourteen right and fourteen left handed males and females were given right handed instructions. While fourteen right and fourteen left handed males and females were given left handed instructions. After viewing the instructions, the subject was asked to perform the task a total of twenty times. On days two, four, six, and eight, the subject was informed by the experimenter to simply perform the task as it was performed the preceding day.

A 2x2x2 factoral analysis of variance with repeated measures at the .05 level of significance was used to determine if random placement of subjects to the four groups was successful. The lack of pretest mean differences demonstrated this. Also, this technique was applied to determine possible interactions between instruction, subject handedness, and sex. Analysis of variance with repeated measures concerning the interaction of days with instruction, subject handedness, and sex was also reported.

The general conclusion reached was that there was no evidence to suggest that the instructional techniques used in this investigation affected the learning and motor performance of the subjects.

## CONCLUSIONS

Based on the results and discussion in the preceding chapter, the following conclusions can be drawn. These conclusions are based on the limitations of the investigation.

a. The type of instruction, whether right or left handed, did not seem to affect the learning and motor performance of the subjects, whether right or left handed.

b. Males (right and left handed) appeared to have superior ability in performing this task than did the females (right and left handed).

c. Being male, female, right or left handed did not appear to affect the individual's learning of this task.

d. The performance of all subjects showed improvement indicating that learning did occur.

## RECOMMENDATIONS

Based on the analysis and interpretation of the data, there is an indication that more research needs to be done to determine the effects of opposite handed instructions on the learning and motor performance of subjects. The investigator suggests that:

a. The effects of opposite handed instructions should be studied with skill used in the various games and activities.

b. Elementary school subjects be used to determine the effects of opposite handed instructions.

c. The quality of the learning and motor performance of the subjects be measured as well as the quantity.

d. A replication of this study be made using film analysis as a means of measuring the quality of performance.

e. The effect of live instruction as opposed to audio-visual taped instructions be measured.

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# APPENDIX A

## VERBAL INSTRUCTIONS FOR SUBJECTS

VERBAL INSTRUCTIONS FOR RIGHT HANDED

In front of you there are two ropes tied to two poles. These ropes are seven and eight feet high. Looking past the ropes is a 24 inch circle on the floor. This circle is your target area. The object of the task is to toss a ball between the ropes and to hit this circle. In order to perform this toss:

a. You must stand behind this line.

b. Your body is facing the target and your feet comfortably spread and parallel to each other.

c. Grasp the ball in your right hand and let your arms hang naturally to your side.

d. Pivot on the left foot and bring the right foot in front so that the right side of the body is facing the target.

e. At the same time you are pivoting, extend your right arm laterally.

f. Notice the palm is down and your weight is on the left foot.

g. In a pendulum motion, let your arm swing downward across the front of the body.

h. As the right hand reaches shoulder level, toss the ball so it will go between the ropes and into the circle.

i. Your weight is now transferred to your right foot and the right hand should be at head level on the follow through.

j. If the ball fails to go between the ropes or if it misses the target area, you receive no points.

k. You will be given 20 trials and for each trial you must start from your original position.

To be sure that you understand the instructions, go through the motions as I explain them:

(1) Grasp the ball in the right hand.

(2) Bring the right foot in front so that the right side of the body is facing the target. At the same time, extend your right arm.

(3) Let your arm swing downward across the body and continue this motion until you reach shoulder level at which time you release the ball.

(4) Your hand remains at head level with the follow through.

VERBAL INSTRUCTIONS FOR LEFT HANDED

In front of you there are two ropes tied to two poles. These ropes are seven and eight feet high. Looking past the ropes is a 24 inch circle on the floor. This circle is your target area. The object of the task is to toss a ball between the ropes and to hit this circle. In order to perform this toss:

a. You must stand behind this line.

b. Your body is facing the target and your feet comfortably spread and parallel to each other.

c. Grasp the ball in your left hand and let your arms hang naturally to your side.

d. Pivot on the right foot and bring the left foot in front so that the left side of the body is facing the target.

e. At the same time you are pivoting, extend your left arm laterally.

f. Notice the palm is down and your weight is on the right foot.

g. In a pendulum motion, let your arm swing downward across the front of the body.

h. As the left hand reaches shoulder level, toss the ball so it will go between the ropes and into the circle.

i. Your weight is now transferred to your left foot and the left hand should be at head level on the follow through.

j. If the ball fails to go between the ropes or if it misses the target area, you receive no points.

k. You will be given 20 trials and for each trial you must start from your original position.

To be sure that you understand the instructions, go through the motions as I explain them:

(1) Grasp the ball in the left hand.

(2) Bring the left foot in front so that the left side of the body is facing the target. At the same time, extend your left arm.

(3) Let your arm swing downward across the body and continue this motion until you reach shoulder level at which time you release the ball.

(4) Your hand remains at head level with the follow through.

# APPENDIX B

## DAILY PERFORMANCE SCORES FOR GROUPS

DAILY PERFORMANCE SCORES FOR RIGHT HANDED INSTRUCTIONS AND RIGHT HANDED SUBJECTS

| Subject Number | Sex | Day 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| 1 | M[a] | 6 | 4 | 9 | 4 | 7 | 4 | 10 | 9 |
| 2 | M | 4 | 8 | 4 | 2 | 5 | 10 | 10 | 10 |
| 3 | M | 6 | 6 | 5 | 5 | 10 | 9 | 6 | 10 |
| 4 | M | 4 | 4 | 2 | 4 | 3 | 10 | 9 | 9 |
| 5 | M | 2 | 7 | 6 | 7 | 4 | 7 | 9 | 11 |
| 6 | M | 0 | 0 | 1 | 3 | 4 | 1 | 6 | 7 |
| 7 | M | 9 | 9 | 11 | 11 | 10 | 8 | 7 | 8 |
| 8 | F[b] | 2 | 3 | 7 | 3 | 1 | 4 | 5 | 5 |
| 9 | F | 0 | 6 | 3 | 6 | 1 | 7 | 6 | 7 |
| 10 | F | 1 | 3 | 2 | 5 | 2 | 3 | 1 | 4 |
| 11 | F | 3 | 5 | 3 | 8 | 6 | 5 | 7 | 7 |
| 12 | F | 6 | 13 | 11 | 9 | 10 | 10 | 9 | 9 |
| 13 | F | 0 | 1 | 2 | 3 | 2 | 1 | 6 | 7 |
| 14 | F | 3 | 3 | 1 | 2 | 7 | 2 | 4 | 4 |
| Total | | 45 | 69 | 77 | 72 | 72 | 81 | 95 | 107 |

[a]Male

[b]Female

DAILY PERFORMANCE SCORES FOR RIGHT HANDED INSTRUCTIONS AND LEFT HANDED SUBJECTS

| Subject Number | Sex | Day 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| 15 | M[a] | 5 | 2 | 3 | 5 | 7 | 12 | 8 | 9 |
| 16 | M | 3 | 6 | 7 | 10 | 10 | 5 | 5 | 5 |
| 17 | M | 5 | 8 | 13 | 12 | 13 | 10 | 15 | 16 |
| 18 | M | 6 | 7 | 9 | 12 | 3 | 7 | 5 | 6 |
| 19 | M | 5 | 2 | 5 | 5 | 4 | 7 | 6 | 7 |
| 20 | M | 3 | 3 | 3 | 4 | 5 | 6 | 5 | 7 |
| 21 | M | 2 | 9 | 5 | 10 | 9 | 11 | 8 | 8 |
| 22 | F[b] | 4 | 4 | 5 | 6 | 4 | 7 | 4 | 6 |
| 23 | F | 3 | 2 | 5 | 6 | 5 | 6 | 6 | 7 |
| 24 | F | 2 | 3 | 2 | 3 | 0 | 3 | 2 | 2 |
| 25 | F | 5 | 9 | 8 | 5 | 8 | 7 | 10 | 8 |
| 26 | F | 2 | 1 | 4 | 8 | 6 | 6 | 5 | 4 |
| 27 | F | 1 | 3 | 3 | 1 | 1 | 1 | 3 | 4 |
| 28 | F | 5 | 2 | 3 | 4 | 3 | 3 | 3 | 3 |
| Total | | 56 | 60 | 75 | 83 | 77 | 91 | 95 | 92 |

[a]Male

[b]Female

DAILY PERFORMANCE SCORES FOR LEFT HANDED INSTRUCTIONS AND LEFT HANDED SUBJECTS

| Subject Number | Sex | Day 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| 29 | M[a] | 1 | 8 | 5 | 3 | 10 | 4 | 8 | 7 |
| 30 | M | 3 | 3 | 4 | 5 | 5 | 5 | 6 | 7 |
| 31 | M | 11 | 6 | 11 | 12 | 12 | 11 | 11 | 11 |
| 32 | M | 4 | 1 | 3 | 3 | 7 | 4 | 8 | 8 |
| 33 | M | 9 | 9 | 9 | 7 | 5 | 9 | 10 | 8 |
| 34 | M | 8 | 9 | 11 | 10 | 8 | 14 | 10 | 11 |
| 35 | M | 3 | 8 | 8 | 7 | 10 | 8 | 7 | 8 |
| 36 | F[b] | 0 | 3 | 1 | 3 | 2 | 3 | 2 | 3 |
| 37 | F | 2 | 1 | 0 | 4 | 1 | 3 | 5 | 5 |
| 38 | F | 1 | 2 | 3 | 4 | 5 | 4 | 5 | 5 |
| 39 | F | 1 | 3 | 1 | 2 | 3 | 2 | 4 | 5 |
| 40 | F | 0 | 2 | 2 | 2 | 3 | 4 | 9 | 9 |
| 41 | F | 0 | 1 | 2 | 0 | 0 | 3 | 3 | 3 |
| 42 | F | 2 | 6 | 7 | 8 | 3 | 10 | 8 | 9 |
| Total | | 45 | 63 | 67 | 70 | 91 | 85 | 96 | 99 |

[a]Male

[b]Female

DAILY PERFORMANCE SCORES FOR LEFT HANDED INSTRUCTIONS AND RIGHT HANDED SUBJECTS

| Subject Number | Sex | Day 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|
| 43 | M[a] | 5 | 11 | 13 | 10 | 3 | 3 | 10 | 9 |
| 44 | M | 7 | 5 | 7 | 5 | 15 | 15 | 7 | 7 |
| 45 | M | 3 | 5 | 5 | 5 | 5 | 7 | 7 | 6 |
| 46 | M | 3 | 3 | 6 | 9 | 3 | 8 | 8 | 8 |
| 47 | M | 6 | 2 | 6 | 9 | 4 | 9 | 7 | 4 |
| 48 | M | 0 | 3 | 4 | 1 | 2 | 1 | 0 | 2 |
| 49 | M | 3 | 11 | 10 | 6 | 7 | 10 | 8 | 12 |
| 50 | F[b] | 2 | 2 | 3 | 3 | 0 | 2 | 3 | 4 |
| 51 | F | 3 | 6 | 0 | 3 | 1 | 1 | 3 | 4 |
| 52 | F | 5 | 7 | 1 | 7 | 7 | 6 | 5 | 7 |
| 53 | F | 4 | 1 | 4 | 4 | 6 | 5 | 6 | 6 |
| 54 | F | 0 | 0 | 0 | 1 | 3 | 1 | 0 | 1 |
| 55 | F | 4 | 4 | 6 | 6 | 6 | 6 | 8 | 9 |
| 56 | F | 0 | 3 | 4 | 6 | 6 | 7 | 7 | 8 |
| Total | | 49 | 63 | 69 | 75 | 68 | 81 | 78 | 92 |

[a]Male

[b]Female

# APPENDIX C

## MEAN SCORES FOR THE INTERACTION OF VARIABLES (Instruction, Subject Handedness, and Sex)

MEAN SCORES FOR INSTRUCTION AND SUBJECT HANDEDNESS

| RH Instruction RH Subject | RH Instruction LH Subject | LH Instruction RH Subject | LH Instruction LH Subject |
|---|---|---|---|
| 5.46 | 5.33 | 5.32 | 5.33 |

MEAN SCORES FOR INSTRUCTION AND SEX

| RH Instruction Male | RH Instruction Female | LH Instruction Male | LH Instruction Female |
|---|---|---|---|
| 6.55 | 4.24 | 6.89 | 3.76 |

MEAN SCORES FOR SUBJECT HANDEDNESS AND SEX

| RH Subject Male | RH Subject Female | LH Subject Male | LH Subject Female |
|---|---|---|---|
| 6.38 | 4.40 | 7.06 | 3.60 |

MEAN SCORES FOR INSTRUCTION, SUBJECT HANDEDNESS, AND SEX

| RH Instruction RH Subject Male | RH Instruction RH Subject Female | RH Instruction LH Subject Male | RH Instruction LH Subject Female |
|---|---|---|---|
| 6.35 | 4.57 | 6.75 | 3.91 |

MEAN SCORES FOR INSTRUCTION, SUBJECT HANDEDNESS, AND SEX (Con't.)

| LH Instruction RH Subject Male | LH Instruction RH Subject Female | LH Instruction LH Subject Male | LH Instruction LH Subject Female |
|---|---|---|---|
| 6.41 | 4.23 | 7.37 | 3.30 |

# EFFECTS OF RIGHT AND LEFT HANDED INSTRUCTIONS ON THE LEARNING AND MOTOR PERFORMANCE OF RIGHT AND LEFT HANDED SUBJECTS

by

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B. S., Fort Hays Kansas State College, 1972

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This study was undertaken to determine the effect of right and left handed instruction on the learning and motor performance of right and left handed subjects as measured by scores on a novel ball tossing test. More specifically, it was the purpose of this study to determine the effect of instruction (right and left handed) on the learning and motor performance of right and left handed subjects; to determine the effect of instruction (right and left handed) on the learning and motor performance of male and female subjects; to determine the differences in performance of a motor task after each successive day of practice; and to determine the effect of days with instruction and days without instruction on the learning and motor performance of right and left handed subjects.

Fifty-six male and female volunteers from the physical education classes at Kansas State University served as subjects. All subjects were assigned to one of four treatment groups. These groups consisted of right handed instructions and right handed subjects (seven males and seven females); right handed instructions and left handed subjects (seven males and seven females); left handed instructions and left handed subjects (seven males and seven females); left handed instructions and right handed subjects (seven males and seven females). On days one, three, five, and seven the subjects were given audio-visual taped instructions. After viewing the instructions the subjects performed the novel motor task a total of twenty times. Each subject could earn up to twenty points for every test period. On days two, four, six, and eight the subjects simply performed the task without

instructions. A 2x2x2 factoral analysis of variance with repeated measures was used to analyze the data. Main effect mean differences (type of instruction, handedness, sex) were tested. Interactions between the variables were also tested. A repeated measure of analysis of variance was also used to determine the effects and interactions of the number of days with instruction, handedness, and sex.

Based on the limitations of this investigation the following conclusions were drawn:

a. The type of instruction, whether right or left handed, did not seem to effect the learning and motor performance of the subjects, whether right or left handed.

b. Males (right and left handed) appear to have superior ability in performing this task when compared to the females (right and left handed).

c. Being right or left handed, male or female, did not appear to effect the individuals' learning of this task.

d. The performance of all subjects showed improvement indicating that learning did occur.