The purpose of this study was to determine if differences exist in the efficiency with which left-handed and right-handed males and females use their nondominant hand in the performance of large and small motor tasks. The Ss, 19 righthanded females, 17 righthanded males, 15 lefthanded females, and 18 lefthanded males were selected from PE 100 classes from the UW-LaCrosse. The subjects completed their testing over two days. The testing consisted of 4 tasks on which the subjects received 7 trials with the last 4 trials on each task used as raw data. The following tasks were utilized in the study: (1) Paddle Task, (2) Scoop Task, (3) Rotary Pursuit Apparatus, and (4) Groove Type Steadiness Tester. A 2-way ANOVA with 2 levels on each factor (Sex X Handedness) was run for each of the 4 tasks. Differences between males and females, between righthanded and lefthanded people, and handedness by sex interaction were computed for each of the 4 tasks. A significant difference was found between righthanded and lefthanded subjects on the Paddle Task, with the lefthanded group performing better than the righthanded group. Also, the Groove Type Steadiness Tester task showed a significant difference. The results of the Scheffe' Test indicated that lefthanded females were significantly poorer than that of righthanded females and lefthanded males. No significant differences were evident in the performance of the 2 remaining tasks. It was noted that the lefthanded Ss showed no pattern of superiority over the righthanded Ss in the use of their nondominant hand.
THE NONDOMINANT HAND
AS A DETERMINANT FOR PERFORMANCE
IN LARGE AND SMALL MOTOR TASKS

A Thesis Presented
to
The Graduate Faculty
University of Wisconsin - LaCrosse

In Partial Fulfillment
of the Requirements for the
Master of Science Degree

by
Susan M. Dummer
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Candidate:  Susan M. Dummer

We recommend acceptance of this thesis in partial fulfillment of this candidate's requirements for the degree:

Masters of Science - Physical Education - Elementary

The candidate has completed her oral report.

This thesis is approved for the School of Health, Physical Education and Recreation.

Dean, College of Health, Physical Education and Recreation

Dean of Graduate Studies
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CHAPTER I
INTRODUCTION

It has been estimated that only about 10% of the world's population is lefthanded (Herron, 1976). This means that lefthanded people have had to adapt to living in a righthanded world. If lefthanded children were reprimanded for using their left hands or made to feel different, it could force them to change their hand preference. A mother could continually put utensils into her baby's right hand establishing a pattern and skill for that hand (Herron, 1976). Until the 1930's, it was a common practice to force lefthanded children to learn to use their right hands for writing. This is still a standard practice in many countries (Pogash, 1977). Perelle and Manowitz (1961) also found that some societies force righthandedness upon people who might otherwise be lefthanded. They found a significant relationship between the social structure of a culture and the incidence of lefthandedness in that culture. Lefthandedness ranged from 9% in Hong Kong Chinese fisherman, a highly perm.”

culture, to less than 1% in Katanga, Congo, a highly structured culture. Thus it was assumed that members of socially rigid cultures who might be or have become lefthanded are under severe pressure to learn righthanded tool use. The writing
desks in many of the schools are designed for righthanded people. Lefthanded children often use righthanded scissors for cutting because lefthanded scissors are not available. Likewise, in larger physical skills, students have had to learn to golf righthanded because lefthanded clubs were not available or learned how to throw righthanded because righthanded gloves were the only ones available to use. Other objects such as can-openers and door-knobs are also designed for righthanded people (Herron, 1976). Lefthanded people could cite many more situations where they could not use their dominant hand and had to resort to the use of their right hands. If these situations occur, would it not seem plausible that lefthanded people would be more efficient with their nondominant hand than righthanded people?

Herron (1976) cites differences between males and females and the type of tasks that they perform within society. Females are thought to be more efficient in small motor tasks or tasks that require precision and males were seen as more efficient in large motor tasks. Females were also thought to be stronger in the fine arts, such as reading, writing, music, and the art areas, while males were stronger in the mechanical area and in math and science (Herron, 1976). Would these roles affect their performance in selected large and small motor tasks? It is the aim of this study to provide possible answers to the previously suggested questions.
Statement of the Problem

This study was designed to determine if differences exist in the efficiency with which lefthanded and right-handed males and females use their nondominant hand in the performance of large and small motor tasks.

Sub-problems of the study were as follows:

(1) Were there any differences in the efficiency with which righthanded and lefthanded people use their nondominant hand while performing large and small motor tasks?

(2) Were there any differences between males and females while performing large and small motor tasks with their nondominant hand?

(3) Did sex and handedness interaction have any effect on the performance of large and small motor tasks for lefthanded and righthanded people while using their nondominant hand?

Need for the Study

The difference between righthanded and lefthanded people has puzzled researchers for a long time. Lefthanded people are not a mirror of righthanded people. They differ in at least the following two ways: (1) they use their nondominant hand much more often, and (2) many have a different brain organization (Herron, 1976). The ways that lefthanded people use their nondominant hand more has been mentioned previously. These ways included implements made for righthanded people such as can-openers and door-knobs, that forced lefthanded
people to use their right hands. Herron (1976) states that there is a difference in the brain organization between righthanded and lefthanded people. She said that the righthanded people's language center is almost always located in the left hemisphere, and only 60% of lefthanded people process language in the left hemisphere. The remainder of the lefthanded people use the right hemisphere or both sides for language processing.

Are lefthanded people somehow different in ability than righthanded people? This question is continually being asked, but not many studies have been conducted that examine the differences between righthanded and lefthanded people while performing motor skills. This apparent lack of research concerning performances on motor skills is rather difficult to understand considering that people make assumptions concerning the differences in ability between righthanded and lefthanded people. This study was developed to examine some of the questions that people have asked concerning abilities of righthanded and lefthanded people. This study utilized large and small motor tasks to determine if differences existed between righthanded and lefthanded people in their ability to use their nondominant hand. The large and small motor tasks were chosen so comparisons could be made to previous studies that also used large and small motor tasks.

Hypotheses

The hypothesis for this study was stated in the null form. It is as follows:
There is no significant difference in the efficiency with which lefthanded and righthanded males and females use their nondominant hand in the performance of large and small motor tasks.

The following sub-hypotheses were stated in the null form for this study:

(1) There is no significant difference between right-handed and lefthanded people while performing large and small motor tasks with their nondominant hand.

(2) There is no significant difference between males and females in their performance of large and small motor tasks with their nondominant hand.

(3) There is no interaction between sex and handedness when righthanded and lefthanded people perform large and small motor tasks with their nondominant hand.

Definition of Terms

(1) **Lefthanded** - a person who performed four of the six tasks on the handedness checklist with the left hand.

(2) **Righthanded** - a person who performed four of the six tasks on the handedness checklist with the right hand.

(3) **Mixed-handedness** - a person who performed three tasks on the handedness checklist with the right hand and three tasks with the left hand.

(4) **Dominant hand** - the hand that the subjects preferred for the small and large motor tasks in the study according to the handedness checklist.
(5) Nondominant hand - the hand that the subject did not prefer for the small and large motor tasks in the study according to the handedness checklist.

(6) Small motor task - a task requiring one limb which was performed within only one cubic foot of space. These tasks were the Rotary Pursuit Apparatus and the Groove Type Steadiness Tester.

(7) Large motor task - a task in which the entire body was used in a space greater than one cubic foot. The tasks utilized in the study were the Paddle Task and the Scoop Task.

(8) Ballistic movements - a movement that is done automatically and with practice is carried out without any form of feedback during the performance (Flowers, 1975).

Assumptions

The following assumptions were adopted for this study:

(1) Each small and large motor task was practiced so that the subjects had acquired the skills needed for the performance of task trials on the second day of testing.

(2) The subjects did not practice the tasks between the two testing sessions.

(3) The subjects performed as well as they could on all trials.

(4) The subjects were not proficient in the tasks prior to participation in the study.
Delimitations

The following were delimitations of this study:

(1) Subjects used for the study were male and female volunteers from the University of Wisconsin-LaCrosse who were enrolled in Physical Education 100 classes during the spring semester of 1981-82.

(2) Mixed-handed people as defined for the study were excluded.

(3) A checklist of tasks was used to determine the handedness of the subjects.

(4) The testing for each subject was completed within two consecutive days.

(5) The sample size for each group was set as follows:
   (a) Group 1 - 17 righthanded males
   (b) Group 2 - 19 righthanded females
   (c) Group 3 - 18 lefthanded males
   (d) Group 4 - 15 lefthanded females

Limitations

The following were limitations of this study:

(1) The subjects were not randomly assigned to groups. They were put in specific groups depending on whether they were righthanded or lefthanded.

(2) The subjects were those taking Physical Education 100 classes during the spring semester of 1981-82 and, therefore, were not a random sample.
(3) The large and small motor tasks utilized in the study may not be representative of all motor tasks.
CHAPTER II

REVIEW OF RELATED LITERATURE

This study was designed to determine if differences exist in the efficiency with which lefthanded and right-handed males and females use their nondominant hand in the performance of large and small motor tasks.

The review of literature was undertaken to examine theories on possible determinants of handedness and the brain organization of righthanded and lefthanded people. This section concludes with a comparison of motor ability between righthanded and lefthanded people.

Possible Causes of Lefthandedness

When working with people, has the question, "Why do people prefer one hand over the other hand?" ever come to mind? Also, why are there so many righthanded people and so few lefthanded people? While reviewing the literature on the causes of handedness, it was noted that other researchers preferred to say what caused lefthandedness, not righthandedness. The reason for this could be that lefthanded people, as mentioned previously, make up only 10% of the world's population (Herron, 1976). It is easier to deal with the small minority of lefthanded people than with the large majority of righthanded people. "Being exceptions", said child psychologist Lauren Harris of Michigan State University, "we
provoke scientific curiosity and at the same time, like many minorities, inspire general enmity and suspicion” (Pogash, 1977, p. 17).

There have been many possible causes given for left-handedness. Some of these causes include the way a mother fed her baby or even held her baby, the way the earth rotated, or even because the left hand was thought to be sinister and represented the evil in the world (Pogash, 1977). One researcher, Dr. Paul Bakan, a Canadian psychologist at Simon Fraser University, believed that a person became left-handed when an oxygen shortage occurred at birth or during pregnancy. Bakan believed that the left hemisphere of the brain needed more oxygen than the right hemisphere. Therefore, if there was an oxygen shortage, handedness was switched over to the right hemisphere and the baby became left-handed. Bakan attributes this theory to the fact that lefthanded people constitute 12 to 20% of the epileptic and dyslexic population (Pogash, 1977). Bakan's minor brain damage theory for lefthandedness has made him the target for those who misunderstood his findings and thought he was saying that lefthanded people were handicapped. However, there are researchers who readily disputed Bakan's theory. Herron (1976) and Coren and Porac (1977) do not accept the Bakan theory. They note that more incorrect facts about lefthandedness are reported than correct facts. In fact, Harris (Pogash, 1977) surveyed more than 200 articles on lefthandedness and found
more errors than facts. Although Harris stated this fact, she did not list any of these errors to support her statement.

Basically, there are two types of theories that attempt to explain handedness and its development in humans. The first theory states that there were physiological causes which could very well be inherited that lead to differences in the preference of hands. The second theory states that social or environmental pressures, or both, lead people to develop their hand preferences (Coren & Porac, 1977).

Over the past 50 centuries, there has been little change in the hand preferences of humans. Perhaps the earliest quantitative account of handedness appeared in the Bible (Judges 20: 15-16) where 700 lefthanded people were counted against 26,000 righthanded people. This account put the righthanded population at 97% (Coren & Porac, 1977). The history of hand preference was assessed from works of art from various cultures and times. More than 12,000 photographs and reproductions of drawings, paintings, and sculpture were examined. These items were drawn from European, Asian, African, and American sources. Ninety-two percent of these items were shown using the right hand. Many of the items were taken from different cultures in the world. The fact that the righthanded population stayed at 90% throughout the 50 centuries indicated that handedness was also cross-cultural. These results seemed to support the physiological
theory of handedness rather than the social or environmental pressures theory (Coren & Porac, 1977).

**Brain Organization**

Research into brain organization indicated that the brain was divided into hemispheres. Each of these hemispheres was found to operate independently of the other. Research has been done that examined different ways in which the two hemispheres processed information. Evidence found by Levy (Edwards, 1979) showed that the right brain's mode of processing is rapid, complex, whole-pattern, and spatial. This hemisphere has been called the visual-spatial brain (Hunter, 1977). The left hemisphere recognized data and relationships that were built across time and were also verbal and analytical in nature. This hemisphere has been called the temporal brain. Edwards stated that this mode of processing is not only different from, but comparable in complexity to the right brain. The right and left hemispheres are connected by the corpus callosum. This is a thick nerve cable composed of millions of fibers. At the California Institute of Technology, Roger Sperry (Edwards, 1979) established that a main function of the corpus callosum was to provide communication between the two hemispheres and to allow the transmission of memory and learning. Furthermore, it was found that if the corpus callosum was severed the two hemispheres continued to function independently with no effect on behavior and functioning.
Edwards, in 1979, referred to a study done by Levy who stated that the two different modes of processing for the hemispheres tended to interfere with each other and, therefore, prevented maximal performance for each hemisphere. She also suggested that this may be a reason for the evolutionary development of asymmetry in the human brain—a means of keeping the two different modes of processing in two different hemispheres. It has been learned that the two hemispheres can work together. Charman, in 1980, found that the processing capacity of the single hemisphere is more limited than that of both hemispheres working independently, yet parallel. Each hemisphere cooperates with the other by contributing its special abilities and taking on the particular part of the task that is best suited to its mode of information processing.

The function of language and language-related abilities is mainly located in the left hemisphere. The knowledge that the left hemisphere is specialized for language was determined from observations of people who have incurred brain damage due to injuries. An injury to the left side of the brain was more likely to cause a loss of speech than an injury of equal severity to the right side (Edwards, 1979). Righthanded people who lost the power of speech have had difficulty regaining their speech because other parts of the brain are slow to take over. However, lefthanded people who have lost speech due to an injury to either hemisphere,
regained their speech quicker. Their brains were less specialized laterally, and the other parts of their brains could compensate faster and, therefore, restore their speech faster (Herron, 1976).

Individual differences in brain organization may have implications for cognitive functioning. Coren and Porac, in 1982, stated that people with right hemispheric speech centers process sequential phrases poorly and often have poorer syntactic skills than those who have left hemispheric speech. Since lefthanded people are more likely to possess bilateral and right hemispheric speech organization, it could be predicted that lefthanded people would show poorer language skills compared to righthanded people. The results obtained by Berry, Hughes, and Jackson in 1982, are contrary to the findings of Coren and Porac. They found that lefthanded people are just as proficient on cognitive tasks as righthanded people. Berry et al., stated that the advantage of hemispheric specialization may only be observed when people are performing two tasks at the same time. They reasoned that if brain control centers were required to mediate different actions at the same time, there would be less interference if the centers were poorly connected. If the tasks being performed involved the same control centers, then the tasks would produce maximum interference, whereas, if the tasks involved different control centers, there would be less interference. This would indicate that there was an advantage
to hemispheric lateralization. Lefthanded people are less lateralized than righthanded people and, therefore, would perform more poorly on tasks that require two different control centers as compared to righthanded people. The results of this study supported Edwards' (1979) statement that hemispheric lateralization developed because it offered an evolutionary advantage on multiple task performance (Berry, et al., 1982).

There have been other studies conducted that have indicated differences in hemispheric functions. Katz and Salt (1981) found that verbal and numerical tasks elicited eye movements to the right indicating that the left hemisphere is being activated, whereas, spatial and musical tasks elicited eye movements to the left indicating that the right hemisphere is being activated. They also found that the right hemisphere processed unpleasant emotional information and the left hemisphere was more involved in processing positive affective information.

The existence of lateralization was observed in infants in their first few days of life by Cioni and Pellegrinetti in 1982. They found that the infants showed preferences in the way they turned their heads and preferences for starting to make placing movements with their feet.

Another study that indicated differences between righthanded and lefthanded people was reported by Newland in 1981. He found that lefthanded people scored significantly higher
than righthanded people on tests measuring creativity. He speculated that this was due to lefthanded people's attempt to adapt to living in a righthanded world. This adaptation required lefthanded people to become creative to meet the challenges provided by the righthanded world.

Motor Learning

Researchers have often investigated the differences between righthanded and lefthanded people. They seem particularly interested in the concept of handedness because the manual preferences of people have been felt to be indicators of cerebral organization. Researchers have employed three different procedures for determining hand preferences in people. The most prevalent method was to administer a questionnaire concerning which hand people preferred to use in a range of selected activities. A second method of determining manual preferences was to ask the subject to perform a number of tasks and to note the hand employed in each case. And finally, researchers may measure the performance level attained by each hand on a given motor task or set of tasks and then determine which hand achieved the better performance (Provins & Milner, 1982). There may be discrepancies in determining handedness depending on which method was used. The assessment of handedness may also vary according to the specific tasks being performed. Writing and throwing appeared to be the activities most often used to determine handedness (Richardson, 1978). It has also been argued that
the inconsistencies in determining handedness was due largely to the group of mixed-handed people. These are people who preferred the right hand for some skilled tasks and the left hand for other tasks normally performed by righthanded people with the right hand (Annett, 1976).

It is commonly agreed among researchers that the two hemispheres of the brain exhibited specialization of functions (Herron, 1976 & Hunter, 1977). Although most studies dealt with the processing of perceptual information, there were a few studies that investigated the influence of hemispheric specialization on motor performance. In these studies righthanded people were found to be superior in sequential motor tasks or those requiring feedback control. On the opposite side, lefthanded people were superior in tasks requiring spatial and/or haptic discrimination, which included position reproduction (Annett, 1974 & Doane, 1978). On this basis, it should then seem logical that lefthanded and righthanded people should show a performance advantage in tasks that use their preferred hand's specific hemisphere.

When studying the differences between the dominant hand and the nondominant hand, researchers made some remarkable observations. In 1975, Flowers found that for ballistic movements, the dominant and nondominant hands have equal potential in their ability to perform that particular movement. This was true for both righthanded and lefthanded people. Flowers also found that in both righthanded and lefthanded
people, there was a consistent difference in performance between the dominant hand and the nondominant hand on a visually controlled aiming task. This implied that the crucial difference in movement control concerned the sensorimotor feedback loop, where some central processing operation was performed to transmit sensory and feedback information to the motor system. The nondominant hand seemed to have a lower rate of information transmission on such tasks, so that the sequential adjustments of ongoing motor activity took slightly longer than with the dominant hand. Consequently, if the nondominant hand was less capable of monitored movements, it appeared to have equal potential for the learning of ballistic movements. The performance will then be a function of the accuracy of motor commands, whose efficiency may be largely determined by practice (Flowers, 1975).

In a study that utilized prolonged practice of a simple finger tapping test, Peters (1976) found that the nondominant hand eventually performed as well as the dominant hand for both righthanded and lefthanded people. This study certainly upheld Flowers' results on ballistic movements. In another tapping test, Peters and Durding (1979) found that lefthanded people showed smaller between hand performance differences than did righthanded people. They felt that the most obvious explanation would be that lefthanded people, while living in a righthanded world, received more motor practice for their
nondominant hand than did righthanded people. As a result, their nondominant hand was superior to the nondominant hand of righthanded people while their dominant hand was similar to that of the dominant hand of righthanded people.

The studies that have been cited used only small motor tasks in the administration of the treatments. This researcher could not find studies that utilized large motor tasks. Nor was there ever a rationale provided in the literature as to why researchers preferred using small motor tasks over the large motor tasks. One point that the studies did bring out was that practice can improve the efficiency of performance in the nondominant hands of both righthanded and lefthanded people. Without practice with the nondominant hands, skills and processes become stagnant. This caused the dominant hand to be used more often, and resulted in minimal use of the nondominant hand (Hunter, 1977).

Despite the completed research, there are still many questions concerning the origin of handedness. More research is needed to determine whether there are differences between the efficiency of the hands of righthanded and lefthanded people while performing large and small motor tasks with their nondominant hands. Further research is needed to determine the origins of handedness in people. In this way, the differences between righthanded and lefthanded people may be better understood.
This study was done to examine sex, handedness, large and small motor tasks as factors in determining the efficiency with which righthanded and lefthanded males and females use their nondominant hand while performing motor tasks.
CHAPTER III

METHODS AND PROCEDURES

The purpose of this study was to determine if differences exist in the efficiency with which lefthanded and righthanded males and females use their nondominant hand in the performance of large and small motor tasks.

Subject Selection

In the spring semester of 1981-82, all instructors teaching Physical Education 100 classes at the University of Wisconsin-LaCrosse were contacted for permission to obtain subjects for the study from their classes. All students attending the University of Wisconsin-LaCrosse are required to complete two credits of Physical Education 100 classes. After receiving consent of the instructors, a time was arranged to explain the study and obtain volunteer subjects (See Appendix A). Following an explanation of the study, the students in the classes were asked if they would volunteer to be considered as subjects for the study. After they volunteered, the subjects' handedness was determined by completing a checklist containing six tasks (See Appendix B). If the subjects performed four of six tasks with one specific hand, then that hand was considered the dominant hand for the purpose of the study. After all the checklists were compiled, the subjects were divided into five groups:
(1) righthanded males, (2) righthanded females, (3) lefthanded males, (4) lefthanded females, and (5) mixed-handedness. Subjects from the mixed-handedness group were not included in the study. From the volunteers, 20 subjects from each of the four remaining groups were randomly selected for the study.

**Procedures**

Subjects were notified of their selection as a subject for the study. Prior to the subjects participation in the study, they signed the consent form contained in Appendix C and then returned the form to this writer. At this same time, each of the subjects signed up for two consecutive one-half hour sessions on two consecutive days.

All testing took place in a classroom in Cowley Hall at the University of Wisconsin-LaCrosse with the room remaining constant throughout the testing. The room was sectioned off with partitions into two areas - with the two large motor tasks being performed in one area and the two small motor tasks being performed in the other area. Refer to Appendix D for a diagram of the testing area. In this way, the subjects could not watch each other perform the tasks.

The two people who administered the tests remained constant throughout the testing. One person administered the two large motor tasks in one area and the other person administered the two small motor tasks in the other area. These test administrators also answered any questions that the subjects may have had concerning the testing.
Earlier in the semester, a pilot study was carried out with six students. From this pilot study, the criteria for the testing trials of the present study were determined. The subjects would be given three trials on the first day of testing and four trials on the second day of testing. The first day's trials would be considered practice trials. These practice trials were provided so that the subjects had acquired the skills needed for each task by day two of the testing.

When the subjects arrived on their first assigned day and time, the tasks were explained to them. They were told that each of the four tasks was to be performed with their nondominant hand. The instructions for performing each of the four tasks had been tape-recorded (See Appendix E). The subjects were required to listen to the tapes before each day of testing. The order for completing each task was randomly assigned for each of the subjects. After the first day of testing was completed, the subjects were instructed not to practice any of the tasks between their assigned days. On the second day of testing, the subjects repeated the same procedures they had followed on their first day of testing with the exception that the subjects performed four trials on the second day compared to three trials on the first day. Although all seven trials were recorded, only the scores on the four trials on the second day were utilized as the raw data in the study.
For all seven trials, the subjects were given 15 seconds rest between each trial. A new task would start after the subjects listened to the instructions and then gave a verbal indication that they were ready to start. Each task was performed in this manner. After each trial, the results were recorded on the subjects’ data sheet (See Appendix F).

Development of Instrumentation

Each subject in each group performed two large motor tasks and two small motor tasks, using their nondominant hand. The large motor tasks used a table tennis paddle and a table tennis ball, and a 12-inch plastic ball and a "Hi-Li" plastic scoop. The small motor tasks utilized in the study were the Rotary Pursuit Apparatus and the Groove Type Steadiness Tester. The description of the equipment used and the explanation of each task is as follows:

Paddle task. The equipment used for this task was obtained from the Cosom Company in Minneapolis, Minnesota. The table tennis paddle and table tennis ball was Model #1750. This task required the subjects to hit a table tennis ball with a table tennis paddle while alternating sides with each hit. The ball was to go in the air with no limit on the height the ball should reach. The subjects were told to keep both feet on the marked spot while trying to keep the ball going continuously. If the subjects missed, dropped, or lost control of the ball, they were instructed to retrieve
the ball, return to the marked spot, and continue the trial. The subjects were timed for 30 seconds with each hit on the paddle being counted. A hit was counted if the ball struck anywhere on the appropriate side of the paddle. The subjects were given seven trials at 30 seconds per trial with a 15 second rest between trials. The total hits for each trial was recorded on the data sheet. The criteria for a miss were the following: (a) the ball did not contact the appropriate side of the paddle, and (b) both feet did not remain in contact with the marked spot.

Scoop task. The equipment used for this task was obtained from the Cosom Company in Minneapolis, Minnesota. The plastic ball used was a 12-inch ball and the scoop used was a "Hi-Li" scoop. Both pieces of equipment were Model 680.

For this task, the subjects were given the ball and scoop. They were told to start with the ball in the scoop, while held at waist level. They were then to toss the ball straight up in the air and catch the ball back in the scoop. The subjects were told to keep both feet on the marked spot while catching the ball in the scoop. When the ball was tossed, the minimum height had to be above the subjects' heads, with no limit on the maximum height. The ball must have been released from the scoop by the time it reached shoulder level. If the subjects lost control of the ball, they were instructed to retrieve the ball, return to the marked spot, and continue
the trial. The subjects were given seven trials with a 15 second rest between trials. The total number of correct catches was recorded for each trial on the data sheet. The criteria for a miss were the following: (a) the ball was not caught on a fly in the scoop, (b) the ball did not go above the subjects' heads, (c) the ball was not released by shoulder level, and (d) both feet did not remain in contact with the marked spot.

Rotary pursuit apparatus task. The instruments that were used for this task were obtained from the Lafayette Instrument Company in Lafayette, Indiana. The Rotary Pursuit Apparatus (Model 30010) was connected to a Stop Clock (Model 54014) that counted the number of correct target hits.

The subjects were given seven trials at 20 seconds per trial with a 15 second rest between trials. They faced the machine so that the turntable for the lefthanded people rotated clockwise and for the righthanded people rotated counter-clockwise at 60 revolutions per minute. The subjects were told to keep the stylus over the light beam as long as possible while it traveled around the circle. After each trial, the number of correct target hits was recorded on the data sheet.

Groove type steadiness tester task. The instruments that were used for this task were obtained from the Lafayette Instrument Company in Lafayette, Indiana. The Groove Type Steadiness Tester (Model 32010) was connected to a Stop
Clock (Model 58007) that counted the number of errors per trial.

The subjects were given seven trials with a 15 second rest between trials. The subjects were required to push a stylus through a gradually narrowing groove without touching the sides of the groove. After each trial, the spot where the first error occurred and the number of errors were recorded on the data sheet with the first error being used for the raw data.

Statistical Procedures

The last four trials for each of the subjects were used in computing the results. These four trials were summed and from this total, mean scores and standard deviations were computed. A two-way analysis of variance (ANOVA) with two levels on each factor (sex X handedness) was then calculated for each of the four tasks. The .05 level of significance was maintained throughout the study. All data were analyzed in the Computer Center of the University of Wisconsin-LaCrosse.
CHAPTER IV

RESULTS AND DISCUSSION

This study was designed to determine if differences exist in the efficiency with which lefthanded and righthanded males and females use their nondominant hand in the performance of large and small tasks. Nineteen righthanded females, 17 righthanded males, 15 lefthanded females, and 18 lefthanded males participated as subjects in the study. These subjects were selected from Physical Education 100 classes from the University of Wisconsin-LaCrosse. The subjects completed their testing over two days. The testing consisted of four tasks in which the subjects received seven trials for each task. The scores on the last four trials of each task were used as the raw data. The statistical analyses employed in this study consisted of analysis of variance (ANOVA) with two levels on each factor (sex X handedness) for each of the four tasks.

Results

The results of the analysis for each of the four tasks are presented in the following order: (1) Paddle Task, (2) Scoop Task, (3) Rotary Pursuit Apparatus, and (4) Groove Type Steadiness Tester.
Paddle Task

The mean scores and standard deviations for performance on the Paddle Task are presented in Table 1. Results of the analysis of variance for the test are included in Table 2. A graph of the means obtained in task one is presented in Figure 1.

An $F$ value of 1.184 was not significant for sex differences on the first task. However, an $F$ value of 7.872 was significant at the .05 level for differences in performance of righthanded and lefthanded groups. An $F$ value of 1.000 was obtained for group interaction and was not significant.

<table>
<thead>
<tr>
<th>Table 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paddle Task</td>
</tr>
<tr>
<td>Means and Standard Deviations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Handedness</th>
<th>Left</th>
<th>Right</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Male</strong></td>
<td>186.22$^a$</td>
<td>170.24</td>
<td>178.46</td>
</tr>
<tr>
<td></td>
<td>28.20$^b$</td>
<td>36.91</td>
<td>33.23</td>
</tr>
<tr>
<td><strong>Female</strong></td>
<td>185.87</td>
<td>152.37</td>
<td>167.15</td>
</tr>
<tr>
<td></td>
<td>40.44</td>
<td>38.79</td>
<td>42.42</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>186.06</td>
<td>160.81</td>
<td>172.88</td>
</tr>
<tr>
<td></td>
<td>33.73</td>
<td>38.45</td>
<td>32.18</td>
</tr>
</tbody>
</table>

$^a$ Mean  
$^b$ Standard Deviation
<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
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<td>1</td>
<td>1552.930</td>
<td>1.184</td>
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<tr>
<td>Handedness</td>
<td>10328.361</td>
<td>1</td>
<td>10328.361</td>
<td>7.872*</td>
</tr>
<tr>
<td>Group Interactions</td>
<td>1312.261</td>
<td>1</td>
<td>1312.261</td>
<td>1.000</td>
</tr>
<tr>
<td>Residual</td>
<td>85284.063</td>
<td>65</td>
<td>1312.063</td>
<td></td>
</tr>
</tbody>
</table>

* = P ≤ .05  \( F \) value ≥ 4.00 with (1,65) df

Figure 1
Paddle Task
Mean Scores

---

= Females  – – – – = Males
Scoop Task

The means and standard deviations for performance on the Scoop Task are illustrated in Table 3. Results of the analysis of variance for the second task are reported in Table 4. The graph of the mean scores for task two is presented in Figure 2.

The F values obtained for the differences in sex of .466, .900 for handedness, and .338 for group interaction revealed that no significant differences existed between groups on the Scoop Task at the .05 level.

Table 3
Scoop Task
Means and Standard Deviations

<table>
<thead>
<tr>
<th>Handedness</th>
<th>Left</th>
<th>Right</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Left</td>
<td>Right</td>
<td>Total</td>
</tr>
<tr>
<td>Male</td>
<td>117.78&lt;sup&gt;a&lt;/sup&gt;</td>
<td>110.12</td>
<td>114.06</td>
</tr>
<tr>
<td>Female</td>
<td>111.27</td>
<td>109.47</td>
<td>110.27</td>
</tr>
<tr>
<td>Total</td>
<td>114.82</td>
<td>109.78</td>
<td>112.19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Sex</th>
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<th>Right</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>16.20&lt;sup&gt;b&lt;/sup&gt;</td>
<td>18.29</td>
<td>17.43</td>
</tr>
<tr>
<td>Female</td>
<td>29.35</td>
<td>18.95</td>
<td>23.72</td>
</tr>
<tr>
<td>Total</td>
<td>22.96</td>
<td>18.39</td>
<td>20.70</td>
</tr>
</tbody>
</table>

<sup>a</sup> = Mean  
<sup>b</sup> = Standard Deviation
Table 4
Scoop Task
Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>203.274</td>
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<td>203.274</td>
<td>.466</td>
</tr>
<tr>
<td>Handedness</td>
<td>392.646</td>
<td>1</td>
<td>392.646</td>
<td>.900</td>
</tr>
<tr>
<td>Group</td>
<td>147.312</td>
<td>1</td>
<td>147.312</td>
<td>.338</td>
</tr>
<tr>
<td>Interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residual</td>
<td>28352.461</td>
<td>65</td>
<td>436.192</td>
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</tr>
</tbody>
</table>

P ≤ .05  F value ≥ 4.00 with (1, 65) df

Figure 2
Scoop Task
Mean Scores

<table>
<thead>
<tr>
<th>LH</th>
<th>RH</th>
</tr>
</thead>
<tbody>
<tr>
<td>118</td>
<td>108</td>
</tr>
<tr>
<td>116</td>
<td></td>
</tr>
<tr>
<td>114</td>
<td></td>
</tr>
<tr>
<td>112</td>
<td></td>
</tr>
<tr>
<td>110</td>
<td></td>
</tr>
</tbody>
</table>

--- = Females  --- = Males
The means and standard deviations reflecting the performance of each group are presented in Table 5. Results of the analysis of variance for the Rotary Pursuit Apparatus scores are reported in Table 6. A graph of the means of the groups for task three is exhibited in Figure 3.

Resulting F values of 2.788 for differences in sex, .000 for handedness, and .853 for interaction effects revealed that no significant differences existed at the .05 level between groups on their performances on the Rotary Pursuit Apparatus Task.

Table 5

Rotary Pursuit Apparatus
Means and Standard Deviations

<table>
<thead>
<tr>
<th>Handedness</th>
<th>Left</th>
<th>Right</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>177.17a</td>
<td>185.88</td>
<td>181.40</td>
</tr>
<tr>
<td></td>
<td>29.16b</td>
<td>43.10</td>
<td>36.31</td>
</tr>
<tr>
<td>Female</td>
<td>170.40</td>
<td>161.32</td>
<td>165.32</td>
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<tr>
<td></td>
<td>48.00</td>
<td>38.68</td>
<td>42.60</td>
</tr>
<tr>
<td>Total</td>
<td>174.09</td>
<td>172.92</td>
<td>173.48</td>
</tr>
<tr>
<td></td>
<td>38.36</td>
<td>42.11</td>
<td>40.07</td>
</tr>
</tbody>
</table>

a= Mean    b= Standard Deviation
Table 6
Rotary Pursuit Apparatus
Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
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<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
<td>4433.636</td>
<td>1</td>
<td>4433.636</td>
<td>2.788</td>
</tr>
<tr>
<td>Handedness</td>
<td>.000</td>
<td>1</td>
<td>.000</td>
<td>.000</td>
</tr>
<tr>
<td>Group</td>
<td>1355.871</td>
<td>1</td>
<td>1355.871</td>
<td>.853</td>
</tr>
<tr>
<td>Interactions</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Residual</td>
<td>103353.688</td>
<td>65</td>
<td>1590.057</td>
<td></td>
</tr>
</tbody>
</table>

P ≤ .05 F value ≥ 4.00 with (1, 65) df

Figure 3
Rotary Pursuit Apparatus
Mean Scores

---

= Females  = Males
Groove Type Steadiness Tester

Table 7 illustrates the mean values and standard deviations for performances on the Groove Type Steadiness Tester. Results of the analysis of variance for this fourth task are presented in Table 8. A graph of the mean scores is found in Figure 4.

An F value of .845 was obtained for the sexes and was not significant. The F value for handedness was .039 and was also not significant. The F value for group interaction was 6.436 and indicated a significant difference at the .05 level. The Scheffe' test was then computed to determine where the significant differences were located. The results of the Scheffe' test are shown in Table 9.

Table 7
Groove Type Steadiness Tester
Means and Standard Deviations

<table>
<thead>
<tr>
<th></th>
<th>Handedness</th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Left</td>
<td>Right</td>
<td>Total</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>82.01&lt;sup&gt;a&lt;/sup&gt;</td>
<td>78.82</td>
<td>80.46</td>
<td>4.88</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>3.99&lt;sup&gt;b&lt;/sup&gt;</td>
<td>5.31</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>77.77</td>
<td>80.61</td>
<td>79.35</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>6.91</td>
<td>3.14</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Total</td>
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<td>79.76</td>
<td>79.91</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>5.82</td>
<td>4.33</td>
<td>5.06</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<sup>a</sup> Mean    <sup>b</sup> Standard Deviation
Table 8
Groove Type Steadiness Tester
Analysis of Variance

<table>
<thead>
<tr>
<th>Source</th>
<th>SS</th>
<th>df</th>
<th>MS</th>
<th>F</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex</td>
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<td>1</td>
<td>20.376</td>
<td>.845</td>
</tr>
<tr>
<td>Handedness</td>
<td>.947</td>
<td>1</td>
<td>.947</td>
<td>.039</td>
</tr>
<tr>
<td>Group Interactions</td>
<td>155.116</td>
<td>1</td>
<td>155.116</td>
<td>6.436*</td>
</tr>
<tr>
<td>Residual</td>
<td>1566.701</td>
<td>65</td>
<td>24.103</td>
<td></td>
</tr>
</tbody>
</table>

* = P .05 F value 4.00 with (1,65) df

Table 9
Scheffe's Test
Groove Type Steadiness Tester

<table>
<thead>
<tr>
<th></th>
<th>LH Females</th>
<th>RH Males</th>
<th>RH Females</th>
<th>LH Males</th>
</tr>
</thead>
<tbody>
<tr>
<td>( \bar{X} )</td>
<td>77.77</td>
<td>78.82</td>
<td>80.61</td>
<td>82.01</td>
</tr>
</tbody>
</table>

LH-Females
RH-Males
RH-Females
LH-Males

* = Significant difference between groups
A discussion of the results of each task is presented, preceded by a review of the test and procedures.

Paddle Task

The first task required the subjects to hit a table tennis ball with a table tennis paddle while alternating sides with each hit. The ball was to go in the air with no limit on the height the ball could reach.

There was a significant difference between the right-handed and the lefthanded groups. The F value for this task was 7.872 which is significant at the .05 level. The mean for the lefthanded group was 186.06 and the mean for the righthanded group was 160.81. Although the average performance of the males, 178.46, was superior to that of the females, 167.15, this difference was not significant.
During this task, it was observed that the lefthanded group found this task to be easier than did the righthanded group. In fact, many of the lefthanded group said they played table tennis with their right hands because that was the way they were taught to play. This fact could account for the significant difference found between the groups.

The males of each group performed better than the females of the same group, but not significantly so. This could be due to the fact that more males are exposed to activities that incorporate tracking skills and the females do not use these skills as much.

**Scoop Task**

The second task of the study required the subjects to start with the ball in the scoop while held at waist level. They were then to toss the ball in the air and catch the ball back in the scoop. When the ball was tossed, the minimum height had to be above the subjects' heads, with no limit on the maximum height.

Performances on this task resulted in no significant differences between any of the groups. In fact, there was little difference between the means of each group. The lefthanded group had a mean of 114.62 compared to a mean of 109.78 for the righthanded group. The males had a mean of 114.06 which was closely followed by the females with a mean of 110.27.
Most of the subjects seemed to find this task relatively easy to accomplish. Again, the lefthanded males showed the highest mean of the four groups. The males of each group also scored higher than each of the female groups. In each of these instances, the females were close behind. The comments that were given during this task were of the nature that the task was the simplest of all the tasks. Thus, the Scoop Task may not have offered a sufficient challenge to the groups.

**Rotary Pursuit Apparatus**

The third task consisted of the subjects trying to keep the stylus over the light beam as long as possible while it traveled around the turntable at 60 revolutions per minute. The mean for the entire righthanded group, 172.92, was not significantly different than the mean for the lefthanded group, 174.09. There was no difference between the scores of the females and that of the males. The fact that there was no significant difference between the males and females would seem to contradict the common findings that females are more efficient than males in performing small motor tasks (Herron, 1976).

It was observed during the testing that the males adapted to the speed of the turntable more quickly than the females. Also, the females expressed more concern about the time limit for the task, while the males appeared unconcerned about the time constraints. If the females were concerned
about the time, it could have resulted in poorer performance on the task. A task that is performed easily when no time demands are made may become uncoordinated and difficult to perform when the stress of a time limit is imposed.

**Groove Type Steadiness Tester**

The fourth task required the subjects to push a stylus through a gradually narrowing groove without touching the sides of the groove. There was not a significant difference between the males and females in their performance on the task. The mean for the males was 80.46 and the mean for the females was 79.35. There also was no difference between the righthanded group and the lefthanded group. Although there were no significant differences shown for sex or handedness, there was a significant difference for the interaction of sex and handedness. An F value of 6.436 at the .05 level of significance was attained for the interaction of the two factors. A post hoc test, the Scheffe', was then applied to determine where the difference between the groups was located. The results of the Scheffe' test indicated that the performance of the lefthanded females was significantly poorer from that of the righthanded females as well as the lefthanded males.

Ten of the 18 lefthanded males wrote with their right hands while only 2 of the 15 lefthanded females wrote with their right hands. Therefore, the males were more proficient with their nondominant hand while performing a task that
appears to be very similar to writing and the females did not have this proficiency. This fact could account for the superior performance of the lefthanded males - they were using their preferred hand for the task. Also, this was the only task where the righthanded females had a higher mean than the lefthanded females.

There did not appear to be consistent differences in performances on the large and small motor tasks. Each task appeared to be totally independent of the other tasks. This could be due to the fact that the tasks being examined could be classified as open and closed skills rather than being classified as large and small motor tasks. The open tasks would include the Rotary Pursuit Apparatus, Paddle Task, and Scoop Task with the closed task being the Groove Type Steadiness Tester. This independency of the tasks also made it difficult to compare the performance of the individual groups across tasks. The fact that the females and males were not significantly different in their performances of large and small motor tasks would not agree with Herron's (1976) statements that females are seen to be more efficient in small motor tasks and males in large motor tasks. These sex-roles are not supported by the results of this study.

The results of this study indicated no clear pattern of superiority for lefthanded people in their efficiency to perform tasks with their nondominant hand. These results would not agree with the literature indicating that lefthanded
people would be more efficient with their nondominant hand than righthanded people. The only difference in handedness was in the Paddle Task. If within this task, the lefthanded people who played table tennis with their right hands were eliminated or made to do the task with their non-preferred hands, this could have resulted in no significant difference in handedness on this task.

On the handedness checklist (See Appendix B), it was noted that 17 of the 33 lefthanded subjects used their right hands for some tasks compared to the righthanded group where only 2 of the 36 subjects used their left hands for some tasks. Again, this could be due to our society being predominantly righthanded which forced some lefthanded people to learn certain skills with their right hands. One tentative explanation offered for the lack of superiority shown by the lefthanded group in the present study was due to the practice trials that were given to the subjects. Peters (1976) found that the nondominant hand, with practice, performed as well as the dominant hand for both righthanded and lefthanded people. By providing the three practice trials, any differences that may have existed between the groups prior to performing each of the four tasks were then eliminated.
CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary

The purpose of the study was to determine if differences exist in the efficiency with which lefthanded and righthanded males and females use their nondominant hand in the performance of large and small motor tasks. Sub-problems of the study also examined any differences in the use of the nondominant hand between males and females, the righthanded and lefthanded groups, and sex and handedness interactions while performing large and small motor tasks. The subjects were selected from Physical Education 100 classes from the University of Wisconsin-Lacrosse in the spring semester of 1981-82. These subjects were classified into the following groups: (1) 19 righthanded females, (2) 17 righthanded males, (3) 15 lefthanded females, and (4) 18 lefthanded males.

The subjects completed their testing over two consecutive days with each day's testing taking approximately one-half hour. The testing consisted of the following four motor tasks: (1) Paddle Task, (2) Scoop Task, (3) Rotary Pursuit Apparatus, and (4) Groove Type Steadiness Tester. Scores were recorded individually for each of the seven trials for each task. The sum of the last four trials of
each task was used as the raw data for the study. Data were analyzed utilizing a two-way ANOVA. Differences between males and females, between righthanded people and lefthanded people, and handedness by sex interaction were computed for each of the four tasks. The Scheffe' Test was also run for the Paddle Task. An F value of .05 was maintained throughout the study.

Results indicated significant differences on two of the four tasks. A significant difference was found between righthanded and lefthanded subjects on the Paddle Task. Performance on the Groove Type steadiness Tester was the other task on which a significant difference was found. The significant F value was for the interaction of sex and handedness. The results of the Scheffe' Test indicated that lefthanded females were significantly poorer from righthanded females and lefthanded males. No significant differences were evident in the performance of the two remaining tasks.

Conclusions

The null hypothesis for this study was stated as follows:

There is no significant difference in the efficiency with which lefthanded and righthanded males and females use their nondominant hand in the performance of large and small motor tasks.
Each of the four motor tasks appeared to be independent of the others and, therefore, no large and small task comparisons could be made.

The null sub-hypotheses for this study were stated and resulted in the following conclusions:

Sub-Hypothesis 1. There is no significant difference between righthanded and lefthanded people while performing large and small motor tasks with their nondominant hand.

The null hypothesis was rejected for the Paddle Task due to significant differences in performance between the lefthanded and righthanded groups. The performance of the lefthanded group was significantly better than the righthanded group.

The null hypothesis was accepted for the following tasks: Rotary Pursuit Apparatus, Groove Type Steadiness Tester, and Scoop Task.

Sub-Hypothesis 2. There is no significant difference between males and females in their performance of large and small motor tasks with their nondominant hand.

The null hypothesis was accepted for all four tasks.

Sub-Hypothesis 3. There is no interaction between sex and handedness when righthanded and lefthanded people perform large and small motor tasks with their nondominant hand.

The null hypothesis was rejected for the Groove Type Steadiness Tester task. Significant differences were found between the lefthanded females and the righthanded females.
as well as the lefthanded males.

The null hypothesis was accepted for performance on the Rotary Pursuit Apparatus, Paddle Task, and Scoop Task.

**Recommendations**

The present investigation led to the following recommendations for future study:

(1) A larger sampling of subjects should be selected for use in further studies.

(2) Physical education majors should be tested to determine if differences exist in their abilities to perform tasks.

(3) A larger area should be utilized for performing the large motor tasks.

(4) If large motor tasks are to be used in future studies, these tasks should be made more complex.

(5) The use of a younger population of people should be selected as subjects for a future study.

(6) A study should be conducted using open and closed motor skills classification instead of large and small motor skills.

(7) A study should be conducted using subjects who prefer to use one hand for some of the tasks and the other hand for the remaining tasks. Subjects would be put into groups according to the hand that they prefer using for each task.
REFERENCES CITED


Peters, M. Prolonged practice of a simple motor task by preferred and nonpreferred hands. Perceptual and Motor Skills, October 1976, 42(43), 447-450.


To: Faculty Members
From: Sue Dummer
Re: Subject selection for my thesis

From reading Dr. Kaufman's letter, you already know that I am asking you for your help and cooperation in finding subjects for my thesis.

I have attached to these letters a schedule of times and days in which I could come into your classes to ask for volunteers. The classes are numbered in the order in which I will be attending them.

In order to complete my subject selection, I will be attending your class on two consecutive class periods. In the first meeting I will explain my study and ask for volunteers to sign-up. This should not take more than ten minutes. In the second meeting, I will be there approximately the same time as on the first meeting. At this time, I will have selected my volunteers and will give them the assigned days and times for their testing.

There will be forty righthanded and forty lefthanded students selected for the study. Of these eighty students, approximately one-half will be males and the other half females. Due to the large number of subjects needed and the fact that I would like to do part of my testing before spring break, I am trying to get this done as soon as possible.
If these times are suitable, please initial your schedule and return it to me at Dr. Joy Greenlee's office, 130 Mitchell Hall.

Thank you for your help and cooperation!

Sincerely,

Sue Dummer
Sue Dummer

Thesis Chairperson

Dr. Joy Greenlee
(1) What hand do you use to write?  
(2) What hand do you use to throw?  
(3) What hand do you use to cut with a scissors?  
(4) What hand do you hold your knife in to cut food?  
(5) What hand do you use to hold your toothbrush?  
(6) What hand do you use to hammer a nail?  

Group: Righthanded  
Lefthanded  
Mixed  

TALLY SHEET

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a= Righthanded  
b= Mixed-Handed  
c= Lefthanded
I understand that the purpose of this study is to compare the differences in sexes and the nondominant hand of right-handed and lefthanded students while performing small and large motor tasks.

I confirm that my participation as a subject is entirely voluntary. No coercion of any kind has been used to obtain my cooperation.

I understand that I may withdraw my consent and terminate my participation at any time during the study.

I have been informed of the procedures that will be used in the study and understand what will be required of me as a subject.

I understand that all of my responses, written or oral, will remain completely anonymous.

I wish to give my cooperation as a subject.

Signed: ____________

Date: ____________

APPENDIX D

DIAGRAM OF TESTING AREA
Small Motor Task Area

Partitions

Marked Spots

××

Large Motor Task Area

Groove Type Steadiness

Rotary Pursuit

Tape Recorder

Tape Recorder
APPENDIX B

TAPE-RECORDED INSTRUCTIONS
Rotary Pursuit Machine Task

You will be given (3) (4) trials with a rest between trials. Without touching the glass, you are to keep the stylus over the light beam as long as possible while it travels around the circle. Your score will be recorded after each trial. Do you have any questions? If not, we will start your first trial.

Groove Type Steadiness Tester Task

You will be given (3) (4) trials with a rest between trials. You are to push the stylus through the groove without touching the sides of the groove. You will continue until you reach the end of the groove trying to make as few errors as possible. Should the stylus come in contact with the sides of the groove, remove it and continue on. After each trial, your score will be recorded. Do you have any questions? If not, we will start your first trial.

Paddle Task

You will be given (3) (4) trials with a rest between trials. You are to hit the ball on alternate sides of the paddle as many times as possible. The ball contacting any part of the appropriate side of the paddle will be considered a legal hit. Your feet must remain in contact with the marked spots on the floor. Should you lose control of the ball, retrieve it as quickly as possible, return to the
marked spot and continue the trial. Your score will be recorded after each trial. Do you have any questions? If not, we will start your first trial.

Scoop Task

You will be given (3) (4) trials with a rest between trials. The trial will start with the ball in the scoop while held at waist level. To be legal, the ball must be released from the scoop by the time it reaches shoulder level. When tossing the ball up, the minimum height of the ball must be above your head with no limit on the maximum height. During the tossing and catching of the ball, your feet are to remain in contact with the marked spots on the floor. Should you lose control of the ball, retrieve it as quickly as possible, return to the marked spot on the floor and continue the trial. Your score will be recorded after each trial. Do you have any questions? If not, we will start your first trial.
Name ____________________________
Righthanded ____________

Sex - Male or Female
Lefthanded ________

ROTARY PURSUIT TASK

Trial - Number of Correct Responses
(1) ___ (4) ___ (6) ___
(2) ___ (5) ___ (7) ___
(3) ___

GROOVE TYPE STEADINESS TESTER TASK

Trial - Number Where First Error Was Made
(1) ___ (4) ___ (6) ___
(2) ___ (5) ___ (7) ___
(3) ___

PADDLE TASK

Trial - Number of Hits in Thirty Seconds
(1) ___ (4) ___ (6) ___
(2) ___ (5) ___ (7) ___
(3) ___

SCOOP TASK

Trial - Number of Correct Catches
(1) ___ (4) ___ (6) ___
(2) ___ (5) ___ (7) ___
(3) ___