AN ABSTRACT OF THE THESIS OF

Nancy O'Banion for the Master of Science Degree

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Title: The Effects of Controlled Video Game Playing Experience on the Eye-Hand Coordination and Reaction Time of Second Grade Children

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Purpose: The purpose of this study was to investigate the effects of seven weeks of video game-playing experience on the eye-hand coordination and reaction time of second grade children, as measured by the Lafayette Rotary Pursuit and a hand reaction time test.

Methods of Research: Thirty male and female students were pre-tested for eye-hand coordination and reaction time. Fifteen students then participated in playing selected video games at their school for 10 minutes a day, four days a week, for seven weeks. Fifteen students did not play any video games for the seven weeks. Post-testing was administered to measure changes in eye-hand coordination and reaction time. The pre- and post-test scores from the tests were analyzed by the analysis of covariance test with a significance being at the .05 level.

Conclusions: The fifteen second grade students in the experimental group who participated in a seven week video game playing program, did significantly improve their eye-hand coordination and reaction time as measured by a rotary pursuit test and a hand reaction time test.

The fifteen students in the control group, who did not participate in video games for the seven week period, made no significant change in their eye-hand coordination and reaction time.

THE EFFECTS OF CONTROLLED VIDEO GAME PLAYING EXPERIENCE ON THE EYE-HAND COORDINATION AND REACTION TIME OF SECOND GRADE CHILDREN

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Chapter 1

INTRODUCTION

This chapter is devoted to information concerning the relationship between eye-hand coordination, reaction time, and video games in children between the ages of 6 and 10 years. The statement of the problem, the null hypothesis, the assumptions, the purpose, and the significance of the study will be discussed. Also included are the definitions of specific terms and the limitations of the study.

Theoretical Formulation

The use of video games is currently a controversial issue. The United States Surgeon General recently declared that the plyaing of video games might be hazardous to the health of those who play them ("Surgeon General Cites," 1982). In some towns, such as Mesquite, Texas, laws have been passed which restrict children from frequenting video game arcades. Such bannings are due to the feelings of many parents that the games are addictive and promote problems such as those cited by the Surgeon General: (1) psychological side-effects; (2) tensions; (3) sleeplessness; (4) children always thinking about "eliminate, kill, destroy" ("Video Game Boosters," 1982).

The microcomputers that are becoming so popular for homes and schools have the capacity for video game programming. By

1984, it is expected that there will be between 300,000 and 650,000 computers in American schools (Golden, 1982). Sales of home computers are expected to reach 3.5 million in 1983 (Greenwald, 1982). The accessibility of computers and video games, which has been cited to be potentially harmful, could be something potentially beneficial.

A study by Favaro (Thornburg, 1982) revealed that video games can improve the eye-hand coordination of young children. Eye-hand coordination and reaction time are fine motor skills which involve small muscles and precise movements (Zaichkowsky, 1980). These skills underlie activities such as participating in sports, driving a car, typing, reading, and writing. Corbin (1973) stated that in view of what is known about the importance of the development of motor skills in early childhood, elementary school programs should be searching for new ways to help the child reach his potential in motor skill development. Hodgkins (1963) reported that the greatest increase in the development of reaction time comes between the ages of 6 and 10 years. This could be considered a prime learning age for the development of fine motor skills; therefore, this study will involve children in that age group.

The Problem

Can video game play aid children in the development of their fine motor skills? Is there a difference in the eye-hand coordination and reaction time of children who do play video games and those who do not? These are some of the questions which have created a need for research in this area.

Thornburg (1982) noted that in Favaro's study, pre-school boys made improvements in eye-hand coordination after playing video games. Gessell (1946) and Oberteuffer (1962) stated that at approximately seven or eight years of age, children show a marked increase in fine motor skill performance. Hodgkins (1963) reported that a major developmental period for reaction time is between the ages of 6 and 10 years. On the basis of this information, this study will examine the effects of video game play on children's fine motor skills at a prime learning age.

Statement of the Problem

Is there a significant difference in the scores of eye-hand coordination and reaction time tests of second grade children who do participate in video games and second grade children who do not participate in video games?

Statement of the Hypothesis
(Null Form)

There is no significant difference in the scores of eye-hand coordination and reaction time tests of second grade children who participate in video games (VG) and second grade children who do not participate in video games (NVG).

Symbolic Statement: H_O: μ VG = μNVG

Assumptions of the Study

1. The subject playing the video games will play at an optimum level each day.

2. The subjects playing the video games will play the full 10 minutes every playing day.

3. The subjects playing the video games will be in optimum health each day they play.

4. All control subjects will not play video games during the course of the study.

5. Experimental subjects will play video games only the allotted amount of time.

Purpose of the Study

The purpose of this study was to examine if video game playing can significantly change the eye-hand coordination and reaction time of second grade children. Both the experimental and control groups were pre- and post-tested for eye-hand coordination and reaction time. The experimental group played video games for seven weeks. The control group did not play any video games for the seven week period. The test scores of the two groups were examined to determine if video game significantly improved eye-hand coordination and reaction time.

Significance of the Study

The significance of this study was to find an additional method of improving eye-hand coordination and reaction time in children. If video games can improve these fine motor skills, the games could be utilized by schools and parents to serve this purpose.

Definitions of Terms

Terms relating to this study have been specifically defined in this section.

Eye-Hand Coordination

"The ability of the eye and hand to work together to produce a manual task" (Stinson, 1982).

Preferred Hand

The subjects' preferred hand was determined by having them write their names on paper. The hand they wrote with was the hand they used during the testing.

Reaction Time

The elapsed time between the presentation of a stimulus and the initiation of a response (Singer, 1980).

Video Games

An electronic-computer game which projects an image on a monitor, such as a television screen, and requires the player to manually control the action of the game. The games are primarily designed for recreational purposes.

Limitations of the Study

An uncontrolled variable in this study was the possibility of the subjects participating in additional video games. The control group was instructed not to play any video games during the course of the study. The experimental group was instructed to play the games only the 10 minutes a day, four days a week, for seven weeks. Any deviations from this could have altered the results of the study.

Chapter 2

REVIEW OF RELATED LITERATURE

The review of literature related to this study is divided into four parts. The first section deals with the general concept of motor skills. A discussion of reaction time is presented in section two. Section three deals with eye-hand coordination and its development. The final section discusses video games, the controversy surrounding them, and the popularity of video games and computers.

Motor Skills

A motor skill is defined as an activity that requires the movement of various parts of the body (Oxendine, 1968). Motor skills are essential for (1) cognitive and affective development; (2) positive childhood experiences; (3) helping a person develop into a physically and psychologically fit person by feeling good about his abilities; and (4) survival in all aspects of living (Zaichkowsky, 1980). To successfully perform motor skills, a person depends on several underlying factors. These factors include strength, speed, power, agility, balance, precision, timing, reaction time, flexibility, and coordination (Corbin, 1973; Oberteuffer, 1962; Oxendine, 1968; Singer 1980).

Motor skills are dichotomously classified as gross and fine motor skills (Cratty, 1964). Gross motor skills are the movements which involve primarily the large muscles of the body (Zaichkowsky, 1980). In gross motor skills, the entire body is often in motion (Singer, 1980). Some examples of gross motor skills are jumping, throwing, catching, and kicking (Corbin, 1980). Fine motor skills refer to delicate or sensitive movements that require the use of smaller muscles and more precise movements (Singer, 1980; Zaichkowsky, 1980). Examples of fine motor skills include typing, piano playing, and handwriting (Corbin, 1980; Singer, 1980). It is difficult to isolate skills as either gross or fine; therefore, motor skills are classified on a continuum which ranges from gross to fine. A varying emphasis on the underlying factors involved, such as timing, strength, and precision, distinguish gross from fine skills (Cratty, 1964; Singer, 1980; Zaichkowsky, 1980). Classification also depends on the size of the muscle involved, the amount of force applied, and the space in which the movement is involved (Cratty, 1964).

According to Zaichkowsky (1980), the development of motor skills follows a sequential process of development, from simple involuntary reflexes in infancy, toward complex, coordinated movements in adulthood. Motor behavior generally moves from involuntary reflexes to postural movements, locomotor movements, and the development of fine motor and manipulative skills. The motor skills increase as motor control develops. Motor control develops in cephalocaudal and proximodistal directional sequences (Cratty, 1964; Gallahue, 1976;

Zaichkowsky, 1980). Cephalocaudal development means that growth proceeds from the head toward the feet. The head and arms form before the legs, and the nervous system develops from the brain downward. Proximodistal development refers to growth proceeding from the center of the body to the periphery. Control proceeds from the trunk to the arms, hands, and fingers; and from the hips to the legs, feet, and toes (Corbin, 1980). A child gains neuromuscular control of the head and trunk prior to gaining control of the hands and feet (Gallahue, 1976).

The distribution of practice is an important factor in learning a motor skill. Cratty (1964) stated that, in most cases, little improvement will be shown with massed practice. With the addition of rest intervals, a marked improvement occurs in performance. It was suggested by Cratty (1964) that the practice and rest periods should be relatively equal in length. However, if the task to be learned is enjoyable to the learner, the ratio of work to rest can be increased.

According to Corbin (1973), during the initial learning of a motor skill, distributed practice is more effective than massed practice. Frequent practice is most effective and is required if the practice periods are very short. The length of the practice sessions depends on several factors: the learner's maturity and interest in the skill, his experiences, and the complexity of the skill. For young learners, Corbin (1973) suggests short and frequent sessions. This promotes high motivation and concentrated effort which are two essentials for motor learning.

A survey of the literature indicates that the time between the ages of 6 and 10 years seems to be the prime period for the improvement of fine motor skills (Corbin, 1973; Gallahue, 1976; Gessell, 1946; Hodgkins, 1963; Oberteuffer, 1962). From ages five to seven, reaction time is still slow, causing difficulty with eye-hand coordination. Children at this age are often farsighted and are not ready for extended periods of close work (Gallahue, 1976). By the ages of seven years, figure-ground perception, speed of vision, perceptual constancy, and spacial relationships are usually well established (Gallahue, 1976).

From six to eight years of age children can respond fairly quickly to moving objects, but cannot yet use the visual information to accurately direct their motor behavior (Corbin, 1973). Gessell (1946) indicated that at the age of eight years, children show an increase in fine motor performance. Oberteuffer (1962) related that at seven or eight years, children's eye-hand coordination usually improves quickly.

The greatest increase in the development of reaction time comes between the ages of 6 and 10 years (Hodgkins, 1963). By the age of nine years, children can make precise perceptual judgements. By the time children are 11 to 12 years old, they can make decisions about moving objects quickly and successfully because their motor responses are smoother and more skillful (Corbin, 1973).

Reaction Time

This review is concerned with the development of fine motor skills; more specifically, eye-hand coordination and reaction time. Reaction time is defined as the elapsed time between the introduction of a stimulus and the initiation of a response (Cratty, 1964; Harrow, 1972; Singer, 1980). It involves in integration of the higher centers of the nervous system. The stimuli must be perceived and the body must initiate an appropriate movement or response (Singer, 1980). Drowatzky (1975) explained that reaction time reflects the speed with which a person perceives and responds to his environment. Reaction time can be decreased by approximately 10% after training (Drowatzky, 1981). The greatest improvement in the development of reaction time comes between 6 and 10 years of age (Hodgkins, 1963).

A study by Henry and Rogers (1960) used subjects who were 8, 12, and 24 years of age. Results showed that reaction time decreased with age. Similar results were found in Hodgkins' (1963) study in which the ages of the subjects ranged from 6 to 84 years. He concluded that reaction time decreased until early adulthood, then increased throughout the later years.

Eye-Hand Coordination

Eye-hand coordination refers to the "ability of the eye and the hand to work together to produce a manual task" (Stinson, 1982). For example, catching a fly ball requires reacting to the stimulus of seeing the ball, following the flight of the ball, and coordinating the visually perceived object (ball) with the movement of catching (Harrow, 1972).

Improving eye-hand coordination helps the child in many ways. Better eye-hand coordination enables the child to receive visual images and respond with correct movements. The child learns to maintain visual contact with moving objects (tracking). Improved eye-hand coordination results in better judgements of distance, size, speed, and timing of movements. Improved eye-hand coordination may also give a child confidence in school and play activities (Ackerman, 1975).

The major growth period for eye-hand coordination is the first year of life. This is the time in which the basic factors involved in eye-hand coordination, such as visual exploration and manipulative movements, appear. The development in the following years is the refinement, the extension, or the use of the basic factors, as the child explores his ever-widening world (Corbin, 1980).

Corbin (1973) presented the work of Gibson (1973), Harris (1966), and Williams (1964), which established four main stages of the development of eye-hand coordination. The first stage, from birth to 16 weeks, is called "static visual exploration." This is the earliest indication of basic eye-hand coordination in a child. In this stage, the infant looks at an object and then looks back at his hands. A large part of his time is spent staring intently at his hands.

The second stage includes the seventeenth through the twenty-eighth weeks. This stage is characterized by repeated visual exploration of objects in the environment. This is a type of "ocular grasping" that is a forerunner of actual manual prehension and manipulation. The child might try to manually grasp the object, and if he does, it goes directly to his mouth for further exploration. The child tries to match up what he sees and the action of his hands with the "tactile-kinesthetic information" which he perceives (Corbin, 1973). Coordination of the sensory information sources is an important part of the development of eye-hand coordination.

Stages three (28-40 weeks) of eye-hand coordination development has one especially important characteristic. The child learns to correct his reaching or grasping movement through intensified visual fixation. The child is building a more refined capacity for using what he sees to direct what he does. This is another important step in the development of eye-hand coordination.

The fourth and final stage begins at approximately 40 weeks and extends through middle childhood. It consists of acquiring a more refined control of eye-hand coordination and extending these abilities to perform a wide variety of tasks. There is a definite involvement of the sensori-perceptual processes in the development of eye-hand coordination (Corbin, 1973).

Video Games

In a recent experiment by Favaro, reported by Thornburg (1982), 45 pre-school boys were tested to determine if video games affected their eye-hand coordination. One experimental group received six, five-minute training sessions on a video game. Another experimental group received the same amount of personal attention, but no video game playing. The third group received no special treatment. The pre-test and post-test consisted of two other video games and a pencil and paper maze-solving test. Results showed that skills on the other video games increased, but no improvement occurred on the maze task. Favaro felt that transfer to the maze might have occurred with longer training sessions on the video games.

Video games are presently a continuing source of controversy. Several towns, such as Mesquite, Texas; Bradley, Illinois; Marlboro, Massachusettes; and Coral Gables, Florida, tried to pass laws to restrict public video game playing for children ("Video Game Boosters," 1982; Oliver, 1982). There is great controversy concerning whether the games are good or bad for children. The United States Surgeon General recently said that video games might be hazardous to the health of young people who are becoming addicted to the machines ("Surgeon General Cites," 1982). Supporters of video games, "ranging from manufacturers to psychologists, said the games help teach skill development, coordination, and togetherness" ("Video Game Boosters," 1982).

In today's society, we are beginning to be surrounded by the presence of video games and home computers. At the present time, 20% of American homes have some type of video game (Time, 1982). Home computers, which are increasing in popularity, have the capacity to be programmed for video games. Sales of home computers are expected to reach 3.5 million in 1983 (Greenwald, 1982).

Golden (1982) stated that the real attraction to video games seems to be the lure of control. The pleasure of being able to plan a strategy and see its result is often denied to children. In playing video games, a child learns to develop a "plan of attack" that will help him win the game. This helps the child develop a feeling of being able to master the game and be in control of a part of his life.

Golden also stated that it is a short step from video game playing to learning the basics of computer programming. Many computer graphics systems are simple enough for even young children to operate, such as Papert's LOGO (Wanner, 1982). Children as young as kindergarten age are now being introduced to computers (Golden, 1982).

American schools are beginning to take advantage of computers and use them for a diversity of learning experiences. Currently there are approximately 100,000 computers in the schools, and by 1985, that number is expected to increase to between 300,000 and 650,000. Computers, like video games, seem to hold a special attraction for children. Many children spend voluntary time after school to stay in the classroom to work with computers (Golden, 1982). The children who are involved with computers are not exceptionally bright, but are normal in every way. Computers come as natural to children as "riding a bike or playing baseball" (Golden, 1982).

With the prevalence and accessibility of computers and the willingness of children to work with computers, it seems logical to try to incorporate them into as many facets of learning as possible. If video games can improve children's eye-hand coordination and reaction time, schools and parents could utilize their computers and video games to benefit the children in this manner.

SUMMARY

The review of literature indicates that eye-hand coordination and reaction time are fine motor skills that are essential to all people. Research has identified 6-10 years of age as the prime age for improving fine motor skills. In addition, researchers have discovered that the playing of video games might be a method for improving fine motor skills, such as eye-hand coordination. The review of literature also reveals a considerable amount of controversy surrounding video game playing. Based on the available information, this study will attempt to discover if video game playing can significantly improve the eye-hand coordination and reaction time of children who are at the prime age for improving fine motor skills.

Chapter 3

METHODS AND PROCEDURES

The purpose of this study was to determine if video game playing had an effect on the eye-hand coordination and reaction time of second grade children. This chapter describes the methods and procedures used in the study. It includes information about population and sampling, materials and instrumentation, design of the study, data collection, and data analysis.

Population and Sampling

The subjects for this study were taken from two local elementary schools. The experimental group was considered a random sample belonging to a theoretical population of second grade students who have attended, are attending, or will attend that school. The experimental group was at a university-related laboratory school. The principal of the laboratory school indicated that parental consent forms would not be necessary; therefore, a letter that explained the study and asked their cooperation was sent to the parents of these children. This group consisted of 15 male and female subjects.

The control group consisted of 15 male and female second grade students from another local elementary school. All the parents of this school's second graders received letters that explained the study, asked their cooperation, and asked permission for their children to be in the study. The parents of 15 of these second graders gave their permission for their child's participation in this study.

Materials and Instrumentation

Subjects were pre-tested and post-tested with one eye-hand coordination test and one reaction time test. On both tests, the subjects used their preferred hand. This was determined by asking each child to write on a piece of paper prior to test. Each child's preferred hand was noted to assure that the same hand was used on both the pre-test and the post-test.

The eye-hand coordination test was conducted on the Lafayette 30013 Photoelectric Rotary Pursuit. The circular disc moved in a clockwise direction at 25 revolutions per minute. Scores were recorded for the amount of time the subject was on target (keeping the wand on top of the light). Subjects were given two 30 second practice trials, followed by five 30 second recorded trials, with 30 second rest intervals between each trial.

The reaction time test was a simple hand reaction time test, with a light stimulus, using a Dekan Automatic Timer. Subjects had two practice trials, followed by 10 recorded trials, with 10 second rest intervals between each trial.

The total times for testing each child was approximately 10 minutes. Testing was done during school hours at the subjects' schools.

Design of the Study

This study was designed to determine if video game playing had an effect on the eye-hand coordination and reaction time of second grade children. In this study, two groups of subjects were used to test the hypothesis.

Both groups were pre-tested and post-tested on an eye-hand coordination and a reaction time test. The eye-hand coordination test was performed in Lafayette 30013 Photoelectric Rotary Pursuit. The reaction time test was a simple hand reaction time test responding to a light stimulus, with reaction time measured by a Dekan Automatic Timer. The stimulus of light was chosen because of the similarity to video game responses to a light stimulus. The researcher did not find any other studies that used tests related to video games; therefore, these two tests were chosen to fulfill the specific needs of this study. The two tests were chosen for their simplicity, appropriateness for the age group being tested, and similarity to video game responses. Test results were recorded on the prepared recording sheets which appear in Appendix C.

The experimental group played video games 10 minutes a day, four days a week, for seven weeks. Each subject played the games between 25 and 28 times during the seven week period. Two games were selected for the subjects to play. "Sink the Ship" involved dropping a bomb on a ship at the correct time to score the maximum number of points. "Nightmare Gallery" involved shooting a movable gun at a moving target on the screen. The control group did not play video games for the same seven week period. An analysis of the pre- and post-test scores was made to determine if there was a significant difference in the two groups.

Data Collection

Both the experimental and control groups were pre-tested the first week of January, 1983. The experimental group then played video games for seven weeks. Post-testing was done March 7 and 8, 1983. Testing took place at the schools, during school hours. Results were kept confidential by coding the data on the recording sheets. Data were reported in such a way that they could not be identified with any specific child.

Each subject was tested privately, in a quiet room with a minimum of distractions. Instructions for each test were explained prior to the tests. The verbal instructions for the tests appear in Appendix D.

Data Analysis

An analysis of the data of the effects of controlled video game playing experience on the eye-hand coordination and reaction time of second grade children as measured by the Lafayette 30013 Photoelectric Rotary Pursuit and a hand reaction time test was based on the pre- and post-test scored for the experimental and control groups. The analysis of covariance (ANOCOV) was used to analyze the changes of the control and experimental groups on their pre- and post-tests. The statistical test, Fortran program USSTOV20, was used to compute and analyze the data. The .05 level of significance was used to test the null hypothesis.

Chapter 4

ANALYSIS OF DATA

This chapter contains the analysis of data for the rotary pursuit and reaction time tests for the control and experimental groups. The statistical procedure used for analysis was the analysis of covariance.

Rotary Pursuit Test

The rotary pursuit test was administered to the control and experimental groups prior to and following a seven week period of video game playing. The mean scores of the pre- and post-test for each group were subjected to the analysis of covariance test to determine if a significant difference existed at the .05 level. The unit of measurement used for the rotary pursuit was seconds.

The mean pre-test score of the control group (Table 1) was 0.513, while the experimental group had 0.464. The control group had a post-test mean score of 0.533, and the experimental group had a 0.957. The adjusted mean for the control group was 0.566, and the adjusted mean for the experimental group was 0.924.

Table 1

Pre-Test, Post-Test, and Adjusted Means
For the Experimental and Control
Groups of Second Grade Children
on the Rotary Pursuit Test

Group	N	Pre-test Mean	Post-test Mean	Adjusted Mean
Control	15	0.513	0.533	0.566
Experimental	15	0.464	0.957	0.924

Using the analysis of covariance (ANOCOV), with the post-test used as the criterion variable and the pre-test as the controlled variable, a significant difference was found, $F(1,27)=11.767$, $p<.01$ (Table 2). The results of the data indicate that there was a significant difference between the adjusted means of the experimental and control groups.

Table 2

ANOCOV Summary Table of Experimental Versus
Control Groups of Second Grade Children
On Pre- and Post-Test Scores of
the Rotary Pursuit Test

Sources	df	Pre-test Sum Squares	Sum of Products	Post-Test Sum of Squares	df'	Adjusted Sum of Square	Adjusted Mean Score	*F*
Between	1	0.018	0.157	1.353	1	0.948	0.948	11.767*
Within	28	1.523	2.071	4.991	27	2.174	0.081	
Total	29	1.541	2.228	6.344	28	3.122		

*Significant at the .01 level, df=1,27

Reaction Time Test

The Dekan Timer hand reaction time test was administered to the control and experimental groups prior to and following a seven week period of video game playing. The mean scores of the pre- and post-tests for each group were subjected to the analysis of covariance test to determine if a significant difference existed at the .05 level. The unit of measurement used for the reaction time test was seconds.

The mean pre-test score (Table 3) for the control group was .319, and the experimental group had a mean score of .295. The control group had a post-test mean score of .312, while the experimental group had a post-test mean of .263. The adjusted mean for the control group was .308, and the experimental group had an adjusted mean of .268.

Table 3

Pre-Test, Post-Test, and Adjusted Means for the Experimental and Control Groups of Second Grade Children on the Reaction Time Sheet

Group	N	Pre-test Mean	Post-test Mean	Adjusted Mean
Control	15	.319	.312	.308
Experimental	15	.295	.263	.268

Using the analysis of covariance (ANOCOV), with the post-test used as the criterion variable and the pre-test as the controlled variable, a significant difference was found, $\underline{F})1,27)=6.344$, $\underline{p}<.05$ (Table 4). The results of the data disclose that there was a significant difference between the adjusted means of the experimental and control groups.

Table 4

ANOCOV Summary Table of Experimental Versus Control Groups of Second Grade Children on Pre- and Post-Test Scores of the Reaction Time Test

Sources	df	Pre-test Sum of Squares	Sum of Products	Post-test Sum of Squares	df'	Adjusted Sum of Square	Adjusted Mean Square	*F*
Between	1	0.004	0.009	0.018	1	0.011	0.011	6.344**
Within	28	0.063	0.024	0.057	27	0.048	0.002	
Total	29	0.067	0.032	0.074	28	0.059		

**Significant at the .05 level, df=1,27

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

This study was completed to determine if there was a significant difference in the effects of a seven week video game playing period on the eye-hand coordination and reaction time of second grade students, as measured by a rotary pursuit test and a hand reaction time test. Data was collected and analyzed as previously described in Chapters 3 and 4.

Summary

A significant difference between the control and experimental groups was found on both the rotary pursuit and reaction time tests. Based on the analysis of the data, the null hypothesis was rejected. The analysis of covariance revealed that the experimental group improved significantly on the rotary pursuit test at the .01 level. The analysis of covariance also showed that the experimental group had a significant improvement at the .05 level on the reaction time test.

Conclusions

Are there any beneficial results from children playing video games? Is there a difference in the eye-hand coordination and reaction time of children who play video games and those who do not? These are some of the questions this researcher attempted to answer in this study.

From the results of the statistical analysis and within the limitations of this study, the following conclusion was drawn. Based on the evidence presented in this study, it can be concluded that video game playing may be used to improve eye-hand coordination and reaction time of children.

Recommendations for Further Study

Based on the results of this study, the following topics were suggested for further investigation. One area that could be explored would be the reason for a greater improvement in the rotary pursuit test than in the reaction time test. Perhaps video games demand more in terms of eye-hand coordination than reaction time. Or, perhaps there is more room for improvement in eye-hand coordination than in reaction time at this stage of the child's development. Also, it might be possible to arrive at a more accurate rotary pursuit test score by using both clockwise and counterclockwise directions. The use of both directions would more closely resemble video game action.

Another area to be explored is that of video games designed for physical education. It is suggested that educators write video game programs for specific use in physical education classes. Children can learn a great deal about movement education, body positioning, and strategies, as well as fine motor skill improvement, from specifically designed video games.

Another area to research would be that of examining the goals of our physical education programs to see if there is adequate emphasis on fine motor skill improvement. An interesting study could compare three groups: (1) children who are on a video game-playing program; (2) children who attend regular physical education classes and do not play video games; and (3) children who do not play video games, but have special sessions in physical education to specifically improve fine motor skills. Would the physical education classes (either regular or special) cause the same fine motor skill improvement as the video game playing? If not, perhaps physical educators need to reevaluate their programs and incorporate methods of fine motor skill improvement.

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APPENDIX A

Letters to Parents

December 9, 1982

Dear Parents,

This letter is to inform you of a study being done with the second graders at Butcher School. It is also being written to ask for your assistance in contributing to the success of the study.

My name is Nancy O'Banion, and I am a graduate assistant in the Health, Physical Education, Recreation and Athletics department at Emporia State University. I am conducting this study as a research project for my Master's degree thesis.

The purpose of this study is to determine if video games have an effect on childrens' eye-hand coordination and reaction time. The children will be pretested the first week of January. For the next eight weeks, the children will play selected video games on the school's computer for ten minutes a day, four days a week. They will be post-tested the second week of March. These results will be compared with the pre- and post-test results of second graders who did not play any video games for the eight weeks. All results will be recorded on coded forms, so that all results will be confidential.

It is very essential to the validity of the study that the children all play the games the same amount of time. Therefore, they must not play video games at any other times. This will require the understanding of the child and the cooperation and supervision of the parents. Your cooperation will be deeply appreciated.

It is essential to the reliability and validity of the study for a child to remain in the study once he begins, but parents have the right to withdraw children from the study if they feel compelled to do so.

A summary of the findings of this study will be made available to parents next spring. If you have any questions about the study or would like more information, please call me at 343-1280. Thank you very much for your understanding and cooperation.

Sincerely,

Nancy O'Banion

December 9, 1982

Dear Parents,

The purpose of this letter is two-fold: (1) to tell you about a research project that will involve some of the children at Logan Avenue Elementary School, and (2) to ask permission for your child to be a participant in this project.

My name is Nancy O'Banion, and I am a graduate assistant in the Health, Physical Education, Recreation and Athletics department at Emporia State University. I am conducting this study as a research project for my Master's degree thesis.

The purpose of this study is to determine if video games have an effect on childrens' eye-hand coordination and reaction time. Testing will take place the first week of January and the second week of March, at your child's school. Children will perform one test of eye-hand coordination and one test of reaction time. All results will be recorded on coded forms, so that all results will be confidential. The results will be compared with the pre- and post-test results of second graders who played video games for eight weeks. A summary of the findings of this study will be made available to the parents next Spring.

Two things will be required of your child: (1) that he/she be tested twice, and (2) that he/she play absolutely no video games during the course of the study, January 10 - March 11, 1983. Obviously, this will require the consent of the child and the consent and supervision of the parents.

It is essential to the reliability and validity of the study for a child to remain in the study once he/she begins, but parents have the right to withdraw children from the study if they feel compelled to do so.

I am attempting to identify 25 children to participate in this study. If you will allow your child to participate, please fill out the enclosed parent consent form and return it to your child's school by December 15. If you have any questions about the study or would like more information, please call me at 343-1280. Thank you for your understanding and cooperation.

Sincerely,

Nancy O'Banion

APPENDIX B

Parent Consent Form

PARENT CONSENT FORM

By signing this form, I give permission for ______________ to participate in the study being conducted by Nancy O'Banion at Logan Avenue Elementary School.

I understand that my child will be pretested and post-tested at his/her school

I understand that my child is not to play any video games during the course of this study. In order to assure the reliability and validity of this study, I will make every attempt to prevent my child from playing video games during this time (January 10 - March 11).

I understand that it is essential to the reliability and validity of the study for a child to remain in the study, but parents have the right to withdraw children from the study if they feel compelled to do so.

I understand that the results of the study will be completely confidential.

______________________	______________________
Date	Parent/Guardian Signature

Child's birthdate: _____ / _____ / _____
Month Date Year

APPENDIX C

Data Recording Sheets

Rotary Pursuit Test Scores
(Lafayette 30013)

Pre-test
Post-test

Experimental
Control

Code Number	Dominant Hand	Trials (1/100 sec.)				
		1	2	3	4	5
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						

Post-test Control

Code Number	Dominant Hand	Trials (1/100 sec.)									
		1	2	3	4	5	6	7	8	9	10
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											
13											
14											
15											

APPENDIX D

Verbal Instructions for Tests

Verbal Instructions for Reaction Time Test

"Hold this button in the hand with which you wrote. I will give you a signal of 'Ready' then this light will flash (point to light). When you see the light flash, press the botton as fast as you can."

Verbal Instructions for Rotary Pursuit Test

"Hold this wand in the hand with which you wrote. See the light going around the circle? Carefully touch the wand on the glass and try to keep the wand on the light as it goes around the circle."