THE EFFECT OF THE GAME ANATOMANIA ON ACHIEVEMENT OF NURSING STUDENTS

A Thesis Presented to The Division of Nursing Drake University

In Partial Fulfillment Of the Requirements for the Degree Master of Science in Nursing

by

Susan Isaacson Jungman

December 1991
THE EFFECT OF THE GAME ANATOMANIA ON ACHIEVEMENT IN NURSING STUDENTS

An Abstract of a Thesis by Susan Isaacson Jungman
December 1991
Advisor: Mary Hansen

The problem. The purpose of this study was to determine if learning through games can effect learning outcomes. A convenience sample of two groups of students was utilized. There were 35 nursing students in the experimental group and 25 nursing students in the control group.

Procedure. A game, ANATOMANIA, developed by the researcher, was used in conjunction with classroom lecture and laboratory experiences with the experimental group. The control group utilized classroom lecture and laboratory experiences with no use of the game ANATOMANIA. A pretest-posttest examination, written by the investigator, was used as the data collection tool.

Findings. A t test was used to determine if there was any statistical differences in pretest score means between the experimental and control groups (t=6.3765; p=0.000). Data analysis demonstrated that the experimental group had significantly higher pretest scores than the control group. A t test was then done to compare the differences in posttest-pretest scores of the groups. This analysis demonstrated that the experimental and control groups did not differ significantly with respect to posttest-pretest scores (t=1.2151; p=0.2293).

Conclusions. This study suggests that the use of the game ANATOMANIA did not significantly effect learning achievement in an anatomy and physiology course for nurses.

Recommendations. Expansion and replication of this study in another setting is recommended. Another recommendation would be to construct a tool to measure the results in the affective domain.
ACKNOWLEDGMENTS

I want to thank and acknowledge many people. I have been very fortunate to have received a lot of support from many people who have believed in me.

I want to thank all of my students for playing the game ANATOMANIA. Their enthusiasm and eagerness encouraged me to continue writing questions. THANK YOU.

To Mary Hansen, my advisor, a million thank yous. You lifted my spirit when I was depressed and wanted to quit. To Sandy Sellers, another committee member, thanks to you for all your help and answering of phone calls. To Jack Gerlovich, my other committee member, thanks for your input and suggestions. THANK YOU.

To my colleagues at Iowa Western Community College in the nursing department who offered their support, THANK YOU.

To Eric Meyer, who let me use his anatomy and physiology class as a control group, THANK YOU.

To Mona Lane, my friend, who kept me going through the years with her constant encouragement and support, THANK YOU.

To my mom and dad, who instilled in me a desire to learn and a belief in myself that I could do whatever I wanted to do, THANK YOU.

To Shala, Chad, and Nathan, my children, who let me go to school along with them to continue my journey, THANK YOU. I also hope you have learned that you can do whatever you put your mind to.
# TABLE OF CONTENTS

<table>
<thead>
<tr>
<th>CHAPTER 1</th>
<th>INTRODUCTION TO THE PROBLEM</th>
<th>1</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Problem Statement</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Research Hypothesis</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Definitions</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Assumptions</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Significance of the Study for Nursing</td>
<td>5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER II</th>
<th>REVIEW OF THE LITERATURE</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conceptual Framework</td>
<td>7</td>
</tr>
<tr>
<td></td>
<td>Game Development</td>
<td>16</td>
</tr>
<tr>
<td></td>
<td>Research on Gaming</td>
<td>18</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER III</th>
<th>METHODOLOGY</th>
<th>22</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Design</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Subjects</td>
<td>22</td>
</tr>
<tr>
<td></td>
<td>Setting</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Instruments</td>
<td>23</td>
</tr>
<tr>
<td></td>
<td>Procedure</td>
<td>28</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER IV</th>
<th>RESULTS</th>
<th>31</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sample Characteristics</td>
<td>31</td>
</tr>
<tr>
<td></td>
<td>Research Hypothesis</td>
<td>38</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>CHAPTER V</th>
<th>DISCUSSION</th>
<th>44</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Conclusions</td>
<td>45</td>
</tr>
<tr>
<td></td>
<td>Limitations of the Study</td>
<td>46</td>
</tr>
<tr>
<td></td>
<td>Suggestions for Further Research</td>
<td>48</td>
</tr>
</tbody>
</table>
REFERENCES. .................................................. 50
Appendix A Directions for ANATOMANIA ............... 55
Appendix B Demographic Data Sheets.................. 56
Appendix C Consent Form ................................. 57
Appendix D Pretest-Posttest ............................ 59
Appendix E Letters from the Panel ...................... 68
FIGURES AND TABLES

Figure 1  The Game ANATOMANIA.........................25
Figure 2  Scattergraph Showing the Correlation
          Between the NLN Achievement Test and
          The Posttest, the Final Examination....27
Figure 3  Scattergraph Showing the Correlation
          Between Score 1 and Score 2 When Checking
          For Reliability .........................27
Table 1  Frequencies and Percentages of the
          Demographic Characteristics in the
          Experimental and Control Groups........32
Table 2  Comparison of Experimental and Control
          Groups by Age .......................34
Table 3  Comparison of Experimental and Control
          Groups by Educational Background. ..35
Table 4  Comparison of Experimental and Control
          Groups by Number of Children .......35
Table 5  Comparison of Experimental and Control
          Groups by Sex .......................36
Table 6  Comparison of Experimental and Control
          Groups by Marital Status ............36
Table 7  Comparison of Experimental and Control
          Groups by Number of Hours Worked. .37
Table 8  Scores and Means on the Pretest of the
          Experimental Group and Control Group ..39
Table 9  T-Test Procedure on Pretests. .......40
Table 10  Scores and Means on the Posttest of the Experimental Group and the Control Group. 41

Table 11  Pretest Means, Posttest Means, and Pretest Posttest Differences.  . . . . . 42

Table 12  T-Test Analysis on Pretest-Posttest Differences  . . . . . . . . . . . . . . . . . . . 42
CHAPTER I
INTRODUCTION TO THE PROBLEM

Nursing education, with the primary goal to educate nurses to be caregivers, involves instruction to facilitate learning for nursing students with diverse backgrounds. This challenges the nursing educator to be creative in developing instructional methods. Nursing educators continue to look for viable strategies to educate students, and strive to use a variety of teaching strategies to enliven the classroom and stimulate learning.

The purpose of this study was to determine whether learning through games can affect learning outcomes. Crancer and Maury-Hess (1980) suggested that curriculum offerings need to be varied because students learn differently. In most community college nursing programs, students are drawn from a population of diverse backgrounds, experiences, and language abilities, which suggests the desirability of utilizing different teaching strategies based on the recognition of different cognitive learning styles.

Games allow students to test their knowledge in a non-threatening way and in a nongraded situation.
These methods transform the classroom from an assembly-line, passive, boring experience into an active, motivating learning process (Crancer & Maury-Hess, 1980).

According to Crancer and Maury-Hess (1980), student learning and motivation are enhanced through the use of games in three specific ways. First, games are written in concert with course objectives. The second benefit is the encouragement of interaction and peer learning. Third, the peer interaction excludes participation of, and judgment by, faculty. Games negate the risk involved in exposing ignorance, fear of failing, and confusion to the instructor. Cessario (1987) reported that gaming can be an effective teaching strategy for reinforcing and motivating students to learn. In this study, a board game entitled "Cessario's Board Game" was developed to teach the conceptual models of nursing. Results indicated that significant learning occurred in the experimental group. The game motivated and reinforced learning and was an enjoyable experience.

Another interesting study by Barak (1990) assessed the effectiveness of the Empathy Game in increasing
counseling trainees' empathic skills. The objective of the game was to develop and enhance empathic understanding in participants while using a technique that emphasized play and competition. The results of the study indicated an increased amount of empathic understanding.

Research in the areas of games and gaming is limited. There are many articles describing games and the use of games in the educational setting and many opinions published, but little research has been conducted with regard to nursing education. In addition, little experimental research has been conducted on the effect of gaming on learning outcomes. This study will enrich that body of knowledge.

Problem Statement
The problem investigated in this study was: Does the use of the game ANATOMANIA significantly increase achievement by nursing students in a community college anatomy and physiology course?

Research Hypothesis
The hypothesis of this study was: Nursing students who use the game ANATOMANIA in an anatomy and physiology course will have higher achievement than nursing students in an anatomy and physiology course who do not use the game ANATOMANIA.
Definitions
For the purpose of this study, key terms were defined as follows:

Game: A contest among participants that has rules, goals, activities to perform, constraints of the activities, and pay-offs (Clark, 1978). A game in this study was operationalized by a board game, ANATOMANIA, developed by the researcher, where the goal was to answer as many questions correctly as possible.

Achievement: Achievement was operationalized by the differences in scores on the pretest-posttest that was given to each student in the study.

Students: Members of a community college anatomy and physiology class who were required to take the course in their nursing program. One group of students was enrolled in the second-year class of an Associate Degree Nursing program in a Midwestern community college. The other group of students was enrolled in a three-year diploma nursing program. Both groups took the anatomy and physiology course, but from different instructors. The course objectives were similar and the same textbook was utilized.

Assumptions
Basic assumptions of the study were as follows: teaching strategies can influence learning outcomes;
learning can be measured; and different teaching strategies need to be used to maintain the interest of the learner.

**Significance of the Study for Nursing**

Educators continually try to develop innovative, creative teaching approaches to meet the varied needs of students. Games are one non-traditional method that is being utilized by educators to stimulate and motivate students. A study by Cessario (1987) indicated that when nursing students used a game to learn the conceptual models of nursing, learning increased. Clark (1976), Walljasper (1982), and King (1984) all identified gaming as one classroom strategy that is useful in nursing education as a reinforcement and motivational tool. Clark (1976) identified that gaming can be an effective teaching strategy in nursing by recreating elements of the actual nurse-patient relationship or other professional linkages. Walljasper (1982) pointed out that gaming encourages interaction among learners, increases learner's interest in a topic, increases learner's motivation, and increases active involvement of the learner. With the complexity of nursing education increasing, nursing educators are currently seeking more humanistic approaches to teach students.
Very little scientific research has been done to support these assertions. It would appear that more research needs to be done to validate games as an effective teaching/learning strategy for nursing education. With research to validate these theories, a variety of games could be developed to help students learn nursing, from skills to theories.

Tanner (1990) and deTornyay (1990) expound on the nursing curriculum revolution and discuss the issues in nursing education and the changes necessary to launch nursing education into the next century. They discuss the new student population, often older, often pursuing a second career, and increasingly goal directed. The curriculum revolution is about teacher-student partnerships. It is about flexibility and individual differences in how and what one learns.

The curriculum revolution means opening up new possibilities for the ways in which nursing educators educate the students. Gaming is certainly an example of a new way to teach nursing students. The open dialogue, the free discussions, and the laughter all lead to an environment which stimulates learning.
CHAPTER II
REVIEW OF THE LITERATURE

The purpose of chapter II is to provide a conceptual foundation for the study as well as a review of the research on gaming as a teaching/learning strategy. The following review of the research begins with the conceptual framework of games in learning, including principles of learning related to gaming. This is followed by a discussion of the advantages and disadvantages of games. The literature review concludes with the process of game development and the research related to gaming.

Conceptual Framework

The conceptual framework of this study was based on the concept of play or gaming used in the teaching/learning process. Motivation, interest, and learning may be increased through utilization of gaming as a teaching/learning strategy (Walljasper, 1982). Florey (1971) emphasized the importance of play in development and states that "play can best be thought of as a learning process" (p. 276) that is intrinsically motivating. The key to intrinsic
motivation is the pleasure inherent in the activity (Florey, 1969). The author suggested that intrinsic motivation develops through play.

For play to occur, and thereby to facilitate learning, White (1987) has suggested that the following variables are necessary:

(a) An environment with human and nonhuman objects that allows for exploration, repetition, and limitation;

(b) An environment that is free from stresses and is not associated with negative feelings;

(c) And, novelty in the nonhuman environment since novelty is the stimulus that directs the intrinsic system (p. 321).

Cognitive learning, which is composed of factual information, concepts, principles, and decision-making skills, may be improved by the use of games. Kielhofner and Miyake (1981) suggested that play enables an individual to "process latent learning by increasing the general stock of knowledge that the person can draw upon in later circumstances" and that games should be included as "legitimate media for practice" (p. 375).

Li (1981) stated that a person develops social and cognitive competencies through play. From this article, it can be extrapolated that the social
interaction between players reinforces social skills and the repetition that occurs in games improves cognitive skills.

Affective learning associated with the subject matter may be improved by altering students' attitudes and perceptions of issues. Researchers of educational games have reported positive results of game procedures in improving attitudes and behaviors. Along with modification of behaviors, educational game players typically experience motivation, interest, enjoyment, involvement, and satisfaction (Barak, 1990). Games may also be used to increase empathy and insight into others different than themselves, according to Barak (1990).

Affective learning is improved by increasing each student's self-awareness and sense of personal effectiveness. As self-awareness and a sense of personal effectiveness increase through the use of play and games, students acquire feelings of competence and mastery over themselves and the environment (Michelman, 1971).

Games may increase student autonomy and increase sharing of ideas among different types of students (deTornyay & Thompson, 1987). Games promote creative thinking, exploration, and active participation. The
interaction among different learners creates new ideas and new thoughts (deTornyay & Thompson, 1987).

According to Hartsock and Lange (1987), "games promote motivation, cooperation, interaction, competition, involvement, and communication while providing an emotional outlet" (p. 24). These authors also suggested that games promote cognitive learning (facts, principles, and theories) and affective learning (involvement, emotions, attitudes, and motivation).

Classroom structure and interactional patterns are improved by promoting positive student-teacher relations. Taylor and Walford (1972) identified three major attributes of gaming:

1. Activity is provided in which both students and educator may participate.

2. It is very often problem oriented and helpful in the development of interdisciplinary approaches, as well as often involves social skills that relate to the world outside the classroom.

3. It is a technique that requires the learner to be flexible and to adapt to changing circumstances (p. 190).

According to Nockajski and Gordon (1987), games enable an individual to become an active participant in the learning process, and games are fun. There is interaction between participants: games allow freedom
of the participants to talk, interact, offer differing opinions, and laugh. The enjoyment of this interaction among peers creates a learning environment free from pressure (Crancer & Maury-Hess, 1980).

Gordon (1970) suggested that gaming formats are most effective in educational settings when used in conjunction with other media as an integral aspect of the program. Because games require active participation, the individual playing the game is able to make decisions, solve problems, and become the initiator of events. Games provide intrinsic and prompt feedback, which has been found to be valuable reinforcement of learning (Gordon, 1970).

Clark (1976) identified simulation gaming as one classroom strategy that is useful in nursing education. She stated that games provide both motivation and reinforcement. The most consistent research finding is that students prefer games to other classroom activities. This, of course, has implications for teaching students with low levels of motivation. Simulation games can teach factual information as effectively as do other methods of instruction. This is important for those teachers who believe that students cannot learn if they are playing.

Simulation games can change student attitudes
(Clark, 1976). This is significant to nursing education and nurse educators who are concerned about students' self-concept. As roles change in nursing, with skills becoming more complex and demanding, it may be wise for educators to consider using a teaching tool that can help change attitudes.

Walljasper (1982) agreed that games are effective learning strategies in that they involve creativity and competition. A simulation game is a simplified representation of a piece of the real world, and it allows participants to actively imitate real situations. The learner can creatively practice skills useful in dealing with real problems with minimal risk.

Cessario (1987) explored the relationship between reinforcement and motivation in the process of learning. "Most learning theorists draw a relationship between reinforcement and motivation, in that reinforcement can actuate motivation or motivation can lead to reinforcement" (p. 167).

Magney (1990) asserted that "the gaming curricula is clearly superior to conventional teaching on the affective dimension, both in fostering higher levels of student interest and in promoting positive attitudes toward the subject matter" (p. 56). In the cognitive domain, the impact is less consistent (Magney, 1990).
Games provide a relaxed, safe environment, which facilitates learning and allow learners to explore their knowledge in a nonthreatening situation (Clark, 1978; Crancer & Maury-Hess, 1980; deTornyay & Thompson, 1987). Fear of failure and embarrassment are minimized with the use of games. (Crancer & Maury-Hess, 1980).

Games offer the learner active control of the learning process, which facilitates learning. Playing a game offers the students an opportunity to work together to solve problems and test solutions (Crancer & Maury-Hess, 1980; Wolf & Duff, 1979).

Games provide a system for immediate scoring and personal social feedback (Crancer & Maury-Hess, 1980; Walts, 1982). There is usually prompt feedback from peers. In some games, there is feedback from game cards. These feedback mechanisms allow the student immediate reinforcement, thereby facilitating learning.

Games allow for experiential learning (Reilly & Dermann, 1985). Experiential learning seems to stay with the learner longer than does information processing. In experiential learning, the learner acts first, begins to understand how to apply principles and concepts, and then has a chance to act again in a different (sometimes real-life) situation. Because experiential learning stays with the learner longer,
nurse educators need to balance information processing and experiential learning.

Games allow anticipation of an intrinsic or extrinsic reward. Upon the completion of the goal, the student obtains an incentive for motivation (Bigge, 1982; Crancer & Maury-Hess, 1980).

**Evaluation of Games as a Teaching/Learning Strategy**

There are many advantages in using games in the educational setting. Participation in games is interesting (Nochajski & Gordon, 1987). Games enhance interest in the topic and may increase motivation to learn (Crancer & Maury-Hess, 1980). Repetition, which some games provide, is one method of learning new information. Concepts, skills, and new ideas all are explored in the game methodology (Van Hoozer, 1987).

Games also can provide a learner with increased confidence regarding the topic and provide a relaxed learning environment, which facilitates interaction between students and teacher. Games also encourage communication, interaction, and peer learning (Crancer & Maury-Hess, 1980).

Games can serve as an alternative mechanism for student evaluation. Games decrease the risk involved in failing and allow the learner to save face if he/she does not know the answer, and thus prevent a perception

A variety of cognitive styles can be incorporated into game strategies to accommodate different learning styles. Some students who are visual learners might do well with card games, board games, crossword puzzles, or word searches. Others who are audio learners might do better with charades or similar games. Others, however, learn best with hands-on experiences. Games set up group-learning situations, which may facilitate learning (Crancer & Maury-Hess, 1980).

There are also disadvantages to the use of games in the educational setting. Some learners do not like games and may not take them seriously. (Cessario, 1987).

Another disadvantage of games is the increased amount of time it takes to implement this strategy. The instructor needs to consider the time it takes to explain the rules, play the game, and discuss the content afterward. Games also can be expensive (Cessario, 1987).

Games may only change attitudes and opinions for a short time, and this change may not persist. Games may not lead to transfer of learning to real life (Makar, 1984).

Games may result in too much competition.
Although some learners thrive on competition, others are threatened by this, and it may impede their learning. Competition has certain advantages and disadvantages. For some, it may increase self-esteem if they find themselves winning or answering questions correctly. For others, it may lower self-esteem if they find themselves losing the competition. Losing the game or missing the question creates negative reinforcement for those students, which, in turn, lowers self-esteem (Taylor & Walford, 1972; Clark, 1976; Walljasper, 1982; King, 1983; Makar, 1984; and Cessario, 1987).

Game Development

Clark (1976) has suggested four criteria that educators should consider when developing a game:

1. The game should meet the learning objectives and needs of the student.

2. The game should fit within the existing curriculum of the education institution.

3. The game should have a pretest-posttest which allows for evaluation of student learning.

4. The game should be field tested for inconsistencies, unknown and rule gaps when played (p. 9).

Clark (1976) identified three steps in developing a game. The first step is to peruse the nursing literature for content areas. Second, develop
objectives, preferably in behavioral terms. The third step is to develop a working model for the sequence of how the game will proceed.

Walljasper (1982) stated that like other learning strategies, gaming begins with a problem or need. Based on that need, the purpose and objectives can then be developed. Written instructions for the game need to be developed. Testing of the game is the next step.

Joos (1984) also emphasized the importance of planning for the use of games. She stressed that games cannot be used at the last minute. She emphasized utilizing the nursing literature to locate an appropriate game. If unable to locate an appropriate game, then designing one becomes the next step.

Placement of the game in the course is another important step. Will it introduce a new topic or reinforce materials already covered? Whatever the purpose, games need to support the course content (Joos, 1984).

According to Joos (1984), assessment of the learner is the next critical step. What prior experiences have the students had with games, and how did they feel about those experiences?

The next step, according to Joos (1984), is preparing the environment for play. The teacher then
needs to facilitate during the game, using her/his observational skills. The major role of the teacher is to see that everything runs smoothly. One quality necessary to being an effective facilitator is the ability to adapt. Adaptability requires dealing with unanticipated consequences and turning them into positive experiences.

The last step is debriefing and discussion of the material. The goals, objectives, and course content can all be incorporated into this discussion time.

Research on Gaming

Nochajski and Gordon (1987) identified that gaming can be a valuable tool in teaching independent living training programs. In this study, Trivial Pursuit, a popular adult game, was adapted for use with 16 adults with mental retardation who attended a developmental center day treatment program. Game questions were developed for six categories of independent living based on the McCarron-Dual Street Survival Skills Questionnaire (SSSQ) and Curriculum Guide. A two-group, pretest-posttest design was used to evaluate the effectiveness of the game in teaching independent-living skills. An analysis of variance on the measurement scale and for the total score on the SSSQ indicated significant differences in improvement rate.
after eight sessions with the game.

Cessario (1987) reported that games can be used, in nursing education, with significant success, to teach some concepts of nursing. In this study, a board game entitled "Cessario's Board Game" was developed to teach the conceptual models of nursing. The intent of the game was to take a specific topic and develop a means by which learning of the subject matter could be reinforced while motivating students to learn. It was hoped the game would be enjoyable for the students, as well as enable the learner to compare one model with another; contrast models by identifying similarities and differences; generalize about the major concepts of nursing (i.e., person, environment, nursing, and health) and categorize various conceptual models according to theme. Conceptual models of nursing were selected as the topic of the game because these models have taken on a new emphasis in nursing education and practice (National League of Nursing, 1984).

To evaluate the usefulness of Cessario's board game, a study was done utilizing a quasi-experimental design (Cessario, 1987). The sample consisted of 23 undergraduate and graduate nursing students enrolled in courses dealing with conceptual models of nursing. Subjects were randomly assigned to a control or
experimental group. A pretest-posttest, developed for determining levels of knowledge, consisted of 29 multiple-choice questions related to conceptual models of nursing. The reliability was .94. The instrument was examined for construct validity by a panel of four instructors, who determined the test was accurate and reflected course content. To determine whether there was a significant difference in the posttest scores of those subjects who played the board game, an analysis of variance was applied. Results indicated that the experimental group performed significantly higher than the control group on the total score of levels of knowledge of conceptual models of nursing ($p < .05$). To determine whether the board game motivated and reinforced learning, as reported by subjects of the experimental group, percentages of responses to the board game questionnaire were computed. Results indicated that all subjects in the experimental group reported that the game motivated and reinforced their learning as well as provided enjoyment.

In conclusion, the research on gaming as a learning strategy is minimal. There is a need to investigate the effectiveness of gaming in nursing education. The research that has been done demonstrates positive results of increased learning,
increased motivation, and enjoyment of learning.
CHAPTER 3
METHODOLOGY

Design

The hypothesis of this study was: Nursing students who use the game ANATOMANIA in an anatomy and physiology course will have higher achievement than nursing students in an anatomy and physiology course who do not use the game ANATOMANIA. This study employed a quasi-experimental design that used two groups of subjects. This design was chosen because group assignment of subjects could not be randomized. There was manipulation of the independent variable, the use of the game ANATOMANIA, in that the experimental group was exposed to the game plus traditional lecture/lab experience while the control group received traditional lecture/laboratory experience.

Subjects

A convenience sample of two groups of students was utilized. Criteria for being included in the study was acceptance into the college, enrollment in the required anatomy and physiology courses, and agreement to participate in the study. The experimental group consisted of 35 second-year ADN students in an anatomy and physiology course who were enrolled in the nursing program of a Midwestern community college. The control
group consisted of 25 students in an anatomy and physiology course who were enrolled in a three-year hospital diploma school of nursing and taking this science course at the same local community college. There were eight non-nursing students enrolled in this course whose data were not used in the study.

Setting

This study was conducted in a small Midwestern community college. The experimental group had a three hour lecture per week, with a two hour laboratory experience, utilizing the game ANATOMANIA during the lab time. Time also was spent on learning assessment skills, using videos and demonstrations. The control group also had a three hour lecture per week with a laboratory session, not utilizing the game, but doing other laboratory activities, such as dissection and discussion. There was no learning of assessment skills in the control group.

Instruments

A board game, called ANATOMANIA (Fig.1) was developed by the researcher where the players move around the board and answer questions about anatomy and physiology. The game consists of questions developed by the researcher from each chapter of the text, Anatomy and Physiology, by John Hole, Jr. The majority
of the questions were written by the researcher but a small percentage of the questions were used from the instructor's manual. Verbal permission to use the questions was obtained from Mr. Colin Wheatley, project editor at the Brown Publishing Company in Dubuque, Iowa.

To begin the game, each player receives $1,000 from the bank. One player is the banker. Each player throws the dice to see who begins the game: the highest dice starts first. The first player throws the dice and moves his/her gamepiece the number assigned from the dice roll. After landing on his/her space, he/she draws a question from the question cards. If the question is answered correctly, the player receives the amount of money assigned to that space. If he/she does not answer the question properly, the player pays that amount of money into the Jackpot. The player who lands on the Jackpot and answers the question correctly wins all the money in the Jackpot. The goal of the game is to collect the most money from answering questions correctly.
The game ANATOMANIA was evaluated for content validity by three expert teachers who currently teach or previously taught anatomy and physiology. Two are nurses; one with a bachelor's degree and the other a master's degree. The third is a professor of biology. These educators were asked to evaluate the game and respond by letter (Appendix E). The content validity of the game ANATOMANIA was supported.

The final examination, used as both pretest and posttest, was a 68-item, multiple-choice exam, developed by the investigator to evaluate achievement in the anatomy and physiology course (Appendix D). Items contained in the final exam tested knowledge from 12 chapters in the textbook *Anatomy and Physiology* by John Hole, Jr., the textbook utilized in the course.

To determine construct validity of the final examination, it was compared to the National League for
Nursing (NLN) Achievement test in Anatomy and Physiology. The National League of Nursing test is a norm-referenced, standardized 115-point, multiple-choice test that evaluates comprehension of anatomy and physiology concepts. This was accomplished by computing a Pearson's Correlation Coefficient. This showed a strong positive correlation of .706 (Figure 2). The data for the Pearson's Correlation Coefficient were compiled from data gathered over three semesters from 82 students who had taken the final examination and the NLN Achievement test.

To test the instrument's reliability, the final examination was administered twice four weeks apart to a group of five students who had previously taken the anatomy and physiology course. A Pearson's Correlation Coefficient was computed and showed a strong positive correlation of $r = .973$ (Figure 3).
Figure 2: Scatter graph showing the correlation between the NLN Achievement Test and the Posttest, the final examination.

Figure 3: Scatter graph showing the correlation between score 1 and score 2 when checking for reliability.
Procedure

The research proposal was submitted to the Drake University Human Subjects Research Review Committee and to the community college for consideration of approval. Permission was obtained from the director of Health Occupations and the community college. In addition, permission was obtained from the instructor in the arts and sciences division who taught anatomy and physiology to allow his students to participate in this study as the control group. These students took the final exam as a pretest and then as a posttest at the end of the semester. The experimental group also took the final exam as a pretest and then posttest (Appendix D).

Each student in both groups was approached on the first day of class and informed of the purpose of the study, and each student was invited to participate in the study. The following statement was made to both groups: You are being invited to participate in a research project evaluating methods of instruction. Each of you will be asked to fill out two forms today (Appendix B and Appendix C). You will then be asked to take a pretest today and the posttest the last week of the semester (Appendix D). Agreement to participate in the study will not affect your grade. When you fill
out the forms, please use the last four numbers of your student I.D. number instead of your name. In addition, if you are a nursing student, please indicate that by writing an N in the corner by your number.

The student's informed consent form was then read and distributed to all students. The purpose of the study, procedures, protection of human rights, risks, benefits, assurance of confidentiality, and withdrawal from the study all were emphasized. The students in both groups filled out the Demographic Data Sheet (Appendix B); signed the consent form (Appendix C); and took the pretest, which was also the course final examination and posttest (Appendix D). All students in both the experimental group and the control group took the pretest, but only data from the nursing students were used in the research.

Students were given instructions to the game (Appendix A). Students in the experimental group played the game weekly for 60-90 minutes during the laboratory session. All students participated for the same amount of time. The laboratory sessions were held following a three-hour lecture session. During this lecture session, the content of the game for that week was covered. Students in the control group did not play the game; they participated in dissection.
activities and experiments utilizing the laboratory manual.

At the end of the semester, the posttest, the final examination, was given to each subject, and the results were then analyzed by the investigator. Confidentiality of all data was maintained. Data were treated in aggregate form. Tests and results were locked up during the investigation, and tests were destroyed following data analysis.
CHAPTER IV

RESULTS

This chapter discusses and analyzes the results of the data collection. The sample population is described. The results of achievement testing are discussed.

Sample characteristics

The study included 36 associate degree nursing students in the experimental group. One student dropped out of the course, which resulted in an experimental group of 35 subjects.

The control group consisted of 25 nursing students. The control group initially consisted of 32 nursing students and 8 non-nursing students. Data from the 8 non-nursing students were not used in the study. Four students dropped the course, and three nursing students were absent the day the posttest was given resulting in a final number in the control group of 25.

Table 1 summarizes the demographic characteristics of the sample.
### Table 1

**Frequencies and Percentages of the Demographic Characteristics in the Experimental and Control Groups**

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>EXPERIMENTAL (N=35)</th>
<th>CONTROL (N=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Percent</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Female</td>
<td>31</td>
<td>88</td>
</tr>
<tr>
<td>Male</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td><strong>Race</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>35</td>
<td>100</td>
</tr>
<tr>
<td>African American</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Hispanic American</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Native American</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Asian American</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17-23</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>24-30</td>
<td>10</td>
<td>28</td>
</tr>
<tr>
<td>31-37</td>
<td>11</td>
<td>31</td>
</tr>
<tr>
<td>38-45</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>46-50</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>51 or more</td>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td><strong>Marital Status</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>Married</td>
<td>18</td>
<td>51</td>
</tr>
<tr>
<td>Divorced</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>Separated</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>Widowed</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td><strong>Number of Children</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0 Children</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>1 Child</td>
<td>12</td>
<td>34</td>
</tr>
<tr>
<td>2 Children</td>
<td>11</td>
<td>31</td>
</tr>
<tr>
<td>3 Children</td>
<td>8</td>
<td>23</td>
</tr>
<tr>
<td>4 Children</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>
Table 1 (Cont)

Frequencies and Percentages of the Demographic Characteristics in the Experimental and Control Groups

<table>
<thead>
<tr>
<th>Level of Education</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>H.S. Dropout (GED)</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>H.S. Graduate</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>1-2 years of college</td>
<td>27</td>
<td>77</td>
</tr>
<tr>
<td>3-4 years of college</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>College graduate</td>
<td>3</td>
<td>8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Number of Hours Worked/Week</th>
<th>Experimental Group</th>
<th>Control Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>9</td>
<td>26</td>
</tr>
<tr>
<td>6-10</td>
<td>5</td>
<td>14</td>
</tr>
<tr>
<td>11-15</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>16-20</td>
<td>7</td>
<td>20</td>
</tr>
<tr>
<td>21-25</td>
<td>6</td>
<td>17</td>
</tr>
<tr>
<td>26-30</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>31-35</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>36-40</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>More than 40</td>
<td>1</td>
<td>3</td>
</tr>
</tbody>
</table>

In order to determine a difference in characteristics of the two groups, a Chi-Square was computed for age, educational background, number of children, sex, marital status, and number of hours worked in employment. This analysis showed that the control group and experimental group differed significantly in age distribution and level of education. The experimental group was older and better educated than the control group (Tables 2-4).
As can be seen in Table 2, the control and experimental groups differ significantly in age distribution; the experimental group tends to be older than the control group.

<table>
<thead>
<tr>
<th>Age</th>
<th>Control</th>
<th>Exper.</th>
<th>Chi Square</th>
<th>DF</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>17-23</td>
<td>11</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24-30</td>
<td>5</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>31-37</td>
<td>9</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;38</td>
<td>0</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>35</td>
<td>13.851</td>
<td>3</td>
<td>0.003</td>
</tr>
</tbody>
</table>
Table 3
Comparison of Experimental and Control Groups by Educational backgrounds

<table>
<thead>
<tr>
<th>Education</th>
<th>Control</th>
<th>Exper.</th>
<th>Chi-Square</th>
<th>DF</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>College 1-2</td>
<td>11</td>
<td>27</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College 3-4</td>
<td>4</td>
<td>5</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>College Grad</td>
<td>1</td>
<td>3</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>H.S. Grad</td>
<td>9</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>35</td>
<td>15.663</td>
<td>3</td>
<td>0.001</td>
</tr>
</tbody>
</table>

As can be seen by Table 3, the experimental group was better educated than the control group.

Table 4
Comparison of Experimental and Control Groups by Number of Children

<table>
<thead>
<tr>
<th>Children</th>
<th>Control</th>
<th>Exper.</th>
<th>Chi-Square</th>
<th>DF</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>9</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>8</td>
<td>12</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>7</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>8</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>35</td>
<td>7.601</td>
<td>3</td>
<td>0.055</td>
</tr>
</tbody>
</table>
The two groups did not differ significantly in marital status, sex, the number of hours worked in employment and number of children. (Tables 5-7).

Table 5
Comparison of Experimental and Control Groups by Sex

<table>
<thead>
<tr>
<th>Sex</th>
<th>Control</th>
<th>Exper.</th>
<th>Chi-Square</th>
<th>DF</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>23</td>
<td>31</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>2</td>
<td>4</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>35</td>
<td>0.190</td>
<td>1</td>
<td>0.663</td>
</tr>
</tbody>
</table>

As shown in Table 5, there was no statistical difference in the two groups.

Table 6
Comparison of the Experimental and Control Groups by Marital Status

<table>
<thead>
<tr>
<th>Marital Status</th>
<th>Control</th>
<th>Exper.</th>
<th>Chi-Square</th>
<th>DF</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>D-S-W</td>
<td>8</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Married</td>
<td>7</td>
<td>18</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Single</td>
<td>10</td>
<td>7</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>35</td>
<td>4.037</td>
<td>2</td>
<td>0.133</td>
</tr>
</tbody>
</table>
As can be seen in table 6, the two groups do not differ significantly in relation to marital status.

Table 7

**Comparison of Experimental and Control Groups by Number of Hours Worked in Employment**

<table>
<thead>
<tr>
<th>Hours</th>
<th>Control</th>
<th>Exper.</th>
<th>Chi-Square</th>
<th>DF</th>
<th>p-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-10</td>
<td>14</td>
<td>14</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11-20</td>
<td>8</td>
<td>10</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21-More</td>
<td>3</td>
<td>11</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total</td>
<td>25</td>
<td>35</td>
<td>3.216</td>
<td>2</td>
<td>0.200</td>
</tr>
</tbody>
</table>

As the above table shows, the two groups did not differ significantly with respect to the numbers of hours worked.
Research Hypothesis

The research hypothesis for this study was Nursing students who use the game ANATOMANIA in an anatomy and physiology course will have significantly higher achievement than students in an anatomy and physiology course who do not use the game ANATOMANIA.

In order to determine base-line knowledge levels of both groups, the mean scores on the pretest were analyzed for both groups. The mean score on the pretest for the experimental group was 54.8. The mean score on the pretest for the control group was 38.84. (Table 8).
Table 8  
Scores and Means on the PreTests of the Experimental group and control group

<table>
<thead>
<tr>
<th>Experimental</th>
<th>Control</th>
</tr>
</thead>
<tbody>
<tr>
<td>41</td>
<td>25</td>
</tr>
<tr>
<td>51</td>
<td>39</td>
</tr>
<tr>
<td>63</td>
<td>55</td>
</tr>
<tr>
<td>58</td>
<td>43</td>
</tr>
<tr>
<td>68</td>
<td>50</td>
</tr>
<tr>
<td>58</td>
<td>43</td>
</tr>
<tr>
<td>48</td>
<td>44</td>
</tr>
<tr>
<td>41</td>
<td>32</td>
</tr>
<tr>
<td>56</td>
<td>43</td>
</tr>
<tr>
<td>58</td>
<td>56</td>
</tr>
<tr>
<td>53</td>
<td>27</td>
</tr>
<tr>
<td>56</td>
<td>53</td>
</tr>
<tr>
<td>46</td>
<td>32</td>
</tr>
<tr>
<td>41</td>
<td>36</td>
</tr>
<tr>
<td>48</td>
<td>36</td>
</tr>
<tr>
<td>77</td>
<td>51</td>
</tr>
<tr>
<td>62</td>
<td>48</td>
</tr>
<tr>
<td>58</td>
<td>34</td>
</tr>
<tr>
<td>46</td>
<td>29</td>
</tr>
<tr>
<td>58</td>
<td>44</td>
</tr>
<tr>
<td>56</td>
<td>31</td>
</tr>
<tr>
<td>60</td>
<td>44</td>
</tr>
<tr>
<td>58</td>
<td>22</td>
</tr>
<tr>
<td>50</td>
<td>13</td>
</tr>
<tr>
<td>56</td>
<td>41</td>
</tr>
<tr>
<td>44</td>
<td>---------</td>
</tr>
<tr>
<td>62</td>
<td>---------</td>
</tr>
<tr>
<td>63</td>
<td>---------</td>
</tr>
<tr>
<td>48</td>
<td>---------</td>
</tr>
<tr>
<td>50</td>
<td>---------</td>
</tr>
<tr>
<td>51</td>
<td>---------</td>
</tr>
<tr>
<td>74</td>
<td>---------</td>
</tr>
<tr>
<td>50</td>
<td>---------</td>
</tr>
<tr>
<td>51</td>
<td>---------</td>
</tr>
<tr>
<td>58</td>
<td>---------</td>
</tr>
</tbody>
</table>

Mean=54.8

Mean=38.8
A *t* test was computed on these pretest scores. As seen in Table 9, the t-value of the pretests was 6.3765 (p=0.0000), showing that the experimental group had significantly higher pretest scores than the control group.

Table 9

| Group    | N  | Mean  | Std. Dev. | *T*  | DF  | Prob>|T |
|----------|----|-------|-----------|------|-----|------|    |
| Exper.   | 35 | 54.800| 8.5329    |      |     | 0.0000|
| Control  | 25 | 38.840| 10.8461   | 6.3765| 58.0| 0.0000|

At the end of the semester, all students in both groups were given the posttest. The mean scores were again computed for both groups. The mean score on the posttest for the experimental groups was 73.5, and the mean score on the posttest for the control group was 60.56. Table 10 shows the scores and means on the posttests of the experimental group and the control group.
Table 10

Scores and Means on the Posttests of the Experimental Group and the Control Group.

<table>
<thead>
<tr>
<th>Experimental Group Scores</th>
<th>Control Group Scores</th>
</tr>
</thead>
<tbody>
<tr>
<td>65</td>
<td>50</td>
</tr>
<tr>
<td>77</td>
<td>68</td>
</tr>
<tr>
<td>79</td>
<td>82</td>
</tr>
<tr>
<td>68</td>
<td>56</td>
</tr>
<tr>
<td>84</td>
<td>53</td>
</tr>
<tr>
<td>79</td>
<td>60</td>
</tr>
<tr>
<td>74</td>
<td>82</td>
</tr>
<tr>
<td>55</td>
<td>44</td>
</tr>
<tr>
<td>79</td>
<td>56</td>
</tr>
<tr>
<td>74</td>
<td>86</td>
</tr>
<tr>
<td>82</td>
<td>56</td>
</tr>
<tr>
<td>70</td>
<td>79</td>
</tr>
<tr>
<td>58</td>
<td>51</td>
</tr>
<tr>
<td>70</td>
<td>60</td>
</tr>
<tr>
<td>79</td>
<td>65</td>
</tr>
<tr>
<td>84</td>
<td>67</td>
</tr>
<tr>
<td>74</td>
<td>74</td>
</tr>
<tr>
<td>58</td>
<td>56</td>
</tr>
<tr>
<td>68</td>
<td>53</td>
</tr>
<tr>
<td>79</td>
<td>50</td>
</tr>
<tr>
<td>81</td>
<td>37</td>
</tr>
<tr>
<td>84</td>
<td>65</td>
</tr>
<tr>
<td>86</td>
<td>41</td>
</tr>
<tr>
<td>77</td>
<td>41</td>
</tr>
<tr>
<td>72</td>
<td>82</td>
</tr>
<tr>
<td>91</td>
<td></td>
</tr>
<tr>
<td>72</td>
<td></td>
</tr>
<tr>
<td>68</td>
<td></td>
</tr>
<tr>
<td>58</td>
<td></td>
</tr>
<tr>
<td>56</td>
<td></td>
</tr>
<tr>
<td>65</td>
<td></td>
</tr>
<tr>
<td>86</td>
<td></td>
</tr>
<tr>
<td>77</td>
<td></td>
</tr>
<tr>
<td>70</td>
<td></td>
</tr>
<tr>
<td>75</td>
<td></td>
</tr>
</tbody>
</table>

Mean = 73.5

Mean = 60.56
The posttest-pretest differences were then computed and analyzed. Table 11 shows the pretest means, posttest means, and the posttest-pretest differences.

Table 11
Pretest Means, Posttest Means, and Posttest-PreTest Differences.

<table>
<thead>
<tr>
<th></th>
<th>Pretest Means</th>
<th>Posttest Means</th>
<th>Posttest-PreTest Differences</th>
</tr>
</thead>
<tbody>
<tr>
<td>Experimental Group</td>
<td>54.8</td>
<td>73.5</td>
<td>18.74</td>
</tr>
<tr>
<td>Control Group</td>
<td>38.84</td>
<td>60.56</td>
<td>21.72</td>
</tr>
</tbody>
</table>

A t-test was used to determine whether or not there was a significant difference between the mean change in the pretest and posttest scores when comparing the experimental and control groups. The level of significance was set at .05.

Table 12
T-Test Analysis on Posttest-Pre-test Differences

<table>
<thead>
<tr>
<th>Group</th>
<th>N</th>
<th>Mean Difference</th>
<th>Std.Dev.</th>
<th>T</th>
<th>DF</th>
<th>Prob T</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exp.</td>
<td>35</td>
<td>18.7428</td>
<td>9.2778</td>
<td>9</td>
<td>58</td>
<td>0.2293</td>
</tr>
<tr>
<td>Cont.</td>
<td>25</td>
<td>21.7200</td>
<td>9.4671</td>
<td>-1.2151</td>
<td>58.0</td>
<td>0.2293</td>
</tr>
</tbody>
</table>

As can be seen in Table 12, the mean difference in
the posttest-pre-test scores for the experimental group was 18.74. The mean difference in the posttest-pre-test score for the control group was 21.72. The computed $t$ value was $-1.2151$ ($p=0.2293$), showing that the experimental and control groups did not differ significantly with respect to differences in achievement posttest-pretest scores.

The hypothesis of this study, Nursing students who use the game ANATOMANIA in an anatomy and physiology course will have significantly higher scores on the final examination than nursing students in an anatomy and physiology course who do not use the game ANATOMANIA was not supported.
CHAPTER V
DISCUSSION

This chapter discusses the findings and some possible reasons for these findings. Limitations and conclusions, as well as suggestions for future research, are presented.

The hypothesis, Nursing students who use the game ANATOMANIA in an anatomy and physiology course will have significantly higher scores on the final examination than students in an anatomy and physiology course who do not use the game ANATOMANIA, was not supported. These findings are consistent with other research which shows that, in the area of cognitive performance, gaming strategies seem to be inconclusive and have a less consistent impact than in the affective domain (Magney, 1990). Taylor and Walford (1978) also point out the inconclusive nature of research findings and suggest that data in support of gaming-simulation are fragmented and based more on hunch and general impression than on systematically validated research. Barber and Norman (1989) pointed out that "on the learning of factual material there is a roughly even spread between studies which found gaming-simulation more effective, less effective, and making no significant difference from traditional teaching."
techniques" (p.147). The results of this study are consistent with Magney, (1990) Taylor and Walford (1978).

Conclusions

Based on the pretest posttest scores of the two groups, it seems that the preliminary course of Body Structure and Function is a beneficial course. The mean pretest score for the control group was 38.8 and the pretest score for the experimental group was 54.8. The posttest scores were 60.56 and 73.54 respectively. It would appear that two semesters of anatomy and physiology are more beneficial than just one semester. The Body Structure and Function course is a good foundational course on which to build more complex concepts.

An observation by the researcher was that the students enjoyed the game ANATOMANIA and looked forward to playing it. The interaction with fellow students, the animated discussions, and communication, which led to new insights led the researcher to believe that the learning technique was beneficial. The laughter and enthusiasm that the students experienced were exciting. One student commented, "In my opinion, the ANATOMANIA game is an invaluable learning tool. It not only helped to direct my thinking towards the main points,
but it also stimulated discussion with other participants. It also clarified and solidified class lectures. The questions are worded in such a way that understanding the content rather than memorizing is the focus. It provided a good way to learn a topic that is typically difficult to grasp." From observations by the researcher, the game ANATOMANIA also seemed to be a motivating tool, which agrees with other educational researchers who identified affective changes such as a more positive attitude toward the subject matter, the teacher, and their own capabilities as students (Magney, 1990).

Even though the research hypothesis was not supported, this study is of value for nursing education and nursing educators. Since the curriculum revolution began in 1986, educators have been searching for new ways to educate the nursing students. The curriculum revolution means opening up new possibilities for ways in which nursing educators educate the students. It is about flexibility and individual differences in how and what one learns (Tanner, 1990). Gaming may be one way to be creative with a more diverse group of learners.

Limitations of this Study

There were limitations to this study that may have
contributed to the nonsignificant findings. The first limitation was the difference in previous course work of the two groups. The experimental group had taken a previous course in Body Structure and Function and their pretests scores were significantly higher than those of the control group. Therefore, it can be postulated that the experimental group had less information to learn and/or less ability to increase their scores.

Another limitation to this study was the difference in learning experiences of the two groups. The experimental group covered 22 chapters in the semester, and the control group covered only 12 chapters in the semester. Consequently the amount of material covered was different. However, this study did test only the content found in the 12 chapters covered in both classes.

Another limitation of the study was the difference in instructors. Instructors vary in methods of instruction and expectations. However, the textbook was the same.

Another limitation to this research may have been the timing of the lab group for the experimental group. They had lab on the same day as lecture, so there was no time to study the concepts learned in lecture.
Conversely, immediate reinforcement of the material following lecture may have been beneficial.

A factor that is sometimes considered a threat to validity is mortality. This is a "loss of study subjects from the first data-collection point (pretest) to the second data collection point (posttest)" (LoBiondo-Wood, 1986, p. 109). There were differences seen in mortality between the two groups. The experimental group, which played the game, lost only one subject. The control group lost seven subjects during the semester. Four nursing students dropped the course and three students were absent the day of the posttest. One might postulate from this that playing the game ANATOMANIA was an influential factor in student retention in the experimental group.

A second threat to internal validity is selection bias. In this study, it was impossible to do a random sample, so the randomization that is essential to validity was not present.

**Suggestions for further research**

Expansion and replication of this study is recommended. One suggestion would be to repeat the study using groups with similar prerequisite knowledge. Validity could also be improved if the same amount of material was required of both groups and the teacher.
was the same for both groups. Timing of lab groups could be varied for the experimental group.

Another suggestion would be to construct a tool to check the results in the affective domain. Comments from students indicated that they enjoyed the game, they anticipated playing it, and it was a stimulating tool for them, but a measurement tool was not developed to measure that aspect of it.
REFERENCES


APPENDIX A

Directions for Anatomania

1. Game may be played by two or more players. May also be played in teams.
2. Each player starts with $1,000.00 from the bank.
3. Choose chapter questions that you want to play (Chapters 1-20).
4. Roll dice to determine who plays first.
5. First player selects his game piece and rolls the dice.
6. Player moves his game piece as indicated by the dice.
7. Player selects a question card from the box. Reads question aloud; answers question.
8. If answered correctly, gets money from the bank as indicated on the board.
9. If answered incorrectly, the player has to pay "Jackpot" that amount of money.
10. Players continue round the board.
11. If player lands on Jackpot and answers that question correctly, player receives all the money there.
12. When all questions have been answered, the player with the most money wins.
13. Play can continue until all questions are mastered.
APPENDIX B

Demographic Data Sheet

The following information will be used for research purposes only. Please do not sign your name to this sheet.

1. Your sex. M _______ F _______

2. Please circle the letter corresponding to your age range.
   a. 17-23
   b. 24-30
   c. 31-37
   d. 39-45
   e. 46-50
   f. 50 or more

2. What is your marital status?
   a. single
   b. married
   c. divorced
   d. separated
   e. widowed

3. How many children living in your home?
   a. 0
   b. 1
   c. 2
   d. 3
   e. 4 or more

4. What is your highest level of educational attainment?
   a. high-school dropout with GED
   b. high school graduate
   c. 1-2 years of college
   d. 3-4 years of college
   e. college graduate (specify degree) _______

5. Please indicate your racial origin.
   a. Caucasian (white)
   b. Black
   c. Hispanic
   d. American Indian
   e. Asian

6. Please indicate the number of hours you work a week.
   a. 0-5
   b. 5-10
   c. 11-15
   d. 16-20
   e. 21-25
   f. 26-30
   g. 31-35
   h. 36-40
   i. more than 40
APPENDIX C

CONSENT FORM

A Study of the Effect of a Game Anatomania on Achievement

Student's Informed Consent Form

Invitation to Participate

You are invited to participate in this research project because you are enrolled in the Anatomy and Physiology course at Iowa Western Community College. This research is being conducted by Susan Jungman as part of the requirements for Master of Science in Nursing at Drake University.

Purpose of the Study

The purpose of this study is to determine if students who use the game ANATOMANIA in an anatomy and physiology course will have higher scores on the final exam than students in an anatomy and physiology course who do not use the game ANATOMANIA.

Explanation of Procedures

As a participant in the study, you will be asked to take a pre-test at the beginning of the course. The experimental group will play the game ANATOMANIA for 60-90 minutes weekly. The control group will not play the game. At the completion of the course, you will be asked to take a post-test.

Potential Risks

There will be no risks involved.

Potential Benefits

By participating in this research study, you will be contributing to the investigation and development of educational learning/teaching tools.

Assurance of Confidentiality

The scores on the pre-test/post-tests will be kept confidential by the investigator. Results will be tabulated and analyzed but your identity will be kept strictly confidential.

Withdrawal From the Study

Participation is voluntary. If you decide to participate, you are free to withdraw your consent and to discontinue at any time. Withdrawal from the study should be by written memo to the investigator. Participation, non-participation, or withdrawal from this study will in no way affect your evaluation in this course.

Offer to Answer Questions

Feel free to ask questions at any time about the research. Questions will be answered by the researcher below.
YOU ARE MAKING A DECISION WHETHER OR NOT TO PARTICIPATE. YOUR SIGNATURE INDICATES THAT YOU HAVE DECIDED TO PARTICIPATE, HAVING READ THE INFORMATION PROVIDED ABOVE. YOU WILL BE GIVEN A COPY OF THIS CONSENT FORM.

If you have any further questions, you may contact Dr. Linda Brady at Drake University. (515) 271-2830.

__________________________________________  _________________________
Signature of subject                       Date

__________________________________________  _________________________
Signature of investigator                    Date

__________________________________________  _________________________
Signature of witness                         Date

RESEARCHER: Susan A. Jungman, M.S. R.N., Graduate Student
Drake University

Phone: Day: 712-325-3321 Night: 712-323-0750
Multiple Choice:

1. The ability of an organism to sense changes that take place within its body would be an example of:
   a. movement
   b. respiration
   c. responsiveness
   d. none of the above

2. Physical and chemical changes or reactions that occur within the body are collectively known as:
   a. metabolism
   b. physiology
   c. assimilation
   d. excretion

3. Homeostasis is defined as the:
   a. ability of human beings to keep body weight within normal limits
   b. maintenance of a constant external temperature inside a room
   c. ingestion of enough food to keep hunger pains from developing
   d. tendency of the body to maintain a stable internal environment

4. How is oxygen used by living organisms?
   a. It controls the amount of heat produced.
   b. It is a source of energy.
   c. It is used to release energy that is stored in food.
   d. It is part of water and is necessary to keep organisms hydrated.

5. The membrane on the surface of a lung is called the:
   a. visceral pleura
   b. parietal pleura
   c. visceral pericardium
   d. parietal pericardium

6. What organ system is responsible for the production of blood cells?
   a. the muscular
   b. the skeletal
   c. the circulatory
   d. none of the above
7. Which of the following substances is an element?
   a. iron
   b. carbon
   c. oxygen
   d. all of the above

8. The atomic weight of an element whose atoms contain 8 protons, 8 electrons, and 8 neutrons would be:
   a. 8
   b. 16
   c. 24
   d. 32

9. If an atom has three electrons in its second shell, and its first shell is filled, it will tend to:
   a. lose 3 electrons from its second shell
   b. lose all of the electrons from its first shell
   c. lose all of the electrons from its first and second shells
   d. gain 2 electrons in its second shell

10. Electrolytes are substances that:
    a. form covalent bonds with water
    b. ionize when dissolved in water
    c. cannot conduct electricity in solution
    d. are not found in the human body in any appreciable amounts

11. The pH scale measures the:
    a. concentration of hydrogen ions in solution
    b. amount of salts dissolved in water
    c. number of hydroxyl ions in water
    d. strength of an electrical current carried by a solution

12. Which of the following is the most abundant inorganic substance in cells?
    a. carbohydrate
    b. water
    c. lipid
    d. protein

13. If the concentration of glucose in the water outside of a cell is higher than the concentration inside:
    a. water will tend to enter the cell by osmosis
    b. water will tend to leave the cell by osmosis
    c. glucose will tend to enter the cell by osmosis
    d. glucose will tend to leave the cell by osmosis
14. The two major components of a cell membrane are:
a. lipid and carbohydrates  
b. protein and carbohydrates  
c. lipids and proteins  
d. carbohydrates and polysaccharides

15. The cell membrane functions to:
a. maintain the wholeness of cell  
b. control the entry and exit of various substances  
c. provide a barrier to water -- soluble substances  
d. do all of the above

16. The nucleus of the cell contains:
a. DNA only  
b. RNA and protein  
c. DNA and protein  
d. protein and ribosomes

17. What occurs if a red blood cell is placed in a hypotonic solution?
a. The cell will shrink.  
b. The cell will swell and may eventually burst.  
c. Nothing. The cell will remain the same size and shape.  
d. Only permeable substances will leave the cell; otherwise the concentrations within the cell do not change.

18. Anabolic metabolism includes:
a. constructive processes by which substances are synthesized  
b. all processes needed to maintain life  
c. destructive processes by which substances are decomposed  
d. changes of larger molecules into smaller ones

19. Which of the following substances increases in amount during cellular respiration?
a. oxygen  
b. glucose  
c. ATP  
d. glycogen

20. The reactions of anaerobic respiration occur in the:
a. cytoplasm  
b. mitochondria  
c. nucleus  
d. all of the above
21. Which of the following is not a characteristic of enzymes?
   a. They speed up the rate of chemical reaction but are not used up in the process.
   b. They are all proteins.
   c. They are most active at temperatures above 55 degrees C.
   d. They have active sites and act on specific substances called substrates.

22. A glucose molecule is changed into two pyruvic acid molecules in:
   a. glycolysis
   b. the citric acid cycle
   c. the electron transport system
   d. none of the above

23. Epithelial tissue functions in:
   a. secretion
   b. absorption
   c. protection
   d. all of the above

24. The tissue through which gases are exchanged between the blood and the air in lungs is:
   a. stratified squamous epithelium
   b. simple squamous epithelium
   c. simple cuboidal epithelium
   d. simple columnar epithelium

25. The tissue that forms the inner lining of the respiratory passages is:
   a. pseudostratified
   b. ciliated
   c. mucus-secreting
   d. all of the above

26. Which of the following are cellular fragments?
   a. red blood cells
   b. white blood cells
   c. blood platelets
   d. blood plasma

27. Reticuloendothelial tissue is composed of cells that are:
   a. phagocytic
   b. hematopoietic
   c. able to transmit impulses
   d. found primarily in the nervous system
28. The muscle tissue that can be consciously controlled is:
   a. smooth
   b. skeletal
   c. intercalated
   d. none of the above

29. As cells are pushed from the deeper portion of the epidermis toward the surface:
   a. they divide continually
   b. their supply of nutrients improves
   c. they tend to die
   d. they become dermal cells

30. Membranes lining body cavities that lack openings to the outside are called:
   a. synovial
   b. mucus
   c. serous
   d. cutaneous

31. Which of the following is a normal response to excessive loss of body heat in a cold environment?
   a. dermal blood vessels become constricted
   b. sweat glands become inactive
   c. skeletal muscles contract involuntarily
   d. all of the above

32. In which of the following regions of the body would apocrine sweat glands be most numerous?
   a. the forehead
   b. the axilla
   c. the neck
   d. palms of the hands

33. The subcutaneous layer consists of:
   a. epithelial tissue
   b. loose connective tissue and adipose tissue
   c. epithelium and loose connective tissue
   d. adipose tissue and skeletal muscle tissue

34. Red bone marrow functions in the formation of:
   a. red blood cells only
   b. white blood cells only
   c. red and white blood cells only
   d. red and white blood cells and platelets

35. The pituitary gland is located in the:
   a. sella turcica
   b. cribriform plate
   c. sphenoidal sinus
   d. glenoid fossa
36. The atlas is one of the:
   a. lumbar vertebrae
   b. thoracic vertebrae
   c. cervical vertebrae
   d. none of the above

37. At what age are all bones normally ossified?
   a. at birth
   b. 5 years
   c. 15 years
   d. 25 years

38. Ribs that join the sternum directly by costal cartilages are called:
   a. true ribs
   b. false ribs
   c. floating ribs
   d. all of the above

39. A synovial membrane:
   a. surrounds the synovial cavity
   b. secretes synovial fluid
   c. stores adipose tissue
   d. all of the above

40. In which of the following is rotational movement possible?
   a. a ball-and-socket joint
   b. a condyloid joint
   c. a hinge joint
   d. all of the above

41. A muscle end attached to a relatively immovable part is called the:
   a. symphysis
   b. articulation
   c. origin
   d. insertion

42. The largest and most complex synovial joint is the:
   a. hip joint
   b. knee joint
   c. elbow joint
   d. shoulder joint

43. Which of the following movements could occur at the hip joint?
   a. extension
   b. adduction
   c. rotation
   d. all of the above
44. Athletes usually experience muscular fatigue less quickly than nonathletes because they:
a. convert glucose into lactic acid 
b. tolerate high concentrations of carbon dioxide
c. make more efficient use of ATP
d. produce less lactic acid

45. A muscle cramp is most likely due to a lack of:
a. actin 
b. myosin 
c. ATP 
d. ADP

46. An example of a partial but sustained contraction would be:
a. muscle tone 
b. tetany 
c. twitch 
d. all of the above

47. The percentage of solids in a sample of human blood is normally about:
a. 15% 
b. 30% 
c. 45% 
d. 60%

48. Nonprotein nitrogenous substances include:
a. amino acids 
b. urea 
c. creatinine 
d. all of the above

49. Which of the following is not needed for the formation of a blood clot?
a. calcium 
b. fibrinogen 
c. prothrombin 
d. albumin

50. Of the following, which are most active as phagocytes?
a. erythrocytes 
b. neutrophils 
c. platelets 
d. eosinophils
51. Impulses carried to the heart by means of the vagus nerve are:
   a. parasympathetic impulses and cause the heart rate to increase
   b. parasympathetic impulses and cause the heart rate to decrease
   c. sympathetic impulses and cause the heart rate to increase
   d. sympathetic impulses and cause the heart rate to decrease

52. The normal pacemaker of the heart is the:
   a. Purkinje fibers
   b. bundle of His
   c. sino atrial node
   d. atrio ventricular node

53. The blood pressure in the systemic arteries is greatest during:
   a. atrial systole
   b. ventricular systole
   c. ventricular diastole
   d. atrial diastole

54. When a person’s pulse is taken by palpation near the thumb on the wrist, what artery is being felt?
   a. the brachial artery
   b. the ulnar artery
   c. the radial artery
   d. the palmar arch arteries

55. The structure of a lymphatic vessel is most similar to that of a(an):
   a. artery
   b. arteriole
   c. vein
   d. capillary

56. The spleen:
   a. functions as a blood reservoir
   b. contains nodules similar to lymphatic nodules
   c. contains numerous phagocytic cells
   d. all of the above

57. Lymph nodes occur in groups throughout the body except in the:
   a. lungs
   b. central nervous system
   c. mesentery
   d. inguinal connective tissue
58. The spleen is much like a lymph node except that the spleen:
   a. doesn’t store lymphocytes
   b. filters lymph
   c. filters blood
   d. doesn’t contain phagocytes
May 5, 1989

Susan Jungman
14 Lainson
Council Bluffs, Iowa 51501

Dear Ms. Jungman:

I reviewed the game cards you prepared for your anatomy and physiology course. As you are aware, my experiential background in this area, consists of five years of teaching anatomy and physiology at the associate degree level plus a master's level preparation in physiology, research, and education. In my opinion, the game cards have content validity for an associate degree level anatomy and physiology course based on the text authored by John E. Hole, Jr. (1987).

I appreciate the opportunity to review this work. If I can be of any future assistance, please contact me.

Sincerely,

Bernadette A. White, BSN, RN
Graduate Student, UNMC
College of Nursing
42nd and Dewey Avenue
Omaha, Nebraska 68105
To Whom It May Concern:

I have examined the questions for the educational game, "Anatomania", by Sue Jungman, and I find the content to be valid for a course in anatomy and physiology. I think the game would be an enjoyable and practical way for students to review the content of this course.

Eric Meyer
Professor of Biology
Iowa Western Community College
May 24, 1990
To Whom It May Concern:

I taught the anatomy and physiology class to nursing students at Iowa Western Community College for seven years.

After having reviewed the ANATONANIA game developed by Sue Jungman, I found the content to be valid and accurate. It's a creative way for students to review the content they have studied and evaluate their own knowledge.

[Signature]