A retention comparison of Agxactly, an interactive quiz game, versus traditional review methods in post-secondary education
by Lucas Seth Porter

A thesis submitted in partial fulfillment of the requirements for the degree of Masters of Science in Agricultural Education
Montana State University
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Abstract:
The purpose of this study was to determine the effect of the use of AgXactly, an interactive quiz game, incorporating time parameters, point values, and teamwork as a means to temper concepts and knowledge, and as a review tool on content related to Montana State University's Introduction to Animal Science course.

This study was conducted using the Solomon Four research design. Participants in this study were those students enrolled in MSU's Animal and Range Natural Resources 100 course spring semester of 2003. Participants were exposed to either a traditional review or review via the means of playing AgXactly. Data was collected using a demand knowledge pretest and posttest. A survey instrument was used to determine students' perceptions of the use of games for education and revision.

Data collected indicated that there was no difference on knowledge retention as evidenced by posttest performance between the control and experimental groups. Results of the survey indicated that the use of games as review was seen as beneficial by the students.

Based on these findings the researcher drew the conclusion that while games had no statistically significant effect on test performance, student motivation was increased. Another benefit from using AgXactly was increased student interaction. It is recommended that further research be undertaken to determine the effect of games on student motivation.

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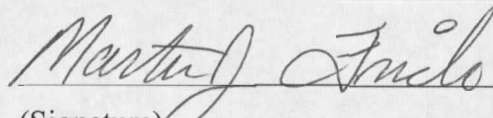MONTANA STATE UNIVERSITY
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This thesis has been read by each member of the thesis committee and has been found to be satisfactory regarding content, English usage, format, citations, bibliographic style, and consistency, and is ready for submission to the College of Graduate Studies.
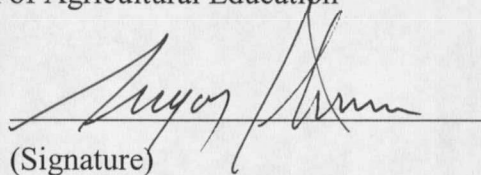
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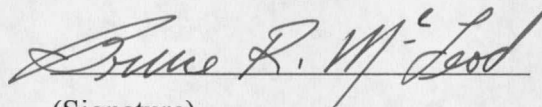Division of Agricultural Education

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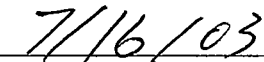Date

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ABSTRACT

The purpose of this study was to determine the effect of the use of AgXactly, an interactive quiz game, incorporating time parameters, point values, and teamwork as a means to temper concepts and knowledge, and as a review tool on content related to Montana State University's Introduction to Animal Science course.

This study was conducted using the Solomon Four research design. Participants in this study were those students enrolled in MSU's Animal and Range Natural Resources 100 course spring semester of 2003. Participants were exposed to either a traditional review or review via the means of playing AgXactly. Data was collected using a demand knowledge pretest and posttest. A survey instrument was used to determine students' perceptions of the use of games for education and revision.

Data collected indicated that there was no difference on knowledge retention as evidenced by posttest performance between the control and experimental groups. Results of the survey indicated that the use of games as review was seen as beneficial by the students.

Based on these findings the researcher drew the conclusion that while games had no statistically significant effect on test performance, student motivation was increased. Another benefit from using AgXactly was increased student interaction. It is recommended that further research be undertaken to determine the effect of games on student motivation.

INTRODUCTION

Advances in technology have allowed us to rise to our present high standard of living. Innovations such as the printing press, internal combustion engine, television, computers, and the Internet have irrevocably changed our society (Marrison, 1992). These technological advances have not only benefited society as a whole, but also more specifically these advances and innovations have benefited the educational field. Wegner, Holloway, and Garton (1999) stated,

> "The practice of using technology to deliver coursework in higher education has seen a veritable explosion. The use of technology has not only created new opportunities within the traditional classroom but has also served to expand learning experiences beyond the popular notion of 'classroom.' Indeed, 'distance learning,' especially utilization of the Internet, is becoming a widely used delivery alternative at universities nationwide." (p 1).

Numerous studies have shown people possess a variety of learning styles (Kagan, Rosman, Day, Albert, and Phillips, 1964; Bjorklund, 1989; Witkin, Moores, Goodenough and Cox, 1977). Some students respond best to oral communication, while others require a visual medium in order to incorporate information. Educators should strive to utilize as many instruction styles as possible to effectively instruct the largest audience possible. Multimedia instruction provides a unique format in order to achieve this goal. Multimedia instruction appeals to visual learners via animation, graphics, and written text and it appeals to the aural learner by utilizing sounds and the spoken word.

While multimedia is a valuable teaching tool, it is not a panacea. An effective instructor must not only present the information in a viable way, but must also motivate the student's desire to learn. Many techniques have been developed to improve

motivation. The use of games and activities is one example of means to increase motivation. Allowing the students to actively shape the content of the course would be another motivational method.

The focus of this study was to determine the effectiveness of games that encourage learning among participants. Games have been designed to appeal to the students' competitive nature as well as incorporating "fun" into the lesson. It has been shown that play performs an important role in psychological, social, and intellectual development while being intrinsically motivating (Rieber, 1996).

Purpose of Study

The purpose of this study was to determine the effect of the use of AgXactly, an interactive quiz game, incorporating time parameters, point values, and teamwork as a means to temper concepts and knowledge, and as a review tool on content related to Montana State University's Spring 2003 Introduction to Animal Science course.

Need for Study

Recent advances in technology, specifically in the field of computers, have allowed for the expansion of gaming as an instructional tool. Amory, Naicker, Vincent, and Adams (1999) stated:

> "The advent of personal computers with superior graphics systems has precipitated an explosion in game software. This multimillion-pound industry produces many different kinds of games ranging from simulations through to first-person adventures. Here players are immersed into virtual worlds filled with stunning graphics, compelling, if not addictive, story lines, sound and video." (p 312).

Numerous studies (Nemerow, 1996; Bell, 1982; Randel and Morris, 1992) have shown that gaming enhances learning. Positive effects on students were increased self-esteem, decreased time needed to absorb information, and decreased test anxiety.

This study sought to increase knowledge regarding the effectiveness of gaming as a review tool. Past research focused on using games for instruction (Nemerow, 1996; Hewitt, 1997; Haught, Kunce, Pratt, Werneske, and Zemel, 2002). Meanwhile little research has been done on games as a means of review (Bell, 1982; Dechristopher, 1991) Due to the lack of research base on games as a means of review this study focused on games as a reinforcement of material presented in the classroom.

Objectives

The objectives of this study were:

1. To determine the effects of AgXactly, an interactive quiz game, as a review tool on academic achievement as shown by scores on the posttest;

2. To determine students' perception of the effectiveness of AgXactly, an interactive quiz game, as a review tool compared to traditional review;

3. To determine the relationship between demographic variables in the AgXactly review group and their posttest performance.

Hypotheses

The null hypotheses for this study were:

H_o1. The use of AgXactly, an interactive quiz game, as a review tool will have no statistically significant affect on knowledge retention levels in the short term;

H_o2. Students' perception of the effectiveness of AgXactly, an interactive quiz game, as a review tool will not vary significantly from their perceptions of traditional review.

Assumptions

The assumptions guiding this study were:

1. Students performed their best on the animal science pretests and posttests.

2. Students in the treatment group did not share information with the control group.

3. Students responded honestly about their perception of the effectiveness of an interactive quiz game as a review tool.

4. Students performed optimally during the traditional lecture instruction.

5. The use of AgXactly had an effect on academic achievement.

Limitations

The following limitations applied to this study:

1. The sample population was students enrolled in the Introduction to Animal Science course at Montana State University Spring 2003 semester.

2. The participants' prior knowledge of animal science topics may have had an affect on test scores.

Definition of Terms

The following terms are defined in order to dispel confusion as to their meaning as they pertained to this study:

Computer
Multimedia: computer application that can incorporate the use of text, video, graphics, animation, audio, and still pictures to convey a message (Marrison, 1992).

Traditional
Instruction: method of instruction in which the instructor presents concepts and information about the discussion topic. Supplemental methods of instruction would include overheads, and chalkboard writing (Marrison, 1992).

Game: an activity in which participants follow prescribed rules that differ from those of reality as they strive to attain a challenging goal (Instructional Media: 7th edition 2001)

AgXactly: an interactive quiz game incorporating time parameters, point values, and teamwork (W. Lanier personal communication November 2002).

Internet: an electronic communications network that connects computer networks and organizational computer facilities around the world (Miriam-Webster 2002).

A REVIEW OF LITERATURE

The History of Computers

In our technologically driven society we have become increasingly dependent on computers. The first true computer was the ENIAC which was developed in the late 1940's at the University of Pennsylvania. ENIAC allowed for rapid and accurate calculations; however, it also had limitations. It was bulky in size and required a large investment of man-hours to reprogram it for new problems.

Since the inception of the computer industry revisions and advances have been phenomenal over the years. Speed of operation has increased many times over. Smaller, faster, and more efficient components have lead us a long way from the days of vacuum tubes. Along with this increase in power and reduction in size, prices have dropped to the point where computers are economically viable for use in industry and for the average citizen. Computers have become an integral part of our everyday lives. Computer technology helps to run the alarm clock that wakes us up. It helps to regulate the operation of our vehicles as we go to work and is present to some extent in almost every industry.

Considering how the computer has invaded almost every aspect of our lives it makes sense that the education field would also incorporate computer technology. Just as computers have become an integral part of society so too have they become integral to education. Schools use computers for administrative functions such as record keeping. The individual teacher uses them for development of lesson plans, handouts,

slides, and overheads. With the invention of the Internet computers are extensively used for research. The majority of students now are more comfortable surfing the web for resources than negotiating the stacks in a library.

Based on all these indirect uses of computers in the classroom it only makes sense that computers should enter directly into the classroom setting itself as indeed they have. Kulik and Kulik (1987) concluded the following about the use of computers in education:

1. Students generally learned more in classes when they received instructional help from computers.

2. Instructional time was decreased.

3. Students perceived their classes to be more enjoyable.

4. Students developed more positive attitudes toward computers. (p 123).

Another form of computer driven technology that is becoming widespread in an educational setting is Internet based instruction. The use of the Internet in the classroom has allowed for easy access to an array of information. In addition to this it has allowed for the 'classroom' itself to expand via distance education. This allows the student the opportunity to take classes not previously offered such as classes for college credit or classes in more obscure subjects. In many cases the impact of this new technology on students has not been considered. Wegner, Holloway, and Garton (1999) conducted a study to determine the effects of distance learning on student achievement as well as student attitudes concerning their learning experiences. The study focused on a curriculum design and evaluation course. The students were divided into a traditional lecture group and an experimental group which received instruction via e-mail and video conferencing. No difference in knowledge retention as evidenced by test scores was

found. However, those students in the experimental group possessed a more positive feeling about the experience. In this respect distance education is similar to games in education. In general no difference in test performance is found but increased motivation is found among those using the new technology.

There are three main ways in which the computer enters the classroom. The most common is using computers to run PowerPoint presentations. This has become a common means of providing lecture material in a multimedia format. The instructor is able to incorporate, visual, audio, still pictures, and video clips in one package. This allows the instructor to appeal to a wide range of learning styles and thus makes the lecture more efficient. Frey and Birnbaum (2002) undertook research to determine students' attitudes towards PowerPoint presentations. Undergraduate students (n=160) at the University of Pittsburgh completed surveys regarding their perceptions of the use of PowerPoint as a lecture format. Results indicated that students felt PowerPoint lectures were advantageous to the student as opposed to traditional lecture. Reasons cited for this was increased ease of note taking and professors who used PowerPoint were perceived as better organized. Another interesting finding from this research was that students did not see making lecture material available beforehand as a detriment to class attendance.

The second major use of computers is as tutorials. There is an array of programs out there which walk students through set topics. The third use and the focus of this paper is the use of computers to run instructional games.

Effectiveness of Games in Education

Randel and Morris (1992) stated: "Because many students enjoy playing games, it has often been asked whether this play aspect could be combined with instruction to enhance learning. This observation led educators to explore the feasibility of using a game format to supplement or replace the teaching of a variety of subjects." (p 261).

The theory of combining play with instruction to enhance learning has subsequently been applied and met with mixed results. There are many examples of research that has found gaming to be an effective means of instruction (Amory et. al., 1999; Nemerow, 1996; Randel and Morris, 1992; Hewitt, 1997). In many cases it has been found that it is not a matter of the game itself being a more effective means of increasing student retention, but rather some interesting side effects of games which cause increased student performance. Games provide a fun and stimulating means of instruction. An effective educator must present information in a clear and concise manner and attempt to also motivate the student's desire to learn the information. Making learning fun can increase motivation and make the learning process more effective (Lepper and Cordova, 1992). Lepper continued to be instrumental in the field of increasing student motivation through gaming technology by operating a company which designs motivational games to aid in learning math skills (Azer, 1998). Johnson and Johnson (1987) reported that the use of games in classrooms stimulated a positive influence on student's attitudes towards school personnel, motivation to learn, self-esteem, and behavior.

Oftentimes there arises confusion between games and simulations. They are often considered one and the same but while they share some elements they are distinct entities. Gredler (1994) defined and classified various elements found in games and simulations. Both games and simulations transport the players or participants to another world. The players and participants control the actions within the set limits of the game/simulation environment.

Games and simulations also vary in three ways. Games are competitive whereas simulations assign responsibilities to students and are faced with the associated rewards and consequences as a result of their decisions. The event sequence also tends to vary between games and simulations. Games are arranged linearly while simulations are not. Games are more static in nature. They are based on a set of rules which does not change over time. Simulations deal with a set of dynamic relationships that may change over time.

Gredler (1994) also defined certain characteristics as key components of games that are appropriate for classroom use. Games should not sanction questionable ethics or practices. Chance should not contribute to winning. An emphasis must be placed on the application of knowledge or problem solving skills as the means of winning.

Gredler (1994) also touched upon the balancing of competition and cooperation in game usage. Gredler (1994) emphasized that while competition is of the essence of any game, it must be balanced with the need for stimulating cooperation among students to foster a positive classroom environment.

Devries and Slavin (1978) conducted a series of ten experiments incorporating a system of forming students into teams and then having those teams participate in a series of games and tournaments. In summarizing their findings they stated: "TGT (Teams-Games-Tournaments) had relatively consistent positive effects (when compared to traditional instruction) on academic achievement, mutual concern, race relations, and peer norms supportive of academic achievement." (p 36).

Whiteley and Faria (1989) conducted a review of literature concerning the use of simulation games, with a focus on business games, in the collegiate setting. This study focused solely on whether incorporating a business simulation game into a marketing course improved acquisition of marketing knowledge. It was determined that overall the game participation had no effect on exam performance but the game playing group performed above the non-game playing group with respect to quantitative questions.

A review of studies on differences between simulations/games and conventional instruction in student performance by Randel and Morris (1992) found the following conclusions:

1. 56% found no difference.

2. 32% found differences favoring simulations/games.

3. 7% favored games but had questionable controls.

4. 5% found differences favoring conventional instruction.

5. Stimulations/games show greater retention over time than conventional classroom instruction.

6. Students reported more interest in simulation and game activities than in more conventional classroom instruction.

7. Games can provide a viable means of reinforcing cooperative skills. By structuring the game so that working in a group leads to success the administrator strengthens team-building skills. In this manner students further develop their interpersonal skills. (p 265).

Marrison (1992) undertook a research project comparing computer multimedia instruction versus traditional instruction in post-secondary education at Purdue University. The participants were students enrolled in an introductory agricultural economics course. It was discovered that there was no difference in academic achievement as judged by test scores in those students taught by computer multimedia and those taught by traditional lecture. Student learning time was decreased by 32 percent for those students taught by computer multimedia. Student learning styles, field dependent/independent, were also considered. No significant difference was found between learning styles, instructional method, and test performance.

Nemerow (1996) experimented with incorporating a variety of games into a high school first year biology course. Among these were question and answer games, strategy games, word games, and noncompetitive games. Surveys were used to assess students' perceptions of games in education. The surveys varied but three questions were always included in each survey. These three questions were: Do you feel that games helped you learn? ; Did playing the game help you gain confidence in yourself? ; Did you learn some information that you did not already know? Student responses indicated that they felt a higher level of self-confidence as a result of the game. One key word that kept being repeated was that students had "fun". This lead to increased participation which implies that student motivation was increased. Students also reported that the games lead to

increased interaction with their peers and as a result of that positive relationships were established among the students.

Hewitt (1997) conducted research among Midwestern fourth, fifth, and sixth graders (n=295) on the use of games in education as a means of encouraging environmentally responsible behavior. A series of six games designed to educate student about environmentally responsible behavior were incorporated into classroom curricula. Results found that scores significantly increased from pretest to posttest for four of the six games. This provides one example where the use of games in education has produced a positive effect on test scores.

Amory, Naicker, Vincent, and Adams (1999) considered four different commercial games in an attempt to identify the game type most suitable for the classroom. They considered four commercial games: a 3-D adventure (a typical shoot-em-up game), a strategy game, simulation game, and another less violent adventure game. The population observed was first and second year college students. Findings indicated that the students preferred 3-D adventure and strategy games. The key elements which appealed to the students were graphics, sound, and story lines. It was their opinion that skills such as visualization, logic, and memory were important skills to possess in order to be successful.

Haught, Kunce, Pratt, Weneske, and Zemel (2002) conducted research to improve student proficiency in learning and retaining basic mathematics facts. The study focused on elementary school students in four midwestern schools. Several strategies were implemented, one of which was the use of games as instruction. Increased test

performance when comparing pretest-posttest performance was reported for the gaming instruction group.

Research has also been conducted on games as a review method. Bell (1982) reports on STRATAGEM: A problem solving game used for revision. Students reported the following benefits:

1. An understanding of the breadth and scope of the major ideas in the subject.

2. Decreased anxiety with regard to later study for term examinations.

3. Corrections of erroneous initial learning of concepts in the subject.

4. Opportunities to weigh alternative ideas. (p 163).

While this review game shares many attributes with AgXactly, it differs in that it was not computer driven. It used a series of flash cards and was conducted under a different format.

A practical application of a Jeopardy formatted review game was used by DeChristopher (1991). Dechristoper (1991) designed a jeopardy style quiz game for use in her high school science classroom. While this was not an actual research study it demonstrated that review games being used in the classroom can have a positive effect. DeChristopher (1991) noted that Science Jeopardy did not involve higher-level thinking skills, but it did make learning basic terms exciting for the students (p 37).