A comparison of Agxactly, an interactive quiz game, versus traditional review methods in secondary education
by Jennifer Leigh Bocksnick

A thesis submitted in partial fulfillment of the requirements for the degree of Masters of Science in Agricultural Education
Montana State University

Abstract:
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Data collected indicated that there was no difference in academic achievement as confirmed by posttest performance between the control and experimental groups. Qualitative results of the perceptions survey indicated that the students saw the use of games as a means of review as beneficial.

Based on these findings the researcher came to the conclusion that while games had no significant effect on test performance, student motivation was increased.

AgXactly also increased student interactions and helped to involve all students. It is recommended that further research be undertaken to determine the effect of games on student motivation.

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APPROVAL

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Jennifer Leigh Bocksnick

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.

Dr. Martin Frick _____ 7/17/03
(Signature) Date

Approved for the Department of Entomology/
Division of Agricultural Education

Dr. Gregory Johnson _____ 7-17-03
(Signature) Date

Approved for the College of Graduate Studies

Dr. Bruce McLeod _____ 7-28-03
(Signature) Date

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ABSTRACT

The purpose of this study was to determine the effectiveness of a supplemental interactive quiz game for improved academic achievement of FFA knowledge in Montana high school freshmen agricultural education students when compared to traditional review methods

This study was conducted using the Solomon Four research design. Participants in this study were those students enrolled freshman level agricultural education courses in Kalispell and Missoula, spring semester of 2003. Participants were exposed to either a traditional review or review using the interactive quiz game, AgXactly. Data was collected using a demand knowledge pretest and posttest. A survey instrument was used to determine students' perceptions of the use of AgXactly, computers, and computers in learning.

Data collected indicated that there was no difference in academic achievement as confirmed by posttest performance between the control and experimental groups. Qualitative results of the perceptions survey indicated that the students saw the use of games as a means of review as beneficial.

Based on these findings the researcher came to the conclusion that while games had no significant effect on test performance, student motivation was increased. AgXactly also increased student interactions and helped to involve all students. It is recommended that further research be undertaken to determine the effect of games on student motivation.

INTRODUCTION

Since the beginning of time, play has been a normal and natural way to learn (Nemerow, 1996). When games are used to learn concepts and ideas, the learners are more motivated and have a greater sense of self-worth and appropriate behavior (Nemerow, 1996). In an article for the Journal of Environmental Education, Patricia Hewitt (1997) related that games provide an opportunity for students to become more active in their own learning. Games let all students participate, regardless of ability or 'normal' classroom behavior. Students are enthusiastic about learning when games are involved, and that helps make cognitive connections "stick" (Randel, 1992). When an inherently unpleasant activity can be made enjoyable, for example, the review of test material, the possibilities for retention are improved (Bell, 1982; Nemerow, 1996).

Games and competitive play as an activity for learning encourage student-to-student interactions and enhance social bonds (Hewitt, 1997; Nemerow, 1996). When students are placed into groups of at least four people, the individual abilities of the students are brought together, so that no one students' ability is focused on above anyone else (Bell, 1982). This allows for a more comfortable setting, less emphasis on personal performance, and more attention paid to the information provided by the activity itself. A cooperative effort in a competitive atmosphere promotes student interaction and can help to overcome communication and social barriers.

When approached well, games and learning activities in the classroom can promote higher order thinking skills by enforcing the use of teamwork and problem

solving to arrive at a desired goal. Students have to analyze questions and synthesize answers. Subject areas with very specific content that can be targeted are most likely to display benefits with gaming exercises (Randel, 1992). This perhaps limits the use of higher order thinking skills; however, there are always opportunities to pull students further into a topic. If not opportunities during the game itself, then chances to expand later on the ideas and concepts presented. Students in all age groups enjoy playing games. To be an effective review tool, games need to enhance cognitive learning. They must focus student energies on important content and help students to assess their knowledge of the material.

Problem

Many contemporary elementary and middle school teachers are seeing the advantages of implementing games into their classrooms. Group activities, worksheets and games are worked into the lessons to improve student motivation and increase individual self-esteem. Frequently though, these are mass manufactured, computer-based programs developed for a generalized topic curriculum.

In high schools and post secondary institutions, review games and computer reviews are less often used and harder to implement on a large scale than in elementary classrooms. At the secondary level, class sizes have increased tremendously as has the variety of students in classes. With the inclusion of special needs students in the traditional classroom and the "melting pot" of cultures and individuals who attend public schools, the task falls to the instructor to bring everyone together. New innovations and

technology are slow to infiltrate school systems. Whether this is a result of marginal funding for technology, or instructors who are not aware of innovative resources, cannot be determined

For many years innovative educators have worked to find ways to make learning fun for their students. Interactive games with a base in computer technology are the coming feature in educational tools. This research was based on that kind of innovative technology

Statement of Purpose

The purpose of this study was to determine the effectiveness of a supplemental interactive quiz game for improved academic achievement of FFA knowledge in Montana high school freshmen agricultural education students when compared to traditional review methods.

Need for the Study

Material review, concept development and assessment of knowledge are ideal uses of gaming instruments. The use of an interactive quiz game to review specific content in agriculture has potential. An opportunity to increase student attention and motivation for specific aspects of agricultural and FFA knowledge is possible through an interactive quiz game. In an American society that is inevitably moving further and further from its agricultural base, there is a need for an effective and interesting way to convey agricultural knowledge. Hooper (1986) cited the need for more research of

emerging technology in her report on multimedia uses in education. She stated, "We need examples that make explicit the wide range of ways that sights and sounds can add to educational experiences, and specific evaluations on how these contribute to the learning process" (p 3). If agricultural educators can implement an interactive review tool that will increase student motivation and retention of knowledge, then all individuals involved in agricultural education will benefit. With the limited funds available to the teaching classroom, the research push should be to help guide teachers to spend their technology funds effectively and properly prepare students.

Objectives

The main objectives for this study were to determine:

1. The effectiveness of a computer-based interactive review tool when compared to traditional review;
2. The students' perceptions of computer-based interactive review compared to their perceptions of traditional review;
3. To determine the relationship between demographic variables in the treatment review group and their posttest performance.

Hypothesis

The null hypotheses for this study were:

H_O1: There will be no statistical difference in the short-term posttest achievement scores between an interactive quiz game and traditional review;

H_O2: There will be no statistical difference between the students' perceptions of computer-based interactive review compared to their perceptions of traditional review.

Assumptions

The assumptions guiding this study were:

1. Students will perform at their highest level on pre-test and post-test evaluations.
2. Student responses will accurately reflect their perceptions of the interactive device.
3. The interactive quiz game will have an effect on knowledge retention.
4. The environment change caused by research will have an equal and even effect on student performance.
5. Students perform at their highest level in classroom activities.
6. Students will react positively with AgXactly team members.

Limitations

This study was limited to:

1. March of 2003.
2. Montana high school freshmen from selected Montana schools (Kalispell and Missoula).
3. Two types of review methods, traditional and AgXactly.

Definition of Terms

Game: competitive interactions bound by rules to achieve specified goals that depend on skill and often involve chance and an imaginary setting (Randel, 1992).

AgXactly: an interactive quiz game incorporating time parameters, point values and teamwork (W. Lanier, Personal Communication, November 18, 2002).

Traditional Instruction: method of instruction in which the instructor presents concepts and information about the discussion topic. Supplemental teaching media used during the presentation include overhead transparencies, handouts, chalkboards, etc. (Marrison, 1992).

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

REVIEW OF RELATED LITERATURE

Due to the abundance of available information concerning the technology age, this literature review focuses on a brief look at educational technology, principles of computer-based learning associated with the use of games and competition, technology uses in education and effective gaming instruments.

Educational Technology

Uses of early computer systems were restricted to those that dealt with raw numbers and equations such as accountants, scientists and engineers. Inventions, in the years since the 1970's, have developed the computer technology that we use today (Marrison, 1992). This computer technology has made the way for advances that were only dreamed of in earlier years. When asked what the future of computers holds, Niman (1985) replied: "In the future, we will see more widespread use of computer systems networked with one another. Such systems transmit videotext information, deliver mail, and perform banking functions, trading transactions, and numerous other tasks" (p 16).

Little did this researcher know the scope of the advances that would be made as they were foreseen. Today, in the early years of the new millennium, computers hold abilities that we are only beginning to develop. Each day there are new uses for computers, from electronic identification and maintenance of a 10,000 head milking Holstein operation to identification of felons by tiny tissue samples, to immediate video

and audio correspondence with countries across the world, for the computer that began centuries ago with rods and beads on an abacus.

With the continued advances of computers in everyday life, the use of the computer in the classroom has developed exponentially in the last two decades. In classrooms today, companies compete to produce teaching and learning software for classrooms. The Internet has opened up a new venue for learning opportunities. Online tutorials, bulletin boards, and quizzes are offered at all levels of the educational hierarchy (Wegner, Holloway, and Garton, 1999) and work to assist classroom facilitators to deliver information to all students. Whiteley and Faria (1989) summarized the plight of the teacher when they stated, "Only by understanding the educational value of an instructional approach can the teacher make the best use of a student's most limited resource – time" (p 60).

Over those same optic fiber cables that send and receive telephone and Internet signals, we now have video conferencing capabilities. This allows individuals to interface visually and aurally wherever there are classrooms wired for this technology. Distance education has gained credibility and acclaim for offering quality courses and professors to individuals who could otherwise not attend such programs. Arsham (2002) notes that the "single biggest advantage in online learning programs is interactivity" (p 15). The demand for educational opportunities is increasing and the student motivation created by new technologies makes distance education a thoughtful option (Arsham, 2002).

Principles of Computer-based Learning

When evaluating the usefulness of an educational tool to promote self-motivation, the roots of the motivation itself must be judged. For instance, some individuals may argue that computer-based instruction or Internet based learning promotes positive feelings because of the novelty of the experience (Wegner, Holloway, and Garton, 1999). Others noted that a computer-based information source has the ability to meet a wider variety of learning styles than more 'traditional instruction' types (Moser, 2000). Still others would say that simulations and games were effective because they "significantly increased a student's conceptual and factual knowledge" (Wolfe, 1985).

Although the computer is used to supplement instruction, motivation is driven by the classroom curriculum. However, implementing online quizzes or offering assignments on a class web site will encourage students to get on the Internet and search out their own information (Carr, 1998).

A current vein of thought centers on the benefits of learning as a cooperative effort. Corporate conferences on workplace efficiency strive to implement a teamwork attitude among employees. Classrooms, it seems, work more effectively in the same way. A teaching or review game's effectiveness is directly related to internal factors such as team size and composition. A team's early agreement and commitment to group goals, interaction and between-group competition has been shown to lead to the high degree of cohesion needed for successful play (Wolfe, 1985).

Current research initiatives support the theory of "teacher as facilitator", and "student as worker" (Wegner, Holloway, and Garton, 1999; Telelearning, 1998).

Instruction on the Internet and using supplemental technology helps to accentuate this model. Learners have high access to Internet sources, the students construct the content and the context offers the instructor and the class a high level of support for new initiatives and resources (Telelearning, 1998).

Closely related to the idea of self-motivation is the ability for computer classroom technology to promote an enthusiastic audience (Nemerow, 1996). The use of the Internet and computers to promote classroom learning is still a "new" enough idea that students in most environments are excited to have the technology implemented into assignments and instruction. This becomes the biggest problem for researchers wishing to explore the effectiveness of new technologies versus traditional instruction methods. The novelty of the instrument itself biases the research. However, undesirable as this may be for research, it spells increased student attention and participation for the classroom instruction. The key, it seems, is to be an innovative instructor who is forever searching for new technologies and molding them to fit different niches in the curriculum, thus ensuring that the students are continually engaged and learning.

Computer gaming applications offer many advantages to instructors for student benefits. When properly applied, the activities promote higher level thinking skills in the students who are participating. They face problem-solving situations, required interaction with others, and competition that creates a "high stakes" situation that entices participation. In a research situation developed by Nemerow (1996), the parents and students participating took a survey that concluded that nearly half of the individuals believed that competition was a major component of games.

Cryer's (1988) paper, "Managing an Educational Game, Simulation or Workshop: A Motivation Perspective," focused on the work of Maslow and his belief that man is always wanting something. She relates the need for safety with group participants with a need for protection. This refers to participants who are shy and insecure in their surroundings. These students must be protected, kept from further insecurity, and made to feel welcome. By working in teams, these individuals can be part of a group and not made to participate overtly or singly (Cryer, 1988). Cryer further points out that an advantage of games over more conventional or traditional instruction is that by their very nature, interpersonal interactions occur. At this level, useful learning can take place and the participants are motivated to be involved in the group work or competition.

Bell (1982) related that the use of games enhances cognitive learning by removing learning blocks that often arise among students through the use of a competitive, achievement-oriented situation. By changing the atmosphere from one of "individual work equals individual rewards" to a group or team activity, each student is not spotlighted so noticeably. This is particularly helpful for those students who are generally too shy to participate in regular classroom activities. There have been numerous studies compiled relating the overall successfulness of a team to whether it was self-assigned or chosen by an instructor. There is overwhelming support for the latter, for although self-assigned teams have already solved a lot of their "socialization problems," those shy students exist in every classroom and perhaps need some support and direction to socialize with their classmates (Wolfe, 1985).

Maslow believed that once the physiological, safety and social needs had been satisfied, then the esteem needs would dominate. These are the desire for self-confidence and for respect and recognition from others. Through the use of games, students may be motivated to display their self-confidence and to improve their image in the eyes of others (Cryer, 1988). It is the job of the instructor to assure that students do not become over-burdened with their tasks or anxious and "burn out" to the extent that they cannot or do not wish to contribute to the group (Cryer, 1988).

In a review of recent research on the effectiveness of games for educational purposes, 14 difference studies took knowledge retention over time into consideration. Ten of these 14 reported significant results in favour of the simulation/game groups. This has been found to be most effective in areas where very specific content can be targeted (Randel, 1992). The idea behind this being that the activity itself assists the learner in placing the information into a compartment that can be triggered due to the review method. When students have fun learning, the attitude of the class is better and instruction is more beneficial. It is believed that we remember events that make us happy or sad for longer periods of time than those events that do not affect us emotionally (Nemerow, 1996). Rae Pica, in her book "Moving and Learning Across the Curriculum: 315 Activities and Games to Make Learning Fun," emphasizes that the more senses are involved in the learning process, the greater the potential impact and retention. The author also points out that each individual has different ways of learning and knowing, emphasizing the diversity of humankind (Maheux, 1999).

Technology Use in Education

Since the introduction of computers into the classroom, games have been implemented to aid in instruction. With the advances made in technology, these games have evolved from very simple number games and review endeavors to simulation exercises, adventure games, strategy and "shoot-em-up" activities (Amory, 1999). Games are a way of implementing a 'fun' aspect into learning. Amory (1999) stated that "for games to benefit educational practice and learning they need to combine fun elements with aspects of instructional design and system design that include motivational, learning and interactive components" (Amory, 1999, p 312). The motivation comes from goal formation and competition that are inherent in games. Experts agree that challenge, fantasy and curiosity add to this fun in games. Computer applications offer many variations to the motivating characteristics found in games. It is apparent that this computer source of motivation and review and learning is to be found in education venues for years to come.

Other computer sources of alternatives to chalkboard lecture are available as well. Microsoft™ has developed a lecture aid that has become a regular for classrooms and seminars around the world. PowerPoint is a projection aid that allows for multiple levels of complexity in lesson development. Students have notes that can be printed from the lecture material and a source of information that is infinitely more appealing than an overhead projector or slides. It is also an effective tool for student presentations and projects. The Windows-based program is user friendly and offers an amount of flexibility that allows for varying use levels.

Television offers a variety of gaming possibilities: Jeopardy, Hollywood Squares, Who Wants to be a Millionaire, Wheel of Fortune, and the list continues to grow. The television game show arena presents concepts that are easily moved into the classroom. Even before the introduction of a computer in the classroom, games have been used to modify the normal classroom environment. The atmosphere that is developed by the introduction of a game into the classroom is one of teamwork and cooperation.

Mary DeChristopher (1991), in her eighth-grade science classroom created her own "Scientific Jeopardy" game to help her students to review for upcoming tests. She asserted that although her game is not appropriate for introducing new information into the classroom, it is very effective in helping the students to analyze their strengths and weaknesses in the material. She has found that by using the Jeopardy format, she can cover all of the material for the test and the student's attention, which is focused on the competition of the game, will assist in learner retention for the test. DeChristopher (1991) granted that her "Scientific Jeopardy" does not require higher level thinking skills to participate; however, by using a creative presentation method, students can go on then to using higher-level thinking skills with a greater understanding of the subject being studied.

METHODOLOGY

In this chapter, the procedures used in completing this study are described. This chapter is organized into five different sections: (1) Population Selection, (2) Instrument Design, (3) Instrument Reliability and Validation, (4) Data Collection and (5) Data Analysis.

Population Selection

The population for this study was comprised of Montana freshmen enrolled in an agricultural education course in selected schools. While the students enrolled in the agricultural education courses was not a random selection, the registration methods of each school are such that students are randomly assigned into a class period at the beginning of term, based on their class schedule. During the study, each of the classes, (four in Kalispell and two in Missoula) were randomly assigned into a research group. Within these groups, AgXactly treatment students were then randomly placed into teams by the researcher.

The student population for this study consisted of ninety-two (92) freshmen students enrolled in selected agricultural education programs for the 2002-2003 academic year. Determining schools with large, diverse group samples available in Montana identified the population. Sixty-six (66) students represented the Kalispell program, while there were twenty-six (26) individuals participated in Missoula.

Instrument Design

The measurement instruments that were used in this study were multiple choice and true-false demand knowledge pre-test and post-test, designed by the researcher. Questions were arranged by the categories found in the AgXactly database. Both the pretest and the posttest contained the same number of questions in each category and the same style and content.

Students were divided into four groups representing a Solomon Four group design. This design can be represented by the following illustration:

Group 1	R	O	X	P
Group 2	R		X	P
Group 3	R	O		P
Group 4	R			P

The symbols are defined as:

R	Randomization	P	Posttest
O	Pretest	X	Treatment

This research design was chosen to complement the types and styles of questions that will be asked on the AgXactly quiz game as well as any FFA Quiz Bowl events utilizing the same question base. Questions covered FFA history, FFA knowledge and fundamentals, and general agricultural and Career Development Event knowledge. This is all material that, according to the Montana Curriculum Standards, has been addressed by the high school agricultural programs in the fall term, so there was a common

knowledge level expected. The instructors at the programs in Kalispell and Missoula also assured the researcher that this information was covered in the fall term.

The dependent variable for this study was the academic achievement of subjects on a 15-question demand knowledge posttest (see Appendix B). The independent variable was the type of review method used with each group, either traditional or AgXactly.

This study design had eight threats to internal validity that were addressed and analyzed. These threats were: history, maturation, testing, instrumentation, regression, selection, mortality, and interaction effects. Following is a breakdown addressing each of these threats.

History refers to the occurrence of an event that could influence performance on the dependent variable, but was not a part of the experimental treatment (Borg, Gall, and Gall, 1996). This could be a world event, local or regional occurrences. This threat was controlled through the use of control groups and a short duration experiment.

Maturation is the process of physical and mental change that could occur within the subjects over a period of time (Borg, Gall, and Gall, 1996). If a study covers a long period of time, this can be an issue concerning the validity of dependent variable scores. This threat should not have had a significant effect on study subjects as the duration of the study was only one hour. This time frame did not offer an opportunity for maturation to occur. Also, the use of randomization of the subjects into test groups should have controlled this threat to internal validity.

A third threat to internal validity is testing. Testing refers to improved posttest scores as a result of taking a pretest (Borg, Gall, and Gall, 1996). The use of a control group was used to control this threat.

Instrumentation is a term referring to unreliability of the measuring instrument that could lead to an incomplete assessment of performance (Borg, Gall, and Gall, 1996). Through the use of a control group and administering the instrument in the same way each time, this threat was negated.

Statistical regression occurs when subjects are selected for scores or measurements that turn out to be extreme (Borg, Gall, and Gall, 1996). Random assignment of the subjects into groups controlled for the threat of regression.

Differential selection of subjects occurs when previously formed groups are used in a study and refers to the reality that the groups may be different before the study begins, and that this difference could be held accountable for differences in the posttest (Borg, Gall, and Gall, 1996). Although the initial bulk of the subjects for this study were self-selected members of the tested population, randomization within the groups was used to account for this threat.

The seventh threat to internal validity is mortality. This refers to students who drop out of a study. Those subjects who opt to drop out may possess characteristics such that their absence has a significant effect on the results (Borg, Gall, and Gall, 1996). The use of a pretest and the short duration of time involved in the study accounted for this threat.

Finally, the eighth threat to internal validity is selection-maturation interaction. This expansive threat refers to the situation that occurs when one group changes along a given plane faster than another group (Borg, Gall, and Gall, 1996). Random assignment of groups, combined with the extremely short duration of the experiment mitigated this threat.

Within the chosen design for this study there are six applicable threats to external validity. External threats refer to the extent to which the findings can be applied to different settings. These threats are: pretest-treatment interaction, multiple-treatment interference, selection-treatment interaction, specificity of variables, experimental effects and reactive arrangements (Gay, 2002). Following is an analysis of these threats and an explanation of the minimization of each.

Pretest-treatment interaction refers to the difference in the response subjects may give to a treatment because they were pre-tested. Thus the subjects are alerted to perhaps the nature of the problem (Gay, 2002). Since the pretest didn't test the method of review, but rather the FFA knowledge material, this threat was harmless.

Multiple-treatment interference occurs when the same subjects receive more than one treatment in succession (Gay, 2002). All groups of subjects participating in this experiment had to complete at least one test. The subjects completing multiple tests were split into pretests and posttests without rapid succession.

A third threat to external validity is selection-treatment interaction. This is a reduction in generalizability of results due to a lack of randomization (Gay, 2002). The

subjects participating in this study were randomly selected into their individual groups, and therefore reduced this threat.

Specificity of variables is the fourth threat to external validity. Specificity is the threat to the ability to generalize the data. This threat expresses the concept that depending on when it is completed, post-testing could yield different results. Some effects are only seen immediately following treatment, while others do not express themselves until the long term (Gay, 2002). As this was a study to determine retention in the short-term for use as a review tool for assessment, only a short-term posttest was administered to the experimental groups.

The threat of experimental effects could also have had an effect on the external validity of this study. This refers to passive factors like age and gender, active bias and evaluation bias (Gay, 2002). Evaluating the pre-test and post-test solely on academic achievement managed the bias of this study. Subject anonymity was maintained as well.

The final threat to this study's external validity is reactive arrangements. This refers to the number of factors associated with the study, as well as feelings and behaviour of the subjects. These reactive elements have a wide range of descriptions (Gay, 2002). In this study there were recognized limitations due to the "novelty" of the AgXactly experience, as well as the introduction of a new element (graduate student researcher) into the classroom. However, randomization acted as an equalizer for this threat.

AgXactly has been developed to work specifically with the types of questions that have historically been presented in a quiz bowl situation. AgXactly was originally

developed and completed in 2002 with assistance by Will Lanier and programmer Edam Lozano. AgXactly originated with the need to establish a tool for review and supplementation of material for agricultural programs. It has been piloted successfully for review of lecture material for Montana Pesticide Re-Certification programs. AgXactly is a "Jeopardy" style program that implements a database of developed multiple choice and true-false questions coded by the level of complexity and cross-referenced to online resources of supplemental information, to review material covered over a specified amount of time. The game is completely interactive and requires teamwork and strategy for success. The flexibility of the development of questions makes the program applicable in many settings and subject disciplines. The instrument has the possibility of four categories, including a practice bank of questions, and each of these are composed of questions coded to three levels of difficulty. All questions were reworded for the context of FFA knowledge for high school freshmen. The first column consisted of three practice questions (one low level, one image, and one bonus). The second column came from FFA history. The third column was developed from FFA knowledge and fundamentals. The final column was questions developed from general agriculture and Career Development Event knowledge.

Demographic variables included gender, home setting (rural or urban), FFA interest assessment, and membership in other organizations. Also considered is the quality and content of prior computer learning and computer ownership.

Instrument Reliability and Validation

To ensure instrument validity, a table of specifications was consulted when developing appropriate questions. Knowledge and comprehension questions were a simple matter to address. Application type questions came from agriculture knowledge and parliamentary procedure. This instrument, in order to correspond favorably with the AgXactly questions and the style of questions generally presented in a quiz bowl situation did not include synthesis or evaluation material. A pilot study using the style of questions developed for the study was conducted at Park High School on March 3, 2003 prior to launch of the true study. Reliability of the pretest and posttest instruments was calculated from the data collected during the pilot study (see Table 1). Both the pretest and the posttest forms were analyzed using Equal-lengths Spearman-Brown split-half test of reliability. A perceptions survey modelled after the one to be used for the study was administered at Park High School. After the pilot study corrections were made on the instruments, they were then administered at the Kalispell and Missoula schools on March 7th and 10th respectively. The Cronbach's Coefficient Alpha test for reliability was conducted on the perceptions survey, and a reliability estimate of .92 was calculated.

Table 1. Split-Half Reliability Analysis for FFA History, Knowledge and CDE Demand Knowledge Tests.

Inventory	Number of Items	Coefficient
Pretest	15	.4907
Posttest	15	.3379

Data Collection

As this is a quasi-experimental study, the data collection occurred at the time of administration of the instrument at the schools on March 7th and 10th of 2003. The classes were set into a Solomon Four group design and FFA knowledge pre-tests were given accordingly. Following classroom introductions, Group 1 received the pretest. Upon completion of this exam, students were separated into groups to participate in the AgXactly treatment. After this exercise, the students received a short-term posttest and then completed the Perceptions Survey. Group 2 completed same steps as Group 1 except the pretest. Group 3 did not to participate in the AgXactly exercise; however, they were presented with a pretest and a PowerPoint lecture-type review presentation on the material covered. Group 4 did not receive a pretest. Other than that, they completed the same steps as Group 3. The time period for introduction, instructions through completion was accomplished within 50 minutes for all students in the research study. At the end of the period, students participating in the AgXactly portion of the study received a perceptions survey to evaluate their responses to the AgXactly experience.

All instruments were hand-scored by the researcher and no true points were awarded for success in the AgXactly instrument. All scores were placed in a Microsoft Excel spreadsheet for record keeping and ease of translation into the SPSS 11.0 statistics program (Statistical Package for the Social Sciences).

Data Analysis

The effects of the interactive quiz game for review versus traditional review methods were evaluated using the following measures. The pretest and posttest scores were subjected to a 2 x 2 factorial analysis for variance. A one between, one within repeated measures factorial analysis of variance was used to determine the knowledge retention levels of those students that were pre-tested and post-tested on the FFA demand knowledge data. T-tests compared the means of academic achievement to different available demographic variables for the treatment group.