

Games as an Interactive Learning Tool: A Case Study of a Jeopardy Style Game Show for Construction Classes

Thomas Leathem and Mark Tatum
Auburn University
Auburn, Alabama USA

Incorporating interactive teaching methods into classroom instruction has been a concept researched for the better part of the last twenty years. As technology has evolved, and the learning styles of students along with it, this has become an increasingly relevant topic. Today's students are of a generation that has never known life without computers or the internet. The use of technology encompasses virtually every facet of their daily life, including learning. It has become increasingly clear that a large gap has formed between traditional teaching techniques and the learning styles of today's students. This paper explores the concept of non-traditional interactive teaching techniques through the design, fabrication, and implementation of a Jeopardy style game show. The idea was developed as a means to create a more engaging learning environment for students of a lecture style Construction Materials and Methods class. The basis for this paper is exploratory in nature and will focus on the design and development of push-button gaming hardware to provide for a more interactive and competitive game itself. While initial feedback from the students will be discussed, the purpose at this time is to provide development information for other universities to use in adopting the format.

Key Words: Games, Game Show, Jeopardy, Interactive Learning, Net Generation

Introduction

The classroom environment is often not at all conducive to the learning outcomes we hope to achieve. When presented with the challenge of trying to bridge the divide of the student-teacher generational gap, instructors find themselves with the daunting question of whether to reinvent the classroom or maintain the status quo. This was the case with a pre-building science class at Auburn University, which was the inspiration for the development of the interactive delivery method contemplated in this paper. The class covered construction materials and methods and convened in a basement auditorium-style setting absent of windows and adequate lighting. A rather relaxing setting in its own right, then add to that an instructor lecturing for an hour about the molecular anatomy of wood, and you have a recipe for unconsciousness. While this may be the extreme, the traditional lecture-style classroom format oftentimes produces the same result for the Net Generation student, regardless of the subject matter or setting.

Millennials or Net Gens

It's no secret to college and university educators that the students of the classrooms in which they teach are vastly different from what they were ten years ago. These students are the product of a technology generation commonly referred to as the Millennial or Net Generation. Their everyday lives are consumed by the use of electronic media for everything from communication to entertainment, and especially learning. Email and text messaging are their preferred form of communication (Roberts, G 2005), and buying a new music album means logging onto iTunes and downloading the latest music craze. Conducting research is primarily done through the use of the internet.

Raised in an environment with a lot of information, the millennial student is a multi-tasker. Students commonly attempt to juggle a text message conversation with surfing the Web and completing a reading assignment at the same time. They often carry various electronic devices where portability of the device is paramount. Howe and Strauss report that students have a fascination with new technology (2005). Games are big part of the millennial

student's life. Oblinger and Hanger (2005) identify games as integrated into college students' daily lives reporting 60% of them as regular game players.
Typical to their multi-tasking, technology-engulfed lifestyle, Net Gens seek a more engaging classroom atmosphere, reporting being bored in the traditional classroom setting (Barnes, et al. 2007). Naomi Baron points out that faculty members once considered excellent for their engaging lectures are now referred to as "sooo boring" by students (Carlson, 2005). Net Gen students have a great desire to seek active and engaging learning experiences through varied forms of communication, interactive environments, and multiple forms of feedback (Barnes et al, 2007; Oblinger & Hanger, 2005; Glenn, 2000). They desire a personal relationship with their instructors. For the Millennial, it is important that professors take "a personal interest, connecting with them one on one, being open" (Teaching the Millennial Generation, 2006). Students want to learn from teachers with honesty and integrity (Raines, 2002).

Today's student has a "bias toward action" (Brown, 2000). Students want to be presented with the material and then have an opportunity to immediately apply that knowledge. Students' quest for experiential and hands-on learning correlates well with research that indicates that such learning is "more significant" than traditional cognitive learning (Rogers and Freiberg, 1994). Experience becomes the main driver for learning as knowledge is built based on the transformative reflection of one's experience (Baker et al, 2002). A 2009 study at Purdue University indicated that students who learned through hands-on methods had higher scores and greater improvement from the baseline when compared to students who were taught in the traditional way (Dark, 2009).

The Net Generation student enjoys working in groups (Howe and Strauss, 2005). Education is a social event, and students believe education should be interactive and engaging. This engagement can occur with other students, friends outside the classroom, industry, and faculty alike. Oblinger and Oblinger identify that if teaching does not provide opportunities for student interaction and group work, the Net Generation student will not come to class (2005).

Educators

A brief look at the face of post-secondary educators in the 21st century reveals a somewhat mixed breed. The majority of university faculty is primarily comprised of Baby Boomers (1943-1960) and Generation Xers (1961-1981), with an average age over fifty (Davies and Denecker 2011, Ciocco and Holtzman, 2000). The culture and educational experiences of this generation were very different from the one today's Net Generation students face. Faculty in the 1980's were viewed by students as wise and experienced individuals. The typical 1980's faculty were both masters and commanders of their classrooms. Most delivery styles were "text-based" and focused on a logical sequence of "content focused" knowledge (Oblinger, 2005). Lectures and the chalkboard were the dominant classroom delivery tools.

For many of these instructors, technology is more a means to an end that requires a concerted effort to understand and implement, rather than an inherent second nature action. Given this adaptation curve, many instructors today still adhere to teaching the fact-based approach, to which they have become accustomed. This ever apparent disconnect between student and teacher has brought increasing focus to the importance of evolution in classroom instruction.

In "The Joy and Responsibility of Teaching Well", Dr. L. Dee Fink (2007) stated that there was evidence today's students were not having significant learning experiences. Ciocco and Holtzman (2000) indicated that in a "significant learning" experience, students remembered key concepts, were able to apply the content, related the information to others, understood personal and social implications of the subject, valued the subject, and created a desire to continue learning. In other words, students mastered the subject knowledge, were able to apply it, and desired to learn more about it as they moved beyond the classroom. If faculty delivered the curriculum in a way that matched the way the Net Generation learns best, could we create more "significant learning" experiences?

Opposition for Change

Some educators do not believe a shift toward student preferences in classroom delivery methods is the best approach. Naomi Baron, a linguistics professor at American University, feels pressure to "shorten lectures, increase

group-discussion time, and ignore the 'multitasking' student who is e-mailing his friends in the back of the room" just to satisfy the needs of the student (Carlson, 2005). Listening in such an environment is distant and foreign to many students, not to mention the distraction created for the faculty member. Ms. Baron states, "At some point, what we are doing is killing higher education." (Carlson, 2005). On the other hand, Seymour Papert (1993) points out that computers and technology can be powerful teaching tools that are not fully exploited by educators using them as isolated tools.

Regardless of our position for or against catering to the needs of students, the simple fact remains today's students learn differently than those of generations past. If we, as educators, strive to be experts of knowledge and communicators of such, it is our obligation to adapt as necessary the appropriate tools to be successful in that endeavor. While catering to the students' every need may not be the answer, there is likely a balance between the two that would be beneficial to both the student and teacher.

Today's students expect that education will be entertaining. In middle and high school, students have employed learning approaches geared toward "teamwork, collaboration, critical thinking skills, classrooms with learning pods/subject corners and individualized options, and learning projects" (Training the Different Generations, 2007). These learning approaches supported the strengths of this generation-multitasking, goal oriented collaboration, and positive attitudes toward the task at hand (Ciocco & Holtzman, 2008). In aggregate, Millennial students would prefer classroom delivery and assessment to be geared toward teamwork, experiential activities, structure, and the use of technology (Ciocco & Holtzman, 2008). In addition, Net Generation classes should be conducted at a quick pace with increased interaction and visual examples (Ciocco & Holtzmann, 2008).

Methodology

Considering the learning interests of Millennials and the classroom environments in which they seek, the authors set out to develop an interactive learning medium that would step out of the traditional boundaries of the educational framework. The concept was to develop a more constructivist instructional design approach whereby knowledge is constructed through activities or interactions within the learning context (Lee, 2010). The development of this was broken down into identified goals or pedagogical outcomes, project concept, delivery medium, and required hardware.

The driving force behind the development of this pedagogy was to establish resultant outcomes more in line with the expectations of today's technologically saturated students, which involve more active, engaged learning environments. Active learning concepts were gaining exposure as early as the 1980's and have been getting increased attention over the years (Cook, 1997). Bonwell and Eison (1991) characterize active learning as, involving students in more than just listening. Considering active learning characteristics identified by Charles Bonwell (2000), key characteristics to success of the project were identified (Table 1).

Table 1

Bonwell Active Learning Characteristics	Characteristics of Project Success
1. Students involved in more than passive listening	1. Create an environment of friendly competition
2. Students engaged in activities	2. Promote group activity
3. Less emphasis on information transmission, more emphasis on student skill development	3. Provide whole class participation
4. Greater emphasis on attitude and value exploration	4. Provide incentive for participation
5. Increased student motivation	5. Create direct student involvement
6. Immediate student feedback	6. Provide immediate teacher/student feedback
7. Higher order thinking	7. Promote student engagement
	8. Require physical involvement of all students
	9. Promote cognitive development
	10. Utilize technology within the classroom

Project Concept

Although the concept of active learning environments has received increased exposure since the 1980's, little advancement has been made toward adoption. The use of PowerPoint has been incorporated into many instructors' lectures, improving the delivery format compared to that of older methods such as overheads and dry erase boards. Nevertheless, the delivery format still maintains the persona of a lecture, and does not get the students actively participating in the class. Namhun Lee (2010) identifies games and simulation activities as methods for creating active learning environments, citing they enhance motivation, and promote active engagement and participation in learning.

Considering the findings of Namhun Lee, the concept was relatively simple. Develop a game strategy wherein you can take a classroom of students and divide them up into teams that compete against each other. The competition basis will be the material relevant to the class being taught. In the instance of the Materials and Methods class in this study, the game format will be used as a test review to help students prepare for their upcoming test. The material will be presented in a fashion that requires cognitive thinking and when necessary, group discussion. Delivery of material must be viewable by all students during the entire game. The game must incorporate an element allowing all students to be physically engaged in answering game questions during some point in the class. By providing an incentive for the winning team (in this case extra credit points on their test), the competitive nature of the game will be heightened, thereby increasing students' attention to the material being presented.

Delivery Medium

The construction education community is not new to the implementation of games as academic tools. Lee (2010) points to a number of games that have been used over the years, including the "Construction Management Game" implemented in 1969. Since then games like CONSTRUCTO, SuperBid, Parade of Trades, and The Construction Marketing Game have been used as active learning approaches in construction classrooms (Lee, 2010). While these approaches have been helpful in knowledge delivery, they are somewhat restrictive. By design, these games have been developed to meet the needs of specific problems; primarily from the standpoint of simulating a practical application issue commonly related to real-world experiences in construction (McCabe et al, 2000).

One of the goals sought by the authors was to develop a gaming system that was more versatile than that of the previously mentioned approaches. They wanted a system that could easily adapt to multiple subject matters and various class sizes. It needed to be usable in multiple types of classroom environments, from lecture halls to small scale lab- type rooms. In researching scenarios that fit this mold, little information was found. However, one article discussed the concept of using the popular television game show, "Jeopardy", as a means to modify the traditional lecture-style classroom format (Cook 1997).

When evaluating the format of Jeopardy, the authors note it works well to meet some of the pedagogical outcomes desired along with the flexibility needs demanded. It allows the ability to break down subject matters, develop different categories of content, create a hierarchy of difficulty in content, and provide a means of competition through point valued questions. In addition, it provides the cognitive learning element by approaching questions in the typical Jeopardy format where the answer is given to the student, and the student has to provide the question to the answer. This ultimately requires the student to change his/her thought process to develop an answer. The authors discovered accomplishing this would be relatively simple by using PowerPoint to create a representation of the traditional Jeopardy game show board. It could then be projected through classroom computer onto the presentation screen for the entire class (Figure 1). Because most classrooms today are equipped with computers and overhead projectors, and because university instructors are relatively adept with PowerPoint, this was an easy medium for material delivery.

Figure 1: Jeopardy Main Game Board

Further evaluation of the game concept identified that having a modified PowerPoint in the form of Jeopardy falls short in accomplishing a number of the outcomes identified as paramount to the project success. While it does create somewhat of a competitive atmosphere, the traditional game show was designed for a small number of competitors, generally three to four. In addition, the game provides players with hardware to actively engage them in the process and heightens the level of competition by developing a sense of urgency. This is done in a twofold manner. First the players are provided with a handheld control allowing them to buzz in if they think they know the answer. Second, once a player has buzzed in to answer, urgency to answer is increased by way of a countdown timer. Both of these facets improve the element of involvement both physically and mentally and increase awareness to the material presented.

The authors felt these two aspects of the game were highly critical. Not only providing the outcomes previously discussed, but also to maintain control of the pace of the game. Given the fact that all classes in which this will be utilized have a time limit, it is important for the instructor to control the pace of the game so they can deliver the amount of material they feel necessary. Providing the aspect of timed questions and answers was easy to accomplish. A countdown timer and corresponding music were incorporated into the PowerPoint. When a question was asked, the countdown timer starts and gives the students 30 seconds to answer the question. If no answer is given the game continues to the next question.

Hardware

Developing a solution to incorporate equipment mimicking the push button system proved somewhat problematic. There were a number of variables apparent in academic applications that prove non-existent within the context of the traditional Jeopardy format. The first, and most apparent issue, is the number of competitors within a classroom setting. In any given class there could be anywhere from ten to 100+ students. While there are marketed Jeopardy games that provide equipment allowing all students in the class to have engagement of every question, they are cost restrictive. Other types of equipment, such as student response systems, are relatively inexpensive to incorporate but don't provide the active engagement sought in the project concept. In addition, student response systems make the setup of teams and tracking of their progress throughout the game difficult.

Given the restrictive nature of the current marketed products, the authors chose to design and construct a custom push-button, lighted competition panel (Figure 2). Development of the panel incorporated the following considerations. First, it needed to be easily portable from one classroom to another and operate via battery power. This was accomplished utilizing small PVC plastic electronics boxes for the button and light housings, collectively fitting into an 18"x22" portable case (Figure 3). The entire system operates from two 6 volt lantern batteries. Second, the system needed to be expandable to allow for different class and team sizes. The authors wanted to be able to allow multiple team representatives the opportunity to actively participate at one time. The base system is expandable from one to four players per team, facilitated through wired connections utilizing phone jacks and CAT 5 wire (Figure 4). Finally, it needed to clearly identify which team buzzed in first along with the respective team

member that was first to buzz in. The development of this feature involved a lighted "team board" and lighted push-buttons for each player.

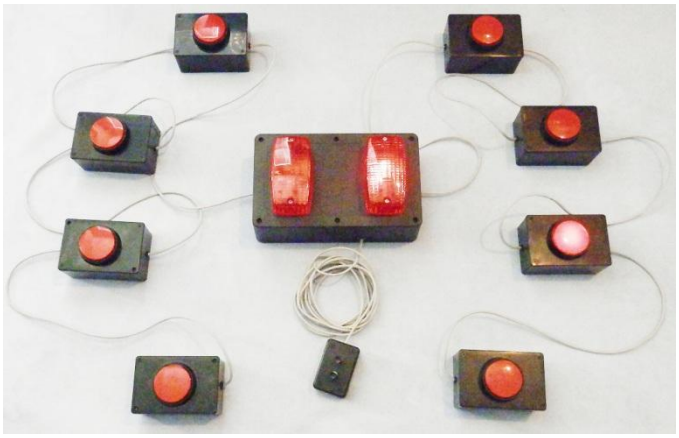

Figure 2: Lighted Push Button System

Figure 3: Push-Button in Carrying Case

Figure 4: Quick-Connect Setup

Design of the circuiting system was developed, providing a prioritized lockout feature which would provide the first response feature identifying the first player to buzz in. With specifications of the hardware clarified, a wiring diagram was completed, materials list developed, and assembly performed (Figure 5). Over the course of one weekend the system was able to be assembled and the first pilot study of the game show performed the following Monday.

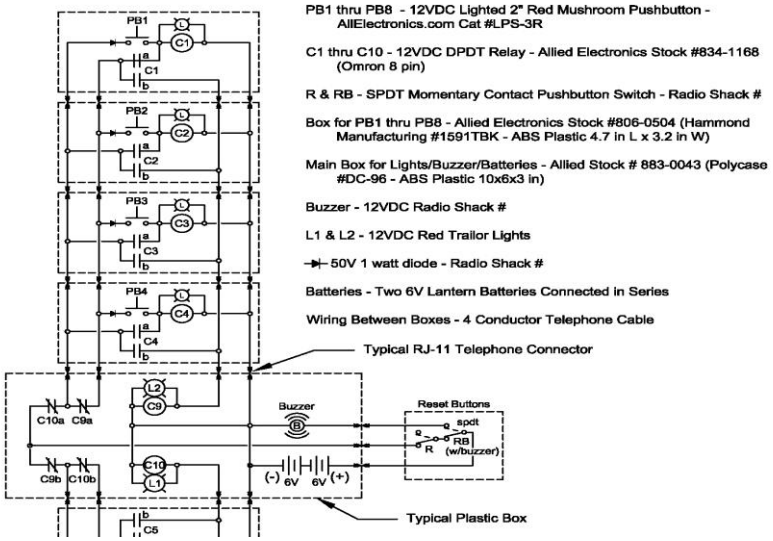

Figure 5: Push-Button Schematic & Material List

Pilot Study

Two building science classes, a Materials and Methods (hereinafter referred to as MM) and MEP class at Auburn University were used to conduct the pilot study for the concept. Upon seemingly positive feedback from the initial study performed on the MM class, a second study was performed on an MEP class, which was conducted by a different instructor. In contrast to the MM class, consisting of 66 students in a theater-style classroom, the MEP class had a total of 24 students in a smaller traditional-style classroom. As with the MM class study, the MEP class study utilized the game show as a test-preparation medium and offered test bonus points to the winning team. A second trial was subsequently performed on the MM class approximately one month after the original study. Once again the format was for a test preparation, providing the same bonus point incentive to the winning team.

Results and Conclusion

Upon completion of the three studies, a 15 question survey was administered to the students of both classes. The survey questions were formulated to provide initial feedback regarding effectiveness of the game show in the following areas.

Increase Attention to Material
Student Engagement in the Class
Requiring Physical Active Participation
Level of Participation
Preparation for Test
Sense of Competition

Importance of Game Aspects to Effectiveness
Creating Competition
Providing an Incentive
Level of Technology Used
Level of Active Participation
Push-Button Response System

A total of 88 students from the MM and MEP class participated in the two studies and of those students 75 responded to the survey. Results of the initial pilot study are encouraging. From a qualitative perspective, students overwhelmingly agree that interactive learning methods such as the game show concept presented, create more interest in the class. Further, it supports the interactive learning outcomes that the millennial student seeks in the classroom environment. With respect to the equipment felt needed for success of the game, the student feedback shows support of the push-button response system, with 95% either agreeing or strongly agreeing it heightened their interest and engagement in the class and the game. While these results are qualitative in nature, the results warrant further quantitative study into the learning outcomes hoped to achieve through this method. Will this method improve student grades? Is retention of material heightened, creating a more cognitive learning environment? Quantitative analyses of these and other questions will be the authors focus for upcoming publication.

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