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Literature Review: Effectiveness of Gaming in the Classroom

Karen A. Milczynski

Michigan State University

Introduction

The idea of using games to engage students in the process of active learning is not new. Over the past several years, educators have been increasingly incorporating various games into their teaching curriculum in an effort to create a fun and engaging learning environment for students. Although this can be very challenging and time consuming, interactive, collaborative and competitive games tend to motivate and encourage student participation in the learning process. Over the years, the format for classroom games has changed drastically. There are many more options that incorporate the use of technology and interactivity. Quinn and Iverson argued that students “need to be engaged more and to be put at the centre of the learning experience to change from ‘passive vessel’ to ‘active participant’” (as cited in Pannesse & Carlesi, 2007). In my classroom, I have conducted several games with my students as a means to review previously taught material and to prepare for tests. I have noticed that most of my students tend to enjoy hands-on activities in my courses; however, I wonder sometimes when we play games or do activities if they are grasping the content of the material in the process. Some students appear to learn more when they are competing in a game or activity while others seem like they are bored or possibly distracted. As a whole, the feedback I have received from students regarding the benefits of the review games we play has been positive and many students suggest that we play them more often. Although I try to listen to my students’ feedback, I am reluctant to play review games more often because I have yet to document quantitative evidence that supports the effectiveness of the review games we play.

For my research, I am seeking learn more about the effectiveness of the different test review methods I employ in my 12th grade Independent Living classes. Additionally, in a

more general approach I am seeking information that supports the question: What makes an educational game effective in the classroom? “Nearly seventy percent of students learn best actively and visually” (McLester, 2005). Because of this, I feel that there are many potential benefits of active learning through games in the classroom.

Perspectives

There are many explanations as to what defines an “educational game” nowadays. While some games are competitive in nature, others may simply allow students to work together as a class to solve a general problem where no one “wins” or “loses.” In “All Play and No Work,” MacKenty (2006) states that, “it’s the act of problem solving that makes games so engaging... devoid of challenge or risk of failure, games really aren’t all that much fun” (p. 46). On the contrary, Tom Schrand (2008) discusses the powerful capabilities of interactive multimedia games (or activities) where students work together as a class to categorize information in charts by moving facts so they rest in the appropriate labeled columns (p.81). Revisiting these types of games and activities can help with reiterating important information for students. Schaller (2006) states that iteration, or repetition of the process, is critical to “support the learning process by encouraging experimentation, hypothesis testing and synthesis” which are all higher level thinking skills.

Both formats of gaming activities tend to show learning benefits because of the active learning components that are present in each (MacKenty, 2006, Schrand, 2008). Games that bring out these higher level thinking skills are becoming more popular, although more research and scientific assessment is necessary to measure their overall effectiveness since they are still relatively new.

Regardless of the format of the game, students can simultaneously build their problem solving skills while having fun throughout the process if an instructional game is well-designed (MacKenty, 2006, Harris, 2009). Throughout my research, I discovered that there are many gaming formats that educators can choose from. There are many factors to consider including: 1) which game best integrates into the existing curriculum, (Harris, 2006, p.26) 2) which game meets the objectives of the topics being taught, (MacKenty, 2006, p.48) and 3) what are the instructor's personal beliefs on teaching pedagogy (Van De Bogart, 2009). Depending on the type of game that is played, there are clear benefits to supplementing games as active learning components in the classroom. According to Franklin, Peat & Lewis (2003), when students work cooperatively on a gaming activity, "games foster group cooperation and typically create a high level of student involvement that makes them useful tools for effective teaching" (p. 82).

Of course, these positive approaches to educational games are not left uncontested by educators and scholars alike. In "This Is Jeopardy!," Audrey Amrein-Beardsley states that, "Methods of gaming tests, (may) result in spurious test score gains unrelated to true gains in student learning" (p. 14). She explains that many teachers are simply "teaching to the test" with games and this causes students to "become experts at answering (the) test questions without entirely understanding the concepts justifying their answers" (p.16). Furthermore, she argues that, "These practices are replacing critical modes of instruction and inquiry-based, higher order, problem-solving activities and lesson we know increase genuine levels of learning" (p.16). Another argument that is made against educational games comes from Okan (2003) in "Edutainment: Is Learning at Risk?" Okan states that edutainment, "involves active pedagogy and (this) totally depends on an obsessive insistence that learning is inevitably 'fun'" (p. 255). This article questions whether or not learning should always have to be "fun." One argument that

is made to support how this could be negative because, "...meaningful learning may sometimes be difficult and requires cognitive and emotional effort... especially in the light of the fact that post-secondary education is not usually a fun undertaking" (p. 258). Finally, one last concern regarding educational games comes from a recent case study that focused on teachers adopting educational computer games. Kebritchi (2010) poses the concern that games are becoming such innovative learning tools that teachers may conclude that they don't need to lecture, and instead they may "rely on the game and use it as a teaching replacement and not as a supplement" (p. 263). It is important to remember that games are supplement teaching tools and teachers ultimately need to be actively involved for them to be truly effective.

Pedagogy

There are a variety of teaching methods that coincide with an active learning pedagogy. To understand what encompasses active learning, it's important to realize that it can be defined in many ways. One way active learning can be defined is, "an effort to make learning authentic," (Van De Bogart, 2009). Additionally, it "refers to techniques where students do more than simply listen to a lecture. Students are doing something including discovering, processing and applying new information" (Van De Bogart, 2009).

Aside from previously mentioned non-competitive interactive multimedia activities, active learning can also include interactive simulation games which may or may not be computer based. Although some may think board games are outdated with the advent of new technologies, in "Meet the New School Board," Harris (2009) speaks of new and emerging simulation style "designer board games" (p. 25). These board games are typically aligned by theme or mechanics (p. 25.) Themed games tend to introduce contextual information and serve as an

anchor for future learning. These appear as though they would work best as an introductory game for a unit as they introduce vocabulary, ideas and concepts. Mechanical games require players to “apply their knowledge to determine the path they will follow” (p. 25). For example, Pandemic is a game based on mechanics that allows students to simulate a situation where they are members of the Centers for Disease Control on a mission to save the world from an outbreak of deadly diseases (p. 24). Students must apply knowledge previously learned in class to successfully complete their mission. These types of complex board games meet various performance indicators of the American Association of School Librarians (AASL) Standards for the 21st Century Learner (Harris, 2009, p. 24-25). Students apply strategy and critical thinking skills to “engage in an inquiry based research processes” by analyzing, synthesizing, evaluating, and organizing information to construct new understandings, draw conclusions and create new knowledge (p. 24). Additionally, students “participate and collaborate as members of a social and intellectual network of learners” where learning takes place authentically instead of through a worksheet or conventional lesson plan (p. 25).

Aside from board games, one game that is commonly known because of the television show that many teachers play with their students is “Jeopardy!” While this can be a very fun and engaging game it can pose many challenges for students with learning disabilities. Rotter (2004) asks, “If a pupil didn’t already study and learn the information, is there any way to get the answer during the game?” (p. 58). This can create a problem for students with special needs because they may, “be embarrassed by their lack of knowledge or may choose to zone out or misbehave to avoid a potentially embarrassing situation,” which can also lead to decreased motivation to succeed (p. 58).

Another issue is that the game doesn't necessarily engage every student throughout the game - instead students take turns (p. 58). This can pose an even larger problem if students "perceive the game as being unimportant 'play time'" (p. 59). To address these concerns head on, Rotter (2004) suggests that teachers, "teach students to prepare their notes for the "Jeopardy!" game" ahead of time (p. 59). This "encourages students to become actively involved in lectures, to clarify information, and to increase test performance" (p.59). Additionally, Rotter (2004) suggests several other pre-game preparations. One way is by encouraging the "student to predict questions that will be asked on the test" and then providing the teams whose questions are chosen with bonus points on the game (p. 59). I think the motivations for students to study and prepare outside of the classroom in this instance are very positive and great for additional reinforcement.

Finally, to address the issue of lagging student participation when one student is answering the question, teachers can "ask all student to bring their prepared notes to class on the day of the game" and then "instruct all pupils to add or highlight the answers to questions as part of the game" (p. 60). Although Rotter (2004) does not mention how to incorporate that into scoring for the game, I think it would be beneficial to give additional points for students with key terms highlighted or something of that nature as incentive.

Aside from "Jeopardy!", there are several other television games shows that Rhodes (2002) suggests can be easily adapted for classroom review. These include, "Family Feud," "Pyramid," "Wheel of Fortune," "Millionaire," and "Deal or No Deal." While "Jeopardy!" appears to be the most commonly played television based game, adding variety with these other games could add excitement and motivation to the classroom.

Considering the competitive nature of these games and the joined approach of team play and individualistic responses, I believe that these competitive games would be most successful with the aforementioned pre-game preparations.

Assessment

Marzano (2010) explains that of the 60 studies he has been involved in regarding the effects of games on student achievement, “on average, using academic games in the classroom is associated with a 20 percentile point gain in student achievement” (p. 71). Although quantitative evidence is quite scarce regarding the use of board games and television based review games, there is evidence that shows positive results from computer based games and other cooperative learning techniques, such as the Team-Games-Tournament (TGT) method and the knowledge net framework.

In the technological realm, there are many computer based games that provide active learning opportunities and reinforce topics learned in the classroom. One important aspect for educators to consider when employing these games is the way in which they arrange for students to interact with the computer based game and with their peers. Will they work independently and individually compete against the computer? Or will the competition extend outward into the classroom to promote cooperative learning? Ke and Grabowski (2007) conducted a case study where one hundred twenty five fifth graders participated in a cooperative Team-Games-Tournament (TGT) (p. 249). The TGT has three basic elements. Students are assigned to “three-member teams randomized on equivalent achievement levels whose membership remains intact throughout the cooperative learning process” (p. 251). Games consist of “skill exercises (which are) played during weekly tournaments” (p. 251). Students compete individually against other

students and their winnings are brought back to their teams. (p. 251). This cooperative technique has been widely investigated and “research indicates that TGT enhances students’ academic achievement and attitudes towards the subject matter” (p.251). These cooperative learning gaming methods tend to be successful because they “provide both group rewards and individual accountability” (p. 256). In their case study, Ke and Grabowski (2007) compared pre-test and post-test results of three groups of students. The first group competed using the TGT format (cooperative gameplay.) The second group of students worked independently as they competed individually with the computer and their scores were posted weekly to compare their results with their peers (competitive gameplay.) The third group participated in paper/pencil review sessions and did not play the games at all (control.) Results showed that there “was no significance for maths performance between cooperative gameplaying and competitive gameplaying but both performed significantly higher than the control group” (p. 255).

Another teaching methodology that incorporates active and cooperative learning pedagogies is the knowledge net framework (Williamson, Lee, Butler, Ndahi, 2004, p.18). A sampling of this method was applied to a group of fifth grade students using the rules of baseball. Students were divided into two teams where they were allowed to choose the teams and questions were provided beforehand. For the game, each student takes a turn “at bat” to score a “hit” by answering the question correctly. Players advance one base at a time. As in baseball, if a student gets a question wrong, he/she is “out” and after three outs, the other team takes a turn “batting” (p. 18). Although no formal assessments have been conducted for this gaming method, “...student achievement in science at the test school showed dramatic gains between 2002 and 2003” (p.18). In addition, “Observations suggest that (the game) creates positive social identification that fosters self-categorization in ways that regulate and motive the learning of

science in meaningful ways” (p. 18). Williamson, Lee, Butler, and Ndahi admit that, “Although it is certainly difficult to claim that all the gains have been the result of this single intervention, the results offer some encouraging insight” (p. 18).

Conclusion

After conducting the literature review research, I now have a greater understanding of the benefits and constraints of games in the classroom. I have always wondered, “What makes an effective gaming experience?” and the articles I explored provided excellent insight regarding that question.

I concluded that my current methods of incorporating games in my classroom should be altered to make them more effective, and the ideas provided throughout these articles have given me an idea of where to start with changes. I particularly like the knowledge net framework method because of how it involves every student yet a team approach is still encompassed. I also like how it supports the need to prepare outside of the classroom through studying and completing review questions beforehand. The TGT method is also very intriguing to me because it provides rewards yet still holds students accountable. I think this method would require significantly more class time to prepare and conduct when compared to other review game methods since it works best with an existing computer based game which would require access to a class set of computers multiple times each week.

Based on the studies I’ve researched, I would likely change my research question to examine the effectiveness of a television based game (such as “Jeopardy!”) or a knowledge net framework game (such as baseball) where the control group partakes in the same review information without any gaming format (i.e. worksheets or study guides.) Both classes would

take a pre-test, post-test, and student interest survey and results would be assessed through comparison of test scores and survey responses. I feel it would be important to conduct these games over the course of two separate semesters with 2-3 Independent Living courses each to truly gain enough evidence for comparative results.

References

Amrein-Beardsley, A. (2009). "This is Jeopardy!". *Education Digest*, 74, 14-18.

Summary: This article discusses standardized testing and test preparation methods. There is a focus on "teaching to the test" as well as the impacts of No Child Left Behind. In addition, there is mention of teacher accountability and the importance of higher order problem solving skills.

Franklin, S., Peat, M., & Lewis, A. (2003). Nontraditional interventions to stimulate discussion: the use of games and puzzles. *Journal of Biological Education*, 37, 79-84.

Summary: This article outlines the usefulness of interactive learning materials such as crossword puzzles and discussion games (activities.) Student attitudes were mixed

towards the crossword puzzles which were supplemental for vocabulary mostly. The discussion games were more activity based and students found them beneficial because they were engaging and promoted interactivity amongst peers.

Harris, C. (2009). Meet the New School Board: Board games are back – and they’re exactly what your curriculum needs. *School Library Journal*, 55, 24-26.

Summary: Harris introduces the new generation of educational board games (“designer board games”) and explains how they promote critical thinking skills through inquiry-based research processes. The article shows how these skills match the performance indicators for the 21st Century Learner presented by the American Association of School Librarians.

Ke, F., & Grabowski, B. (2007). Gameplay for maths learning: cooperative or not?. *British Journal of Educational Technology*, 37, 249-259.

Summary: This study investigated the effects of gameplaying on fifth grade math students. Their performance and attitudes on gameplay vs. traditional math exercises were evaluated. A cooperative Team-Games Tournament was conducted where interpersonal competition and no gameplaying conditions were compared.

Kebritchi, M. (2010). Factors affecting teachers’ adoption of educational computer games: A case study. *British Journal of Educational Technology*, 41, 256-270.

Summary: This article examines factors that affect teachers’ adoption of modern educational computer games in the classroom. It further explores the supplemental role that games play when guided by effective teaching.

MacKenty, B. (2006). All Play and No Work. *School Library Journal*, 52, 46-48.

Summary: MacKenty explores COTS (commercial, off the shelf) games and their effectiveness in the classroom. He presents several guidelines to look for when seeking out well designed COTS games.

Marzano, R. J. (2010). Using Games to Enhance Student Achievement. *Meeting Students Where They Are*, 67, 71-72.

Summary: This article presents an overview describing the benefits of games in the classroom. It then goes on to further explain what teachers can do to be sure their games are designed effectively to get the greatest results with students.

McLester, S. (2005). Game Plan. *Technology and Learning*, 26(3), 18-20, 22, 24, 26.

Summary: The need to incorporate games in our classrooms is presented here because of the frequency in which major companies and the U.S. military presently train individuals in the workforce. The article explores the history of early gaming in the 1980s and presents the ever growing trends that younger generations are more comfortable with games because they have grown up with them as “digital natives.”

Okan, Z. (2003). Edutainment: is learning at risk?. *British Journal of Educational Technology*, 34, 255-264.

Summary: Edutainment is presented as a potentially problematic way of looking at educational materials being presented as entertainment. This article questions whether or not education needs to always be “fun” and how that may even prove to be a negative

thing if students begin to assume that studying and hard work outside the classroom is not necessary.

Pannese, L. & Carlesi, M. (2007). Games and learning come together to maximize effectiveness: The challenge of bridging the gap. *British Journal of Educational Technology*, 38(3), 438-454.

Summary: This case study examines the training sessions of business professionals and university student groups in northern Italy to analyze how the learners perceive instructional games in terms of effectiveness, engagement, pleasure, usability, and freedom of behavior.

Rhodes, M. (2002). Beyond “Jeopardy!”: Five review games: test prep and review. *Instructor*, 116 (4), 50.

Summary: This article recommends several review game methods based on TV game shows. Many teachers are familiar with how to incorporate the game “Jeopardy!” into their curriculum. This article examines similar ways to incorporate other well-known games shows to involved students in active learning during test reviews.

Rotter, K. (2004). Modifying “Jeopardy!” Games to Benefit All Students, *Teaching Exceptional Children*, 36, 58-62.

Summary: This article presents the need to alter review games (such as “Jeopardy!”) to accommodate for students with learning disabilities. Rotter explains why this is necessary and points out certain weaknesses that learning games neglect to address for students with special needs. Additionally, she gives suggestions as to how a teacher can provide a more beneficial gaming experience through pre-game preparation and other supplemental teaching/review methods.

Schaller, D. (2006). What Makes A Learning Game? Retrieved from <http://www.eduweb.com/schaller-games.pdf>

Summary: The four key characteristics of an effective learning game are provided along with explanation of the role each characteristic plays. Additional aspects of an effective game are provided, including iteration and reflection.

Schrand, T. (2008). Tapping into Active Intelligences with Interactive Multimedia: A Low-threshold Classroom Approach. *Collegiate Teaching*, 56, 78-84.

Summary: Schrand encourages educators to go beyond PowerPoint presentations and incorporate interactive multimedia activities in the classroom. He explains how simplistic it can be to create reusable templates to accomplish this and he provides examples as to how he has specifically experimented with this in his teachings.

Williamson, K. M., Land, L., Butler, B., & Ndahi, H. B. (2004). A structured framework for using games to teach mathematics and science in K-12 classrooms. *The Technology Teacher*, 64, 15-18.

Summary: This study explores how kids have a general interest in games and how it can be valuable to link this motivation with games in the classroom to increase student achievement. The knowledge net framework is introduced as a means to encourage students to study and prepare assignments outside of the classroom so that they can be competitive when playing the review game against their peers. Cooperative learning

techniques are addressed as well as the social benefits of this gaming method.

Van De Bogart, W. (2009). Developing a Pedagogy for Active Learning (PAL) Part I. Retrieved from http://www.earthportals.com/Portal_Messenger/ActiveLearning.html

Summary: Active learning is presented as a teaching pedagogy. The article specifically compares teacher based and student based active learning scenarios. The main goals and overall purpose of active learning is outlined and example scenarios are presented.