Bowling Green State University

ScholarWorks@BGSU

Visual Communication and Technology Education Faculty Publications

Visual Communication Technology

5-31-2014

Automated Hints on Quizzes: An Approach to Combined Learning and Evaluation

Jerry Schnepp
Bowling Green State University, schnepp@bgsu.edu

Christian Rogers
Indiana University - Purdue University Indianapolis

Follow this and additional works at: https://scholarworks.bgsu.edu/vcte_pub

Part of the Education Commons

Repository Citation

Automated Hints on Quizzes:
An Approach to Combined Learning and Evaluation

Introduction

Most current college students belong to the millennial generation - the first to grow up with computers in their homes and convenient Internet access (Smola and Sutton, 2002). These students have a depth and duration of experience with technology that differs vastly from previous generations. Consequently, their workflow is different. Millennials are accustomed to conducting multiple tasks simultaneously with the support of technology (Blackburn et. al. 2013). Regardless of generation, the ubiquitous incorporation of computer technology is pervasive across most industries. In fact, few jobs require that employees store all important knowledge "in their heads". Instead, they use computers and mobile devices to supplement expertise. While the acceptance of, and reliance on, technology spans generations, it is especially emblematic of Millennials.

Educators have responded to this paradigm shift by incorporating multiple modalities into curricula. Instead of traditional lectures, flipped classrooms (Mull, 2012) and gamification (Apostol et. al. 2013) are commonly used to accommodate students who have become accustomed to a different style of learning. Students respond well to these approaches as evidenced by studies conducted by Enfield (2013) and Strayer (2012). Teachers are developing new ways to engage Millennials in the spirit of Ignacio Estrada, who famously said: "If a child can't learn the way we teach, maybe we should teach the way they learn."

While classroom instruction and assignments undergo a technological renaissance, little has changed regarding quizzes and exams. Should the assessment of these students follow the same structure as those of previous generations? Harris and Hodges define assessment as "the act or process of gathering data to better understand the strengths and weaknesses of student learning" (1995). Since students are exposed to different ways of learning, modern educators should adjust their evaluative approach as well as their instructional approach. Rawson and Dunlowski (2012) further suggest that the act of testing is more than a means to evaluate learning. Testing can be used to improve learning, specifically when students are provided feedback.

This paper describes and evaluates a novel approach to student assessment. It introduces an online quiz system called Point Barter that allows students to sacrifice partial credit in exchange for hints about the correct answer (Schnepp, 2013). The purpose of this approach is to present students with alternate strategies to earn quiz points. In this way, students are engaged in the quiz similarly to the way they engage in strategic video games. Our goal in this line of inquiry is to identify a combined learning and evaluative activity that will lead to more effective knowledge acquisition.

The Point Barter System

Point Barter is an online quiz system that allows students to trade points for hints. For each question, the student has the option to barter a pre-determined point value. If the student does not know the correct answer and chooses to barter, points are automatically deducted from the overall point value of the question and the hint is displayed. Each question can have multiple hints. After the bartering transaction, the student answers the question. If answered correctly, the student is awarded the remaining points.

This interactive testing activity engages students using a game-based format for assessment that provides continual feedback as the student participates. Students can gain insight on the subject while also being evaluated on that knowledge.

The exchange of resources - points for hints - is familiar to Millennials, as it is the basis for many strategy games such as *The Legend of Zelda* (Nintendo, 1986) and *Call of Duty* (Activision, 2003). It is common in game play for a character to trade currency (points, coins, etc.) for weapons, powers, or even clues to advance their mission. Success in such games is achieved through careful compromises and an exploration of options. In games, there is *always* a way to achieve success, and usually there are multiple ways to that accomplish that goal.

Point Barter incorporates game-like features because it affords students the option to trade something of value - quiz points - for information that leads to the achievement of a goal - a correct answer. More importantly, it reinforces that there are multiple paths to success. A testing system that allows students to draw on outside information promotes ingenuity and strategy instead of simple rote memorization.

Preparedness, reciprocation, and compromise are important to real life goal achieving. Consider the analogy of a construction contractor. When hired to complete a project, the contractor may have the capability to finish the job and receive full pay. However, if he unexpectedly finds that he lacks important resources, he must hire subcontractors. This arrangement is a compromise because, instead of keeping the entire payout for himself, the contractor pays the subcontractors a percentage. Still, this compromise is beneficial because the builder turns a profit, however smaller than if he had been fully prepared. Point bartering is similar in that students receive reduced points in exchange for each hint given. Sacrificing a small point value may actually lead to more points earned for a correct answer.

Literature Review

Students belonging to the millennial generation pose unique challenges to educators. Because they were raised with consistent access to the Internet, millennial students tend to receive and interpret information differently than members of generation X or the baby boomer generation (Gorman et al., 2004, Howe and Strauss, 2003). They are used to accessing information quickly and readily in a just-in-time fashion. Because of the usual

way information is displayed on the Internet, Millennials expect to acquire information in small chunks and to have the option to customize multiple aspects of their experience (Tapscott, 1998).

Access to Technology

In 2002, the Pew Internet and American Life Project reported, "the Internet is part of college students' daily routine, in part because they have grown up with computers" (Jones, 2002). As of September 2009, 93% of young adults between the ages of 18 and 29 used the Internet, as compared to 81% of adults between the ages of 30 and 49 (Lenhart, et al., 2010). Young adults are also more likely to own a cell phone and to use social media like Facebook and Twitter. Students from this age group have had access to technology throughout childhood, growing up with personal computers, and consequently relying heavily on them for productive work. They are confident in their abilities to use technology and find information on the World Wide Web. In fact, an Online Computer Library Center white paper found that found that 80 percent of undergraduates use web search engines for all or most assignments, while only half used the library's subscription-based resources (OCLC, 2002). Brown et al. (2003) suggest that students are often overconfident because they equate their technology savvy with information literacy.

Informational Exchange

Access to technology has affected how students send and receive information. For previous generations, television and newspapers were the primary sources of news. As social media outlets increase in popularity, young adults now seek information in smaller chunks. Millennial students tend not to read newspapers. They are more likely to learn about breaking news from social media sources "just as it is happening" (Sweeney, 2006). Using social media sources like Facebook and Twitter Millennials can aggregate information in real time from multiple individuals. Information is provided with very few characters, requiring readers to piece together these chunks as if putting together a puzzle.

Personalization

Sweeney (2006) found that millennial students expect products and services to have as much personalization and customization as possible to meet their evolving needs, interests and tastes. Millennial students are often accused of self-absorption, expecting special treatment (Howe and Strauss, 2003). As a result, these students value the option to choose their preferences, both in interface and workflow.

The Prevalence of Gaming

Gaming has been a common platform for entertainment and education for many years (Gros, 2007, Prensky, 2001). In *Got Game-How the Gamer Generation is Reshaping Business Forever*, John Beck and Mitchel Wade reported the results from a large-scale survey on the impact of video games. The results showed that workers ages 34 years and younger have had substantial game experience as they have grown up. In the early

1980's, Atari sold over three million game units in a year. The following generation saw Game Boy Color sell six million units in three months in the 1990's. Beck (2004) posits that gaming offers everyone to be the star of the show. In games, there is always an answer and always multiple opportunities to explore options through trial and error.

According to Squire (2005) games create experiences in which learners are immersed in situations where they must use tools and resources for complex problem solving. Learning from games can engage students in an entirely different way than traditional learning. The experience of problem solving is the most important aspect of the game.

Educators have responded to the "gamer generation" by developing curricula that incorporates games into class content. Game-based learning can motivate students to actively participate (Garris et al., 2002)**.**

While research has been conducted on game-based learning, very little has been done to evaluate games as a part of the assessment process. Wang (2008) developed one such system for assessment named GAM-WATA, based on quiz and multiple-choice questions. The uniqueness of its design is an approach based on 'Ask-Hint Strategy' that can help to empower students by providing immediate online hints about the correct answer.

Methodology

We developed Point Barter (Schnepp, 2013) specifically to evaluate how students would use an online testing system that incorporates an automated hints-for-points feature. To assess the usability of the system, we conducted a pilot study in December 2013 with 22 university students in a video production course. Students completed the exam in a computer lab and had the option to use the Point Barter system or the OnCourse learning management system that is the primary testing environment of the university. The format of the questions was either multiple choice, true/ false, fill in the blank, or essay. Each student who used Point Barter viewed each question individually. When presented with a question the student had the option to answer directly or use the barter option. If a student chose to barter, the specified point value was subtracted from the question's total point value and the hint was displayed. Students could barter multiple times - up to four, depending on the question.

Upon completion of the exam, participants completed a short questionnaire about their experience with the point barter feature. The results of this questionnaire appear in (Rogers and Schnepp, 2014)

Results

The purpose of this pilot study was to gauge the overall usability of the point barter system and its perceived value and usefulness. Of the 22 students who were offered the option, all but one chose to use Point Barter instead of the university's learning management system. Eighteen of the 21 used the barter feature. Qualitative responses were mostly positive. Comments such as "I thought the system worked well and was not at all hard to use." and "I liked this system" indicate that participants found the Point Barter easy to understand and intuitive. One participant mentioned the value of point bartering, correlating it to real-world knowledge acquisition. Other comments include the following:

> "I think this system is a good idea. It still encourages students to study in case the hint does not help them. I think this system uses a fair exchange."

> "The point bartering system creates an interesting dynamic that allows one to trust their instincts or go with concrete advice. The tricky part is knowing if the advice will help. I like that I have the option to chose between these options."

> "I liked this system a lot because sometimes you may know about the subject and just not understand the question or need a quick hint to spark the rest of the information."

> "It is new and different type of exam taking using the hint system. Overall, I liked it. "

Discussion

This pilot study was relatively small. Its main purpose was to evaluate the usability and functionality of the Point Barter web application. From a technical standpoint, the study validated that the software functions as intended. For the student, it displays questions, accepts answers, and presents hints when the barter feature is activated. For the instructor, it stores student answers and barter choices. The pilot also validated the application's usability, to the extent that all participants understood the barter feature and were able to complete the exam.

Eighty six percent of participants used the barter feature to trade points for hints. We surmise that this high usage rate indicates a perceived value of the barter feature. As this was their first exposure to Point Barter, It is also possible that students tried the feature because of its novelty. Conversely, some students may have abstained from using the barter feature because the fear of losing points outweighed the prospect of arriving at the correct answer.

Interestingly, 70% of the time when participants bartered, they arrived at the correct

answer. While it is unknowable whether these students would have determined the correct answer without bartering, it is reasonable to assume that in at least some cases, the hint led to a correct answer to a question that would have otherwise been answered incorrectly.

Conclusions

While the size of this study facilitated a reasonable technical evaluation, it was not large enough to glean deep insight into the way students might use this application in the long-term. However, small-scale experiments such as this are important stepping-stones toward large-scale innovation. Having validated the functionality of Point Barter, we can now turn to the more profound questions of its utility and effectiveness both in terms of assessment and pedagogy.

The successful use of point bartering involves evaluation, deliberation, and prudence. By using the barter feature, the student has decided that instead of answering incorrectly, he will improve his score by choosing an alternate path. Some may criticize this approach as a lazy compromise. Others will approve of it as an important life skill. Considering that most modern industry workflows rely heavily on external resources, perhaps the flexibility ingrained in this approach is particularly valuable.

Rawson and Dunlosky (2012) found evidence that students learn important associations during the testing process. These associations bridge the gap between familiar and new information, strengthening ties between keywords and newly learned information. Hence, an ancillary benefit of point bartering is that the student intrinsically learns while taking the exam. The hints that lead to the correct answer reinforce the student's understanding in such a way that the Point Barter system may be more useful in formative assessments than summative.

Of course, the way students will use Point Barter is highly dependent on the difficulty of the question, the usefulness of the hints, and the point value of the hints. This ambiguity makes an objective evaluation of the system difficult.

Educators should not ignore the profound effect technology has had on modern students. Testing environments should adapt to the way students learn, process, and use information. Traditional testing techniques are certainly valuable. However, explorations of new methods may lead to yet unidentified potential. The integration of automated hints is a step toward intelligent adaptive learning. The enriched testing experience allows students to explore multiple avenues to arrive at an answer. In this way, evaluation and learning can be combined into an experiential and dynamic activity.

Further Research

We are currently conducting a follow-up study that spans a semester with two sections of the same course. Both sections receive the same instruction, activities, and

homework assignments. However, one section uses Point Barter for tests and quizzes while the other uses the standard online testing system. Both sections will use the standard system for the final exam. Comparing final exam scores of the two sections may provide insight into the long-term learning potential of testing with Point Barter.

Moving forward, we plan to use and evaluate Point Barter in the context of different academic disciplines. Of particular interest are highly technical subjects such as mathematics and computer science, where test answers are very specific. Exams in these subjects often require that students use complex formulas and algorithms. In these instances, we anticipate that students will find bartered hints particularly useful.

Finally, we plan to evaluate this testing system with members of other generations. This line of inquiry can validate our assumption that using Point Barter for assessments is especially suited for millennial students.

Works Cited

Activision. (2003), Call of Duty [Brand Name video game]. California: Activision.

Apostol, S., Zaharescu, L., & Alexe, I. (2013), Gamification of Learning and Educational Games. *Elearning & Software For Education*, (2), 67-72. doi:10.12753/2066-026X-13-118

Blackburn, K., LeFebvre, L., & Richardson, E. (2013), Technological Task Interruptions in the Classroom. *Florida Communication Journal*, *41*(2), 107-116.

Brown, C., Murphy, T.J. and Nanny, M. (2003), "Turning techno-savvy into info-savvy: authentically integrating information literacy into the college curriculum", Journal of Academic Librarianship, Vol. 29 No. 6, pp. 386-98.

Enfield, J. (2013), Looking at the Impact of the Flipped Classroom Model of Instruction on Undergraduate Multimedia Students at CSUN. *Techtrends: Linking Research & Practice To Improve Learning*, *57*(6), 14-27. doi:10.1007/s11528-013-0698-1

Garris, R., Ahlers, R., & Driskell, J. E. (2002). Games, motivation, and learning: A research and practice model. Simulation & gaming, 33(4), 441-467.

Gorman, P., Nelson, T., & Glassman, A. (2004), The Millennial generation: A strategic opportunity. Organizational Analysis, 12(3), 255–270.

Gros, B. (2007), Digital Games in Education: The Design of Games-Based Learning Environments. Journal of Research on Technology in Education, 40(1).

Harris, T. L., Hodges, R. E., & International Reading Association. (1995), The literacy dictionary: The vocabulary of reading and writing. Newark, Del: International Reading

Association.

Howe, N., & Strauss, W. (2003), Millennials go to college: Strategies for a new generation on campus: Recruiting and admissions, campus life, and the classroom. Washington, DC: AACRAO.

Jones, S. (2002), The Internet Goes to College. Pew Internet and American Life Project.

Lenhart, A., Purcell, K., Smith, A., & Zickuhr, K. (2010), Social Media & Mobile Internet Use among Teens and Young Adults. Millennials. Pew Internet & American Life Project.

Mull, B. (2012, March 29), Flipped learning: A response to five common criticisms. November Learning. http://novemberlearning.com/resources/articles/flippedlearning-a-response-to-five-common-criticismsarticle.

Nintendo. (1986), The Legend of Zelda [Brand Name video game]. Japan: Nintendo.

OCLC (2002), "OCLC white paper on the information habits of college students: how academic librarians can influence students' web-based information choices", available at: www.oclc.org/research/announcements/2002-06-24.htm.

Prensky, M. (2001), Digital game based learning, New York: McGraw Hill Press.

Rawson, K.A., & Dunlosky, J. (2012), When is practice testing most effective for improving the durability and efficiency of student learning? Educational Psychology Review, 24, 419-435.

Rogers, C. & Schnepp, J. (2014), Students Perceptions of an Alternative Testing Method: Hints as an Option for Exam Questions. Manuscript submitted for publication.

Schnepp, J. (2013), US Patent No. 61,862,126. Washington, DC: U.S. Patent and Trademark Office.

Smola, K. W., & Sutton, C. D. (2002), Generational differences: Revisiting generational work values for the new millennium.Journal of Organizational Behavior, 23, 363–382

Squire, K. (2005), Game-based learning: Present and future state of the field. Madison, WI: University of Wisconsin-Madison Press.

Strayer, J. (2012), How learning in an inverted classroom influences cooperation, innovation and task orientation. *Learning Environments Research*,*15*(2), 171-193. doi:10.1007/s10984-012-9108-4

Tapscott, D. (1998), Growing up digital: The rise of the net generation. New York: McGraw-Hill.

Wickelgren, W. A. (1981), Human Learning and Memory.