Learning Information Literacy Through an Adventure Video Game

Elaine Reeder

University of North Texas

December 6, 2016

Abstract

This paper outlines the motivation, process, and creation of an adventure video game to teach library information literacy as well as define the process of producing an alpha version of the game. The target audience for the instructional game is fifth-grade students, ten to eleven years old. The library contains more than just books; it is an excellent source of a wide variety of materials that young adults can utilize for school work or pleasure. Students will need to understand how to access, organize, and manage information to build a foundation for future research, which is important to lifelong learning. Information literacy is also about finding resources, critically evaluating, and presenting those resources. The developers of the adventure video game, *Gremlins in the Library: A Library Literacy Mystery* attempted to make learning information literacy more fun to help fifth graders grasp concepts quicker by using multimedia elements. It is the hope of the researchers that the students will enjoy playing the game, thereby spending more time on the skills required to be library literate and eventually retain, at least, the most pertinent information needed to have a cursory working knowledge of the library. This foundation knowledge can be built upon in future grade levels using more sophisticated games. Although the game design and development was part of this initial phase, it is the hope of the researchers to extend the project into a research phase where a study can be conducted to determine if an adventure video game can be successfully added to a library information literacy program for fifth graders with a positive outcome of a better appreciation for the library as well as better retention of information literacy terms and techniques.

Keywords: adventure games, information literacy, k-6 grade, gaming

Learning Information Literacy Through an Adventure Video Game

The idea that education can be fun taking the form of a computer game has not been embraced by everyone in the academic community. Technology is continually transforming the way we teach, and converting instruction to incorporate technology has taken many people in education by surprise revealing both optimists and skeptics (Campbell, 2001). We have come to expect learning to happen in a classroom with rows of desks facing the front of the room, conveying that the teacher talks or demonstrates and the student listens or observes (Chism, 2006). Teachers are now faced with the challenge of engaging students who are immersed in the information age. Students born after 2000 have grown up with technology and have different expectations for learning. Barrett (2010) contended teachers need to realize that they are dealing with a new generation of student and they have to captivate, entertain, and stimulate this student to keep their attention. *The Gremlins in the Library*: *A Library Literacy Mystery* adventure game is an attempt to engage students in a more interactive learning experience and to reach the next generation student with a technology they are familiar with. The use of a game was meant to capture the attention of the audience and make an effort to relate the material to the student's current environment.

The idea was to involve fifth graders in a scavenger hunt type mystery adventure with the ultimate goal of teaching library information literacy skills. The developers felt that a game format would make the subject matter more engaging. It is vital to understand the dynamics of educational technologies and how to best utilize these tools to overcome barriers to successful learning (Voderwell & Savery, 2004). The game is set in a 2D world where the players are responsible for seeking information that will allow them to use a library and solve a mystery that

ties the story and the learning expectations together. Siderius (2011) asserted that games motivate learners to actively participate, facilitate critical thinking and problem solving, and promote lifelong learning and ethical use of information.

Literature Review

Research indicates that computer technology is especially useful in developing the higher-order skills of critical thinking, analysis, and scientific inquiry (Roschelle, Pea, Hoadley, Gordin, & Means, 2000). Mabvela and Dehinbo (2016) believed that because today's students have grown up with entertaining media, it is paramount to engage them and stimulate participation to improve student learning. Technology has a strong impact on student motivation and can increase student productivity (Castro,2016). Mungai, Jones, and Wong (2002) explained the use of games as tools that can help learners to reflect on new information, reinforce what they already know, enhance knowledge transfer, and establish the foundation for formative and summative evaluation to support key learning.

Information literacy has attracted attention within learning as well as in library science. The importance of digital and information literacy skills has increasingly come to the fore at a national level as an important attribute for employability (Russell, McGuinness, Burns, Carey, Crump, Young, Ryan, & Toibin, 2015). Information literacy skill levels are an area of concern for educators (Gross & Lathem, 2012) and Gross and Latham (2007) found that many students enter higher education institutions without achieving needed information literacy skills. Detlor, Julien, Willson, and Serenko (2011) found an emerging student population that is largely unprepared in terms of information literacy. MacLean (2008) stressed the importance of helping children discover that libraries and literacy can be enjoyable. Gameplay and active learning allow the school librarian to deliver differentiated instruction (Siderius, 2011). Ward-Crixell

(2007) advised educators to pay attention to play in delivering knowledge because games, technical or non-technical, engage students by allowing them to explore topics in a safe setting. Play is a natural way for children to learn and games provide a place for trial and error (Adcock, 2008). Designing interventions that get individuals engaged in activities increases the likelihood of completion and helps them attain better outcomes (Huang & Soman, 2013).

Learning Theory and Design Approach

The instructional adventure video game, *Gremlins in the Library: A Library Literacy Mystery,* was created to offer an active learning experience for fifth-grade students to acquire information literacy skills. Mayer (2002) believed that active processing occurs when learners are engaged in selecting relevant words and pictures, organizing them into coherent models, and relating them to each other and prior knowledge. Bruner (1966) contended that instructional approaches such as interactive games facilitate discovery and help students connect to the world around them by constructing mental models. As the developers discussed the concepts to be taught through the use of an interactive game, the idea of the cognitive theory of multimedia learning and constructivist learning guided the process. According to this principle, Mayer (2005) claimed that learning is an active process and that is why people can retain information better when words and pictures are combined to reinforce concepts. It is the hope of the game developers that students will not only learn concepts and terminology from *Gremlins in the Library: A Library Literacy Mystery,* but ultimately they will be able to retain those information literacy skills that will benefit them in future levels of education. Mayer (2005) argued that multimedia supports the manner in which the human brain learns, and it was that thought process that led to the development of the aforementioned adventure game.

The ADDIE instructional design model is the framework used in the development of the instructional approach for the *Gremlins in the Library: A Library Literacy Mystery* adventure game. This model provides a road map for project analysis, development, design, implementation, and evaluation. The sequence of the ADDIE method was a good model for constructing the performance-based learning experience. The basis of the ADDIE model is that intentional learning should be student-centered, innovative, authentic, and inspirational (Branch, 2009). For this project, background information was gathered targeting specifics related to information literacy skills to determine the best instructional strategies needed to build information literacy skills at a K-12 level. The initial step in determining the purpose of an instructional game is to identify a specified need to address a problem. A literature review was conducted to gather the information necessary to understand the importance of information literacy skills for elementary school children.

The design of the interactive video game addresses information literacy skills set forth by Texas state standards. The learning goals align with state standards to create an effective learning tool. The person in charge of the game art created imagery to make the game visually appealing but also to create images that were recognizable and could be associated with the student's current learning environment. Game questions were developed to be consistent with the skills that are to be evaluated to demonstrate successful completion of the game and a basic knowledge of information literacy. It was the job of the scriptwriter to convey a believable story that could not only incorporate all the theories needed to acquire information literacy skills but also make the game enjoyable and worthy of the student's attention. The development phase consisted of the actual game creation and will be discussed in more detail later in the paper. The implementation phase for this project was more of a preliminary testing phase because the project was being used

for a class assignment and, at this juncture, will not be developed into a working finalized prototype. If the game were to be developed further, implementation would involve integrating the game into a library information literacy curriculum to address Texas state standards.

The final phase of the ADDIE model involves evaluation. Although this project was not developed to completion, the evaluation phase was still implemented within the development group as well as a group of peers in the same Ph.D. cohort. If the game is eventually implemented, observations of students' interaction will need to be completed to determine any necessary changes that should be made. Interviews were completed throughout alpha testing but should eventually be done with students when the game is implemented. Interviews of players focused on gaining feedback on the positive and negative aspects of the game's instructional design. The task-based activities were constructed to measure specific goals and objectives, and successful completion of each task indicated a mastery of the skills related to that task. The game was structured to reinforce skills that may be difficult for a student by redirecting them back to the informational area associated with whatever skill they were not able to master in the gameplay. The student would not be able to move forward through the game until they have mastered the concept and completed the specified task in the game. One of the most positive elements of the interactivity is the storyline that is weaved into the instruction that pushes the student to want to continue to solve the mystery.

Engaging Learners

New technological innovations challenge educators (Richardson, 2006). Teaching and learning have changed and with it the need for a different approach to sharing knowledge with students. It is important to engage learners in the learning process and encourage them to be self-motivated. It is important to create a double or triple loop in the process to enable participants to

reflect on their learning process (Palloff & Pratt, 2000). Information literacy encompasses a variety of skill sets that range from print to digital materials. The challenge for a designer is to match the content of the subject matter to the needs of the learner (Simonson, Smaldino, Albright, & Zvacek, 2012), and to compel the student to persist through the instructional material by making it entertaining and enjoyable. Students who are engaged are energized by success, curiosity, originality, and satisfying relationships (Strong, Silver, & Robinson, 1995).

Gremlins in the Library: *A Library Literacy Mystery* is meant to be an active learning experience that allows the student to interact with library materials right from the computer monitor. Game navigation is structured, to a certain extent, allowing some flexibility of direction mainly based on correct and incorrect responses to questions and riddles. It is important to establish a structure and guidelines, which are free flowing and generated with the participants in mind (Palloff & Pratt, 2000). There are visual representations of print and electronic materials allowing the players to interact with imagery that is representational of actual elements they will encounter in the library to reinforce concepts. The authentic representations were purposefully built into the fictional quests so that students could make better associations with materials that they would eventually experience in their real world quests. Active learning and student engagement through hands-on activities resulted in an increase in learning and retention (Amburgh, Devlin, Kirwin, and Qualters, 2007). Active learning supports recognition of many concepts and ideas and also ties that information to background knowledge and future encounters (Veckert, 2008). It is the belief of the developers that reinforcement of terms and techniques by repetition in the game will lead to better retention.

Gamification

The Gremlins in the Library: *A Library Literacy Mystery* adventure game was created not only as a requirement for a class assignment but to eventually be used as a method to help fifth-grade children to develop better information literacy skills. The game format was a requirement, but the choice of topic was selected because it would lend itself well to an instructional game. Gamification takes advantage of a human psychological impulse for competition and winning (Mabuela & Dehinbo, 2016). It was thought that the student would be so invested in solving the mystery and "winning" the game that they would not even realize that they were learning in the process. Hsin-Yuan and Soman (2013) stated reasons for drop-outs or low performance included boredom or lack of engagement, which is why educators are using techniques such as gamification to increase motivation and engagement. It was important to the developers to design the learning in such a way that students would be engaged and work through difficulties not because they wanted to learn more but because they wanted to solve the riddle or figure out "who done it." The challenge is to promote interaction by creating an enhanced sense of engagement for the user (Fraher & Boyd-Brent, 2010) which motivates and assists in managing information for ease of understanding and thinking (Lin, 2007).

There are many software options for game creation each having a special characteristic or effect needed for different aspects of game development. This has allowed more people to get involved in the process of game design, not to the level of professional entertainment and instructional games, but at a more fundamental level that can be incorporated into everyday teaching and learning. Multimedia technology has advanced remarkably and has the potential for influencing both processes and products of learning (Anaraki, 2004). Marzano (2010) documented studies that showed, on average, using academic games was associated with a twenty percentile point gain in student achievement.

Proposed Research Questions

1. Do fifth-grade students enjoy learning library information literacy through gameplay?
2. Does utilizing an adventure game format for learning library literacy help students retain applicable terminology and skills?

Methodology for Proposed Research

Research Design

This proposed research focuses on the effectiveness of the gaming environment as a vehicle to teach library information literacy skills. The game as designed allows the participants to navigate through a series of situations with appropriate guidance and rewards as the tasks are completed. There is not currently a mechanism that identifies and counts the number of attempts to complete a given task, however, this is a possible change that would add additional insight into both navigational efficiencies as well as time to complete a given task. Further, if the value of speed to solve as it relates to attempts to solve was deemed necessary, the construct could allow for assessing these individual criteria. Students who used the adventure game to learn library literacy skills would be required to take the same examination as those students who learned library literacy using the traditional format as one way to test the success of the tool. A survey of the fifth-grade teachers could also be used to test the success of not only game navigation but also retention of the information for application outside the game setting. A survey should be given to the students seeking to ascertain their overall entertainment quality of the game and their thoughts on learning through an adventure game format. The questions should be designed to elicit the student's level of engagement with the game as well as their thoughts on the design and gameplay itself.

Challenges

There are inherent difficulties in assessing results that are not biased by the participant's own history and demographic. If gameplay is encouraged at home, the skewing of data towards a positive result is a possible outcome. Similarly, if gameplay is discouraged in a household, then relative success can be inadvertently affected as the gaming is not part of the home culture of the participant. The game construct, as a rule, can lead the participant to a conclusion with rewards and, therefore, inadvertently measure the impact of positive reinforcement as opposed to the game's efficiency. The final possible challenge is the excitement of a new opportunity that is different from the standard teaching method. A participant may be more focused and subsequently score better because their interest is peaked by the game.

Methodology of Proposed Research Participants

It is expected that the *Gremlins in the Library*: *A Library Literacy Mystery* adventure game will be implemented in elementary schools for children in grades four and five for the purpose of developing library information literacy skills. Students will need to determine, locate, and explore the relevant sources. They will need to use various strategies to collect and organize information from a variety of formats while also learning safe, responsible, legal, and ethical behavior in the use of digital tools and resources. Outlining general goals followed by more specific goals and objectives, the nature of the structure of the content, and the values of specific information will increase the "interactive value" of the learning experience (Simonson, Smaldino, Albright, & Zvacek, 2012). A structured quantitative research approach is proposed and the design and implementation of the process following established research criteria. The information will be gathered in two distinct and relative groups: the participants in the game and the teachers/librarians in charge of library literacy instruction. The goal of the first set of data is to define the overall retention of presented material within the game construct and to determine if

students enjoyed this format for learning. This will be measured by a series of questions that specifically relate to the game and its content. The second data set will come from the educators involved in overseeing the educational game.

Methods and Design

The product was envisioned as an adventure game set in an interactive 2D world where players would be tasked with manipulating objects and seeking out information that would allow them to use a library and solve a mystery embedded in the story narrative. No one on the team had ever created a working game, so the choice of a game platform came more from reading reviews than from experience. *Adventure Creator,* a full-featured extension to Unity, was the software of choice for the project. As the development process progressed, the game team realized that none of the members had the expertise required to use *Adventure Creator* to develop interactivity in the form of object manipulation in the 2D environment and, although each member was capable of learning to use the software, the time constraints were a significant factor. It was decided that the instruction could be addressed through an interactive scavenger hunt adventure rather than manipulating on-screen objects, therefore, *Twine*, an open-source tool, was chosen for game programming. This required a redesign of the game interaction and navigation.

The story centers around a player character who is a student at an elementary school that encounters an unexpected event. The student comes to school to find the librarian upset that the library has been vandalized. He begins a quest to reassemble his school library and follow the clues that will lead him to the culprit. As the main character, Frankie begins to fit the clues together, he realizes that Ayagi, the mythical creature from the book he returned but never finished reading, has left the story and is loose in the Library. The only way to get Ayagi home

is to find his book and read the last chapter. The game is a role-playing game with the main character of similar age as the target audience. The goal was to provide a simple, uncluttered interface and offer gameplay through story elements, to keep the interest of fourth and fifth graders. Players participate in a scavenger hunt by answering questions and riddles that will lead to more questions and riddles, under the premise of cleaning up the library by putting away the items as they pick them up. This format is analogous to other games that may be familiar to the players but leaning on the technology aspect of the interface to augment their interest as well as their understanding of the concept to complete each game segment.

The original gameplay dynamics were to be mouse-driven using *Adventure Creator*, however, that design element changed with the use of *Twine*. The gameplay now follows a scavenger hunt type format with the character following clues and solving problems that revolve around learning the areas and items important to library information literacy. The player will read the story and interact with the game using a mouse, clicking responses when required. Questions are posed in the form of drop-down menus that give the player choices related to the question or riddle that will move them closer to the ultimate goal, putting the library in order and sending Ayagi back into his book. Correct answers move the player forward through the game; incorrect answers require students to reread informative material to try again. This reinforcement of the positive result adds to the overall effectiveness of the game and allows the participant to be encouraged along the designed path.

Implications for Future Research

The topic of information literacy has broad implication within society. Digital and information literacy are seen as key attributes for employability (Russell et al., 2015). If students

are excited about learning library information literacy through the use of games, other areas could be targeted for game development to achieve similar results.

Conclusion

Designing an adventure game within the confines of a virtual library allowed the developers to apply foundation approaches to teaching fifth graders to navigate and utilize the library along with learning key terminology. The game interface permits students to interact with various resources beyond just books to reinforce the value of the library as a broader reserve. Using a game format for instruction could improve the desire of the student to finish the lessons, glean the pertinent information, as well as develop a working knowledge of the library. While learning and fun are not necessarily associated, the idea to integrate a fun environment into the learning model was the intent of the researchers. Understanding the audience, in this case, fifth graders, allows the design to not only be effective but also stay relevant and relatable to the learner. A scavenger hunt is in some ways an analogy of learning. The process should not be so overwhelming or laborious that the end goal, finding the item or learning the lesson, is abandoned. Moreover, encouraging learning, motivating and rewarding the student for their efforts can be accomplished within the construct. For this game scenario, the checkpoints and goals along the road to student productivity permit learning and engagement to commingle. Although the game itself is 2D, the colorful imagery and relatable characters help to make the gameplay more memorable and the lessons more fully integrated within the body of knowledge and experience for the student. While entertainment is no single simple answer to bridging the gap between enjoyment and education, the utilization of technology is certainly one possible path. Further enhancing learning with the use of technology creates a more engaging virtual setting for students to progress, moving forward along a possible path to a solution. Video

games allow for constructive development among users and, therefore, are an ideal approach to helping a student retain information. Libraries are a perfect place for games and the presenters at the TechSource Gaming, Learning, and Library Symposium agreed that important skill sets can be achieved through experimentation (Ward-Crixell, 2007).

Gameplay can be developed using many different instructional models depending on the desired outcomes. The ADDIE model was the basis for the *Gremlins in the Library: A Library Literacy Mystery* because of the analysis, design, development, and structure that the developers felt fit well into the style of game needed to teach information literacy. Although the specific instructional model will not be studied as it relates to whether or not the adventure game was successful in teaching literacy skills, it could still be considered in future instructional game designs. The design of the game went through many iterations as the developers cycled through the design/development phases of the instructional model. Questions were created to help teach library terminology and the organizational structure of the library, and from these questions, the story was written followed by development of the gameplay. The technology was not the focus of the product, the narrative and desired skill sets took precedence in the design. Another aspect of developing a game to educate is the drive to have students want to learn and, therefore, be motivated to continue to learn. Further study of the overall impact of improved information literacy is a possible avenue to consider.

References

Adcock, A. (2008). Making digital game-based learning working: An instructional designer's perspective. *Library Media Connection*, *26*(5), 56-57.

Amburgh, J. A. V., Devlin, J. W., Kirwin, J. L., & Qualters, D. M. (2007). A tool for measuring active learning in the classroom. *American Journal of Pharmaceutical Education, 71*(5), 1-85.

Anaraki, F. (2004). Developing an effective and efficient eLearning platform. *International Journal of the Computer, the Internet and Management, 12*(2), 57-63.

Barrett, B. (2010). Virtual teaching and strategies: Transitioning from teaching traditional classes to online classes. *Contemporary Issues in Education Research, 3*(12), 17-20.

Branch, R. M. (2009). *Instructional design: The ADDIE approach* (Vol. 722). Springer Science & Business Media.

Bruner, J. S. (1966). *Toward a theory of instruction*, Cambridge, MA: Belkapp Press.

Campbell, N. (2001). E-teaching, e-learning, e-education. *School of Education University of Waikato.* Retrieved from http://cms.steo.govt.nz/NR/rdonlyres/C11315DE-804A-4831-AB75-3D4E77393DD8/0/eteaching.htm

Castro, S. (2016). *Meeting the 'T' in STEM Through Computer Science and Coding* (Doctoral dissertation, California State University, Northridge).

Chism, N. V. N., (2006). Challenging traditional assumptions and rethinking learning spaces, *EDUCAUSE, 25*(1), 2.2-2.12. Retrieved from https://www.educause.edu/research-and-publications/books/learning-spaces

Detlor, B., Julien, H., Willson, R., & Serenko, A. (2011). Learning out- comes of information literacy instruction at business schools. *Journal of The American Society for Information*

Science and Technology, 62, 572–585.

Fraher, R., & Boyd-Brent, J. (2010). Gestalt theory, engagement and interaction. *CHI 2010*. Retrieved from http://dmrussell.net/CHI2010/docs/p3211.pdf

Gross, M., & Latham, D. (2007). Attaining information literacy: An investigation of the relationship between skill level, self-estimates of skill, and library anxiety. *Library & Information Science Research, 29*, 332-353. Retrieved from https://www.researchgate.net/profile/Melissa_Gross2/publication/223486487_Attaining_information_literacy_An_investigation_of_the_relationship_between_skill_level_self-estimates_of_skill_and_library_anxiety/links/53cfb2980cf2f7e53cf81ddd.pdf

Gross, M., & Latham, D. (2012). What's skill got to do with it?: Information literacy skills and self-views of ability among first-year college students. *Journal of the American Society for Information Science and Technology*, *63*(3), 574-583.

Huang, W. H. Y., & Soman, D. (2013). Gamification of Education. *Research Report Series: Behavioral Economics in Action*. Retrieved from http://inside.rotman.utoronto.ca/behaviouraleconomicsinaction/files/2013/09/GuideGamificationEducationDec2013.pdf

Limberg, L., Sundin, O., & Talja, S. (2013). Three theoretical perspectives on information literacy. *Human IT: Journal for Information Technology Studies as a Human Science*, *11*(2).

Lin, T. S. (2007). Visual information design and design for understanding: a thinking of learning. *The International Journal of Learning, 14*(8), 183-186.

Mabuela, K., & Dehinbo, J. O. (2016). Development and evaluation of a system to increase students' participation in class using gamification techniques. In *Proceedings of the*

World Congress on Engineering and Computer Science, 1. Retrieved from http://www.iaeng.org/publication/WCECS2016/WCECS2016_pp378-383.pdf

MacLean, J. (2008). Library preschool storytimes: Developing early literacy skills in children. *Penn State University*.

Marzano, R. J. (2010, February). Using games to enhance student achievement. *ASCD, 67*(5), 71-72. Retrieved from http://www.ascd.org/publications/educational-leadership/feb10/vol67/num05/Using-Games-to-Enhance-Student-Achievement.aspx

Mayer, R. E. (2002). Cognitive theory and the design of multimedia instruction: An example of the two-way street between cognition and instruction. New Directions for Teaching and Learning, 2002(89), 55-71.

Mayer, R. E. (2005). Cognitive theory of multimedia learning. In R.E. Mayer (Ed.), *The Cambridge Handbook of Multimedia Learning.* New York, NY: Cambridge University Press.

Mungai, D., Jones, D., & Wong, L. (2002, August). Games to teach by. In *18th Annual Conference on Distance Teaching and Learning*, 1-6. Retrieved from https://pdfs.semanticscholar.org/4117/359ddbde233b7def3d827bb50f9f406384f6.pdf

Palloff, R. M. & Pratt, K. (2001). *Lessons from the cyberspace classroom: the realities of online teaching.* San Francisco, California: Jossey-Bass.

Richardson, W. (2006, October). The internet breaks school walls down. *Edutopia,* Retrieved from http://www.edutopia.org/new-face-learning

Roschelle, J. M., Pea, R. D., Hoadley, C. M., Gordin, D. N., & Means, B. M. (2000). Changing how and what children learn in school with computer-based technologies. *The future of children*, 76-101.

Russell, P., McGuinness, C., Burns, J., Carey, B., Crump, M., Young, K., Ryan, K., & Toibin, M. (2015). The library association of Ireland task force on information literacy: An overview of objectives and progress. *An Leabharlann*, *24*(1), 21-25.

Siderius, J. A. (2011, September-October). What's your game plan?: Developing library games can help students master information skills. *Knowledge Quest, 40*(1), 18-23.

Simonson, M., Smaldino, S., Albright, M., & Zvacek, S. (2012). *Teaching and learning at a distance: Foundations of distance education* (5th ed.). Boston, MA: Pearson Education Inc.

Strong, R., Silver, H. F., & Robinson, A. (1995). Strengthening student engagement: What do students want (and what really motivates them)? *Strengthening Student Engagement, 53*(1), 8-12.

Vonderwell, S., & Savery, J. (2004). Online learning: Student role and readiness. *The Turkish Online Journal of Educational Technology, 3*(3), 38-42.

Ward-Crixell, K. (2007, September). Gaming advocacy. *School Library Journal, 53*(9), 36-38.