Learning by Game Design: Exploring Its Potential in Undergraduate Information Literacy Instruction

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ABSTRACT
This study explores the use of game design and its impact on content learning, understanding and retention of knowledge, in information literacy classes. Information literacy (IL) concept is considered critical in a growing number of social and academic contexts. Despite the importance of IL, many learners still have little idea how to evaluate information for relevance, accuracy or authority and are generally uncritical about messages offered to them through online media. The discourse on the use of games as a platform for library orientations and instruction is increasingly addressed in the current practitioner oriented literature. However, very few learning programs offer the design component. This quasi-experimental study uses a pre-test/post-test design. The sample is a non-probability convenience sample of undergraduate students. Findings show that students were able to design functional games using various game design characteristics. This study has the potential of creating new knowledge about the incorporation of learning by game design specific to higher education and libraries.

Keywords
Learning by Game Design, Constructivism, Constructionism, Knowledge as Design, Information Literacy.

INTRODUCTION
For most libraries, a primary component of their service mission is to educate users on information literacy concepts and skills. However, many librarians will attest that keeping the attention of many students in information literacy classes is a challenge. Some students show signs of boredom by not following along, reading e-mail, sleeping or choosing not to participate in various activities (Eisenberg and Berkowitz, 1990; Head & Eisenberg, 2009, Kolowich, 2010). Reasons for lack of interest vary among students; some thinking they already understand what the librarian is sharing to finding the material dull and tedious. This disinterest in information literacy classes is reflected in the manner in which many college students locate, utilize and internalize information to learn about topics that are studying. Librarians have expressed great concern about student’s research skill deficiencies (Asher, Duke & Green, 2010; Kolowich, 2010). As noted by Head & Eisenberg, 2009, 2010 many college students tend to be satisfied with finding just enough information to fulfill the requirements of their assignments, and they rarely see the need to seek assistance from librarians or other information professionals available at their institutions. This apparent superficial information literacy skill is of great concern for librarians and educators especially since information literacy is integrated into educational standards for kindergarten through 12th grade students (American Association of School Librarians, 2007). Despite this integration, college freshmen are still ill equipped to analyze and synthesize information, which is regarded as a key skill for the 21st century (Fitzgerald, 2004; Lupton and Bruce, 2010).

Ultimately, the goal of information literacy instruction is to help students become critical thinkers and function as independent researchers confident in their abilities to locate, identify, access, evaluate and ethically use valid information both in physical and digital formats (Eisenberg and Berkowitz, 1990; Lindsay, 2004) and internalize these practices to transform themselves and society (Lupton and Bruce, 2010). To assist in meeting this goal the manner of instruction needs to be revisited and alternative methods explored.

The incorporation of gaming activities in learning environments has demonstrated some positive outcomes. Many studies have theoretically proposed that gaming activities around education material can serve as effective instructional tools (Markey, Swanson, Jenkins, Jennings, St. Jean, Rosenberg, Yao and Frost, 2009). These approaches are regarded as beneficial because they address different learning styles, provide immediate feedback, increase student motivation, and enhance a student’s overall learning experience, all of which increase the chance of a positive learning outcome for the student (Randel, Morris, Wetzel ASIST 2013, November 1-6, 2013, Montreal, Quebec, Canada.
and Whitehill, 1992, Doshi, 2006; Kafai, Fields and Burke, 2010).

For some time it has been noted that the library operative vision of information literacy was too limited and needed to incorporate visual and media literacy, which demanded broader skills (Breivik, 1998; Ratthemacher, MacDonald and Burkhardt, 1999; Marcum, 2001). Mainstream spokespersons have urge librarians to get involved with games (Squire and Steinkuehler, 2005). The use and acceptance of game design in libraries is limited. However, slow and steady adoption is picking up as its potential benefits is recognized as helping towards promoting creativity and literacy skills which can be a more engaging way of teaching how to collect information and employ the resources available in the library (Mulligan, Kelsey and Davis, 2007, Nelson, 2009).

While there is an abundance of theoretical data regarding the benefits of gaming environments, empirical data is not common among studies. This proposed study attempts to help fill that gap by providing some of the data in regards to the impact of game design activities in learning environments. More specifically, this alternative method of instruction teaches learners how to develop their own problem-solving strategies so that they can learn to use and evaluate information sources, while developing successful strategies for conducting research to solve a problem. The guiding questions of this study examine the learning retention level and understanding that occurred when game design was used as part of instruction. In addition, the study investigates what game design characteristics students used and how students represented information literacy concepts through the design process.

LEARNING BY GAME DESIGN

According to Kafai 2006 and reiterated later by Hastie (2010) more emphasis should be placed on making games for learning instead of just playing games for learning. Despite the increasing interest in game design and the purported theoretical potential for deep engagement in learning, the processes and outcomes of learning using this approach is not well understood. Learning by game design holds great potential for improving information literacy instruction and students use of these concepts as oppose to memorization of definitions or a brief introduction to a specific set of resources. Many times this has proven as insufficient to reach the intended goal at hand. Contrary to other approaches that integrate games into instructional sessions where the individual is the player; learning by game design places the individual in the role of the producer. More specifically, learning by game design refers to the process of learning content during a design task that promotes greater engagement with content (Kafai, 1995). Having students design and create artifacts that demonstrate knowledge of information literacy content is the underlying activity of this study. Artifacts can exist in multiple forms such as reaction papers, multimedia, narratives, games etc. According to Sennett (2008), “making is thinking” (p. ix) and the act of designing and creating an artifact that represents what a learners knows may provide evidence of understanding and thinking and use of that content. This artifact may represent more than just superficial thinking but may reflect a deeper level of thinking that goes beyond memorization or recall and reaches into the realm of higher order thinking associated with Bloom’s taxonomy of cognitive skills such as evaluating, creating and applying (Bloom & Krathwohl, 1956; Anderson & Krathwohl, 2001).

THEORETICAL FRAMEWORK

The phenomenon learning by game design is understood through interrelated concepts of theoretical and pedagogical perspectives. From a theoretical perspective, learning by game design is grounded in constructivist theories of knowing. Social constructivism theory serves as its guiding theory. Within a pedagogical foundation, learning by game design embraces constructionist (Papert, 1991) and knowledge as design (Perkins, 1986) pedagogical approaches, which is an application of constructivist learning theory (Perkins, 1986, Papert, 1991). Both pedagogies contribute to the experiential learning environment. There are several models related to experiential learning, but the basic premise is the same throughout; individuals have an experience, then they reflect on the experience which improves the learning process (Osterman & Kotkamp, 2004). This learning style takes on a holistic approach to learning and emphasizes how experiences, including cognitions, environmental factors, and emotions influence the learning process. Experiential learning allows one to capture the interest and involvement of the participants, but most importantly, it contributes significantly to the transfer of learning (Luckner & Nadler, 1997).

METHOD

A pilot study employing a quasi-experimental (pre-test/post-test) design approach was done since it was not logistically feasible to conduct a randomized control study. A convenience sample of 200 undergraduate students enrolled in a six-week program at Syracuse University was the participants. The program provided pre-freshmen an opportunity to become familiar with the academic, social, and cultural life at the college level. Part of the program activities included student’s participation in library sessions, where they became familiar with resources and services offered by the five libraries located on the Syracuse University campus. These sessions were done in a typical classroom setting, where students passively learn about the library services. After the introductory session, students did a self-guided tour, where they were given the task of finding the location of objects and service points in the library. The objective was to either identify or record the location shown in photographs. Students submitted the completed activity document to the librarian and were then orally quizzed as a group about the activity they completed.
Answer sheets were given to each student at the end of the session.

For the purposes of the pilot, the library session was modified. Three instructional environments were compared. Prior to the library session, all students were taught the basics of game design using the game/multimedia design application, Scratch. Instructors were also taught the application using the same tutorial materials. After the tutorial, students designed a couple of game narratives, animate characters, add music and created backgrounds. Most importantly, they had an opportunity to add their creativity to this session and explore the various functionalities. They also played with completed games; selected from Scratch website, which is a sharing community where creations are uploaded. This was done so participants had a better sense of what design creations were possible. All students were given a pre-test to establish a baseline measure for comparison with the post-test outcome measure. Post tests were given to the students two weeks after the class. See Table 1 for data collection points of pre and posttests.

<table>
<thead>
<tr>
<th>Groups</th>
<th>Pre Test</th>
<th>Treatment</th>
<th>Post Test</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Game Group</td>
<td>O₁</td>
<td>O₄</td>
<td></td>
</tr>
<tr>
<td>Pre-Made Game Group</td>
<td>O₂</td>
<td>X₁</td>
<td>O₅</td>
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<tr>
<td>Game Design Group</td>
<td>O₃</td>
<td>X₂</td>
<td>O₆</td>
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Table 1: Research Design for Quasi Experiment

Four groups of students visited the library during one of the scheduled sessions. All students did the introductory session and tour. The first group of students had no game activity and orally quizzed in the classroom as a group. The second group of students played a simple pre made game that focused on elements of the self-guided tour. The third and fourth group developed a plan for a game using either a game/multimedia application or paper. Students were asked to design a game to teach other students about using and locating library resources to help with assignments. The only limitation to the design activity was that games or narratives had to be developed around the content of the self-guided tour. All the class activities were observed and video-recorded. This offered a firsthand examination of the participants engaged in library instruction and gaming activities.

ANALYSIS

Analysis of the data from the pre and posttests showed that students in the game play and game design group achieved significantly higher posttest scores than students who participated in the no game activity group. There were no significant differences between game play and game design group. Analysis from the recordings showed that most of the students in the game development group were more engaged compared the other groups. However, there were students who had problems working with the design software and were not as engaged. Because students were allowed to select their group members, many tend to work with their friends. Other students either chose to work alone or in groups of two people. As such, engagement was more pronounced in larger groups. Time was the most debilitating factor that worked against the design group. Many students became proficient very quickly using the design application, but because of the brief time allocated to the session, they were unable to complete their ideas. Some designs as well as the results from the pre an posttest will be shown in the poster. To overcome this time limitation students presented their ideas in a written format. From observations and class recordings, not all students who participated in the play activity were engaged. For example, in these sessions, the same group of students answered questions throughout the Q and A session resulting in non-uniform participation.

DISCUSSION AND CONCLUSION

These preliminary findings show that despite time constraints students were able to design functional games. The pilot study showed that game development activity could be a feasible pedagogical activity for teaching information literacy once instructors take the time to incorporate it into class activities. The objective part of this study shed some light on that use of games (whether playing or designing) can potentially improve learning retention. A longer game design session may have helped in showing the difference between game play and game design. The qualitative data gave more insight into the student learning processes and interactions in the different learning environments. More structured qualitative data could have been more useful in understanding the phenomenon.

This pilot study was a useful exercise in experiencing firsthand the planning of this intervention in a library instruction session. It allowed the researcher to see that there was a need for the incorporation of more qualitative approaches to provide insights in deeper ways thereby providing a better understanding of this complex instructional environment. The researcher had the opportunity to interact with individual participants who had different perspectives when it came to learning by game design. However, these perspectives were not captured. Exploring the phenomenon proved a more complex situation and a better approach was needed to capture the multi-faceted insights that would have presented a more complete picture. Therefore, the study research design will be revisited to incorporate methods that elicit deeper qualities of the instructional environment.
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