Designing Games in the Classroom: Learning Benefits

ABSTRACT
The purpose of this study is to determine if the introduction of game design has an impact on the learning of information literacy concepts among undergraduate students. The study proposes a descriptive case study which draws upon the theories of social constructivism and motivation to explore the phenomenon learning by game design. The study was conducted in an online one credit information literacy class. Preliminary findings offer insight into the use of game design in learning scenarios.

Keywords
Learning by game design, constructivism, constructionism, knowledge as design, information literacy.

BACKGROUND
Information literacy is viewed as a critical issue of national and international concern (UNESCO, 2006; Head, 2012). The recognition of the significance of information literacy as a learning outcome in higher education resulted not only in increased opportunities for instructional collaboration between librarians and faculty but also in increased demand for direct instruction (Katz, 2013). At some institutions new opportunities have been created for librarians to develop and teach credit-bearing courses (in some cases a requirement) focusing on information literacy skills (Rader, 2002) and broader campus initiatives such as instruction in critical thinking, first-year-experience programs, and writing across the curriculum (Rebmann, Molitor, Rainey, 2012).

There is an increased interest in educating users on information literacy concepts and skills. Therefore the teaching role of librarians has become increasingly important, as users are faced with the challenges of accessing, retrieving, evaluating, and managing information in a technology environment (Breivik, Gee and Gordon, 1989; Rader, 1997; Rockman, 2002, Kuhlthau, 2004; Walter, 2006; Katz, 2013). However, keeping students engaged still remains a challenge. Many librarians tend to employ a teacher-centered directed form of instruction in the classroom and attest that keeping the attention of many students is a chronic problem (Head, 2012). The apparent superficial information literacy skills among students is of great concern for librarians and educators (American Association of School Librarians, 2007). College undergraduates are labeled as ill equipped to analyze and synthesize information, which is regarded as a key skill for the 21st century (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 (Lindsay, 2004) and internalize these practices to transform themselves and society (Lupton and Bruce, 2010). To assist in meeting this goal many librarians recognize that the manner of instruction needs to be revisited and alternative methods explored.

In looking for ways to reach beyond their traditional patron base and establishing itself as a third place libraries have endorsed the use of games to help fulfill their various missions (Katz, 2013). Several librarians and researchers have analyzed the beneficial ways games relate to library instruction or information literacy. For example, Waelchli (2009) describe how games align with the first four Information Literacy Standards established by the Association of College and Research Libraries (ACRL) (Association of College and Research Libraries, 2000). Martin and Steinkuehler (2010) analyzed World of Warcraft players and concluded that information literacy was occurring, even though it did not support the traditional frameworks established by ACRL. Incorporation of games in library instruction is not new and has been discussed as early as 1958 (see School Library Association of California publication Library Skills; Teaching Library Use through Games and Devices).

Why use games for instruction? There are a number of reasons: from being engaging to strengthen critical thinking in the learner. A key concept that emerges from the literature on the use of games in learning scenarios is motivation. Games have the potential to enhance motivation because they stimulate curiosity and interest by presenting learning in meaningful context in which the learner is in control (Kirriemuir & McFarlene, 2004).

Several researchers encourage instruction librarians to draw analogies from games to relate to the information literacy skills. Johnson, 1995 refers to games as “cognitive workouts”. He goes on to say that intellectual benefits of gaming addresses learning how to think, learning to make the right decisions, weighing evidence, analyzing situations and consulting long term goals and then making decisions. This echoes the goals of information literacy classes, determining the information needed, gathering that information, evaluating it critically, and then acting upon it for a purpose.
ADDING DESIGN FOR LEARNING

Some libraries have taking the initiative and developed games to support their information literacy instruction. However, the results of having students play games developed by libraries have been mixed (Broussard, 2012). Funding problems, graduation of game designers, students lack of interest in ill designed games had plagued game projects sustainability (Cohen, Nishikawa and Miner 2009, Gallegos & Allgood, 2008 and Markey, 2010).

One manner for incorporating the use of games for instruction purposes is game design. The use of this approach in libraries is limited; but its slow and steady acceptance is picking up as its potential benefits is recognized as helping towards promoting creativity and literacy skills which can be a great way of teaching how to collect information and employ the resources available in the library (Mulligan, Kelsey and Davis, 2007, Nelson, 2009). However, these game design activities do not necessarily involve users designing around information literacy concepts. Game design encourages the translation of thinking into specific artifacts. Rather than thinking that learning can change by just bringing games into the classroom one should also consider the effects the thinking process engender by not just play but also design. Papert helped pioneer the thinking about game design as empowering the individual to model knowledge and to see their environment as a system of interconnected parts. Contrary to where the individual is the player, 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; 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).

This study explores the impact of game design activities in learning environments. More specifically, the incorporation of the design activity 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 and understanding that occurred when game design is used as part of instruction. In addition, the study also investigates how student motivation developed over the duration of the class and what game design characteristics students used and how students represented information literacy concepts through the design process.

THEORETICAL FRAMEWORK

Promoting learning by game design is viewed through interrelated concepts of theoretical and pedagogical perspectives. From a theoretical perspective, learning by game design is grounded in constructivist theories of knowing. As shown in Figure 1 social constructivist thought encompasses the phenomenon learning by game design. In an oversimplified view, social constructivism moves knowledge out of the head and into the open. In this view, knowledge is a community and not an individual possession. Therefore, the individual creates their own understanding based on an interaction between what they already know and believe and ideas and knowledge with which they come into contact (Resnick, 1989). One of the advantages of using social constructivism in the classroom is that student become actively involved in the learning process. For instructors, social constructivism affords the opportunity to help students take responsibility for their own learning and create a classroom where students explore and discover. In other words a way of way of understanding the world.

Within a pedagogical foundation, learning by game design embraces constructionist (Papert, 1991) and knowledge design (Perkins, 1986) pedagogy, which is an application of constructivist learning theory (Perkins, 1986, Papert, 1991). Both pedagogies contribute 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 and learn. This learning style takes a holistic approach to learning and emphasizes how experiences, including cognitions, environmental factors, and emotions influence the learning process.

Social constructivists see motivation as both extrinsic and intrinsic. Because learning is essentially a social phenomenon, learners are partially motivated by rewards provided by the knowledge community. However, because the learner constructs knowledge actively, learning also depends on the learner's internal drive to understand and promote the learning process (Malone & Lepper, 1987).

METHOD

The origins of this study lies in a different research design. Initially a quantitative approach was used to answer the research questions; aimed at exploring causality of the learning by game design intervention. A quasi-experimental study was employed as a pilot. The phenomenon proved a more complex than initially envisioned and a better approach was needed to capture the multi-faceted insights that would have presented a more complete picture. The, research design was revisited to incorporate more
qualitative methods that elicit deeper qualities and add a more descriptive data.

**Figure 1. Interrelated Concepts of Theoretical and Pedagogical Perspectives**

The study was conducted in a seven-week required online one-credit information literacy class during the summer 2014 semester. Participants were undergraduates (8) students. The course was modified to include a game design component. Students were grouped based on their gaming and library experiences. This information was elicited from two questionnaires. Attempts were made to group students with varied skills. Students were asked to develop a game around content that was covered in the class. The designed game would be used to help the player better locate, evaluate and use information effectively; they had the option to create an online or board game. The game requirements were; easy to learn and fast to play (not exceeding 30 minutes of play). Learning outcomes and rules were required.

Students were placed into two groups. The first deliverable was a plan where students specified the topic and the learning objectives. Students shared this through the online course space. After receiving comments and suggestions from the instructor, they then proceeded to develop their game. The completed game was shared with the class using the class blog. Students were asked to play the other group game and offer comments and suggestions based on how well the game met learning objectives, challenges offered, look and playability. After receiving their peer suggestions, groups were asked to submit a document that detailed what changes they will make to their design.

A case study approach was deemed more appropriate. Data was collected from pre and posttests and a game experience questionnaire that was completed at the beginning of the class. Students were asked to evaluate their team members contributions to the game design activity. All submissions related to game design were collected and semi structured interviews was conducted at the end of the class. Questions focused participant’s experiences during game design activity, information literacy concepts they used in their design, rationale behind their game design and use of learned information literacy concepts. The Intrinsic Motivational Inventory (IMI) was used to assess the subjective experiences of participants related to designing games. This is a valid instrument used to assesses participants’ interest/enjoyment, perceived competence, effort, value/usefulness, felt pressure and tension, and perceived choice while performing a given activity (McAuley, Duncan, and Tammen, 1989). This instrument was used at the three points of the study: - At the beginning to establish a baseline measure, during and at the end of the game design activity. This study employed a similar version of the inventory used by Vos, Van Der Meijden & Denessen, 2011. Their inventory was modified to fit a game design scenario. The sub scales interest, perceived competence and effort was used.

**ANALYSIS**

Data from the pre and posttests showed an improvement in student scores. Not all students consider themselves gamers but all students played some form of sports and a family game. The games created taught the player how to cite and reference sources. One covered the MLA structure and the other the APA format. Both games were board games; one was a mod of chutes and ladders where the student was asked question about the MLA structure before they moved on the board. Failure to answer the question meant the player moved back one space. The other game was designed around the board game Clue. Players collected components to arrange a reference in APA format. Means of the intrinsic motivation variables in the post IMI suggested that student motivation in terms of competence, interest and effort was higher, compared to the pre IMI scores. Student motivation improved as the class progressed. Student indicated that they were confused game initially, it was difficult to explore ideas in an online class, and they were unable to meet face to face. They felt they could have done a better job and explored the content in greater depth in order the create the content for the game.

**CONCLUSION**

Data from this study in presently being analyzed. A more detailed analysis of the data will be presented. Preliminary findings offer insight into the use of game design in learning scenarios. There are some limitations; conducting this study in an online class in that the researcher was unable to observe the students during the design process. Observations would have helped in building the interview questions and getting a better sense of individual student participation in the activity.
REFERENCES


Gallegos, B. and Allgood, T. (2008), The Fletcher Library game project, Association of College and Research Libraries, Chicago, IL, pp. 149-63


Lindsay, E. B. (2004). Distance teaching: Comparing two online information literacy courses. The Journal of Academic Librarianship, 30(6), 482-487.

Lupton and Bruce, 2010. Windows on information literacy worlds: Generic, situated and transformative perspectives pp. 3–27


Waelchli, P. (2009), Gaming in libraries class – Guest Paul Waelchli on Information Literacy", Available at: www.youtube.com/watch?v=PAVo8Tmn7o