COMPARATIVE GAMIFICATION PRACTICES FOR INFORMATION LITERACY INSTRUCTION IN HIGHER EDUCATION

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ABSTRACT

Due to the recent call for the need to change information literacy instruction for 21st century skills, many scholars, educators, and librarians are exploring gamification as a teaching and learning pedagogy for information literacy instruction, design, and assessment for student learning. The research literature provides an overview of various information literacy tools, teaching methods, and pedagogies suggested by scholars and educators for improving information literacy instruction and student learning. Based on results from empirical studies, to improve information literacy outcomes for undergraduate students, especially literacy gains for at-risk or underperforming students, gamification can be used as a conceptual framework for pedagogy assessment for teaching and learning.

Keywords: gamification, information literacy instruction, game-based formative assessments, instructional design

INTRODUCTION

The concern over Information Literacy Instruction (ILI) methods used by faculty in higher education for learning and teaching is not new and has been a problem in existence that has been frequently reported in the research literature (Gunn & Miree, 2012; Mazella, Heidel, & Ke, 2015; Rendahl & Kastman Breuch, 2013; Shao & Purpur, 2016). Information Literacy (IL) instruction methods, teaching techniques, pedagogies, and learning strategies used by faculty in higher education has continued to be a central concern that has recently received considerable attention within and outside institutions of higher learning, which has resulted in a debate among researchers specifically about its existence causes, implications and solutions in improving ILI, promoting and integrating ACRL IL standards, and cultivating an environment of successful learning (Detlor, Julien, Willson, Serenko, & Lavallee, 2011; Detlor, Booker, Serenko, & Julien, 2012; Fain, 2011; Hsieh, Dawson, Hofmann, Titus,

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& Carlin, 2014; Loo et al., 2016). The interest in investigating ILI and its impact on student learning in four-year universities was compelled by the fact that scarce research exists about the problem in IL distance education courses at fouryear universities (Catalano, 2015; Gonzales, 2014; Gray & Montgomery, 2014; Mune et al., 2015) in comparison to research on ILI in face-to-face IL courses (Daugherty & Russo, 2011; Fain, 2011; Hsieh et al., 2014; Mazella et al., 2015; McBride, 2012; Shao & Purpur, 2016).

INFORMATION LITERACY INSTRUCTION IN HIGHER EDUCATION

Many online undergraduate degree programs require students to take a four-credit, distance education information literacy course (Catalano, 2015; Fallahay Loesch, 2011; Gonzales, 2014; Gray & Montgomery, 2014; Mune et al., 2015) or online first-year writing courses (Rendahl & Kastman Breuch, 2013; Stiwinter, 2013). For most academic institutions, teaching library and information literacy skills is an essential part of the college curriculum regardless of the student's major. Many institutions have examined the long-term effects of information literacy courses on student information literacy development, though from different theoretical perspectives, methods of assessment, and emphases. However, delivering online information literacy instruction and integrating information literacy into the curriculum can be a challenging task due to limited time and resources. Also, when designing and implementing an online game, it is important to consider student demographics (Kim, 2015). For example, most online students are older working adults with diverse learning styles. Also, it is important to address the needs of digital natives— Generation Y. Teaching and learning activities through technology encourages learning by doing and promotes student interaction and engagement. As suggested by Kim (2015), incorporating audio, video, animation, and interactive exercises or game features along with text-based instruction will help address the changing student demographics and needs.

In their study, Rendahl and Kastman Breuch (2013) shared the same assertion as Daugherty and Russo (2011) in that many undergraduate students have difficulty mastering skills in developing search strategies in online databases, finding and accessing appropriate sources and technologies, organizing research and information, discerning the differences between sources and evaluating the content of information, and referencing sources in APA style formatting. To better understand undergraduate students' research and writing strategies and study habits, Rendahl and Kastman Breuch (2013) conducted a case study of two online first-year writing courses. A major source of information was students' self-reports of their study habits and statistics from the course Learning Management System (LMS). Students who rated themselves as making good use of their study time had higher grades compared to students who did not. In addition, students reported in their end-of-course surveys that they highly preferred instructors who are engaging and active. At the same time, they did not seem to value interaction with their peers based on data analytics from the course LMS (Rendahl & Kastman Breuch, 2013).

On the contrary, Daugherty and Russo (2011) administered a web-based survey to 2,147 currently

matriculating Louisiana State University students who had taken the one-credit Library Information Science (LIS) 1001 course. Daugherty and Russo (2011) noted that assessing an information literacy course from a student's perspective is important because it provides a record of progress as well as a guide for any needed changes in the program. Through the 28-question survey instrument, students were asked to answer closed and openended questions about their demographics, applications of skills learned in a course in other classes, and applications of skills outside of academic classes. Although the response rate was low, the survey indicated that students use the materials and skills taught in the course throughout their college careers for both course work and personal research (Daugherty & Russo, 2011).

Similar to the study conducted by Daugherty and Russo (2011), Fain (2011) assessed literacy gains among first-year University students enrolled in English 101 Composition and first-year university students enrolled in University 110 First Year Experience using a pretest-posttest design. To measure literacy gains across the five-year time period, the Library Skills Assessment was administered to first-year students at the beginning and end of their first semester. The McNemar's test, a non-parametric test, was used to determine if there were changes in students' information literacy skills after receiving a one-shot library instruction session over five assessments (Fain, 2011). The Library Skills Assessment was developed in-house and consisted of 12 to 15 multiple choice and true/ false questions based on the ACRL Information Literacy Competency Standards for Higher Education. Over the five years the Library Skills Assessment was conducted, one common theme emerged; students showed statistically significant changes on understanding library resources or services that were required as part of a research assignment (Fain, 2011). Overall, first-year students exhibited knowledge of information skills to be low; however, over time, students did demonstrate significant change in their information literacy development (Fain, 2011). A major limitation of the research methodology used for this study was the concern of not having control groups to accurately assess the impact of library instruction sessions on student learning. Also, other internal and external factors that may influence student learning is the

instruction program and university personnel that students came in contact with as they differed for English 101 students and University 110 students (Fain, 2011). Regardless of findings, per Fain (2011), library instruction, as part of the overall first-year experience, contributes to the early stages of information literacy development.

To improve information literacy skills among first-year college students enrolled in a threecredit information literacy course at Buffalo State College, McBride (2012) redesigned the course to align with the ACRL IL standards. Using the problem-based learning (PBL) approach, McBride (2012) used a mixture of video and slide show presentations that showcased how students can sharpen their research and technological skills. The author, who also taught the course, received overwhelmingly positive results from students, and assessment of the classes showed improvement in students' information literacy skills (McBride, 2012). Despite positive findings, McBride (2012) failed to clearly define the variables, and the methods used to measure student learning were not discussed. Therefore, it is difficult to draw accurate conclusions regarding the relationship between information literacy instruction and student learning. Nonetheless, based on this research findings, McBride (2012) advocated that the Constructivist approach in the classroom is the best approach, while Connectivism may be a possible approach to teaching information literacy in the future.

While McBride (2012) took a Problem Based Learning (PBL) approach, Hsieh et al. (2014) compared four pedagogical approaches for single or multi-IL session among undergraduate students enrolled in CMP-125 Research Writing and BHP-150 writing courses at Rider University in New Jersey. Regardless of information literacy instructional method, traditional methods such as lecture, search demonstrations by the librarian, and hands-on time for search practice were employed in all four sessions. However, the traditional method was the control group for this study. The experimental groups, on the other hand, consisted of three groups: a preview method, an active learning method, and a multi-session library method.

A different pretest and posttest based on the first two ACRL Information Competency Standards for Higher Education (2000) were

Although 363 students completed the pretest and 153 completed the posttest, 107 of these students completed both the pretests and posttests, and both tests comprised of ten multiple-choice questions, which were installed on Google Docs for students to take in the library's computer labs. At the beginning of the semester, students were directed to take the voluntary online pretest. Three or four weeks after the first ILI session, the students returned to the library for their follow-up sessions with more instruction and hands-on time. The librarians administered the posttest in the second follow-up sessions, which measured the effect of two instruction sessions instead of one.

developed for assessment (Hsieh et al., 2014).

Using one-way ANOVAs to test for significant difference in pretest scores, the BHP honors' students scored significantly higher than the non-honors students, and the freshmen scored higher than the sophomores, but there was no significant difference across academic disciplines. In addition, multiple comparisons indicated that the BHP group performed better than the both the preview and CMP-125 groups, which did not differ (Hsieh et al., 2014). Hsieh et al. (2014) proposed that the complex nature of IL and limited time students have in the session(s) may impact student learning; thus, students learn best by interacting with the course content and applying what they know through assignments.

Mazella et al. (2014), on the other hand, took a different approach in developing a threeway information literacy instruction model built around an annotated bibliography assignment in a junior-level English class at the University of Houston in Texas. Collaboration between an English professor at the University of Houston, a Learning Strategies Counselor, and a Librarian resulted in an integrated model of information literacy instruction, critical reading, and literacy studies to help students become effective readers and researchers (Mazella et al., 2014). While the professor introduced the learning objectives and structure of the three-session workshop at the beginning of the course, the librarian focused on information literacy instruction, which consisted of in-class demonstration, practice, and facilitated discussion through a course blog. Finally, the Learning Strategies Counselor focused on assisting students in extracting key information

⁵²

from scholarly articles necessary for an annotated bibliography assignment using a "form schema" concept developed by Rigney and Munro (1977), an abstract prototype for providing general information about the format and conventions of research articles rather than content (Mazella et al., 2014). After the third session, students were given time to complete an evaluation form that contained 13 four-level Likert scale questions, one multiplechoice question with open answer, and three short-answer questions. According Mazella et al. (2014), overall, students reported having a positive experience with this teaching model. Most students expressed that they acquired new knowledge of scholarly resources and believed strongly that they would use the skills learned in future courses but felt less confident when asked to locate an academic journal in the library (Mazella et al., 2014). As a result of this type of collaboration, a rich learning environment was created, intellectual frameworks, tools, and resources were developed, and most of all, students' mastery of research skills increased (Mazella et al., 2014).

Shao and Purpur (2016) examined and compared the information literacy skills of college freshmen at Appalachian State University in North Carolina who were taking either a basic English writing class (ENG1000) or a First Year Seminar course (UCO1200). To measure information literacy skills, a class project consisted of a minimal five-page writing assignment that cites at least five sources. Information literacy skills test scores were collected from 398 students in 19 classes taught by eight instructors during two semesters in 2014; the average information literacy score was 78.5 out of 100 points. Shao and Purpur (2016) found through Pearson's correlation coefficients, that students' writing scores and their course grade were strongly associated with students' knowledge of scholarly versus popular sources. To determine if using certain library services by students, such as the library research guides, online tutorials, research advisory program (RAP), library desk service (LDS) enhanced students' information literacy skills and overall course performance, an independent samples t-test was conducted. The findings validated the support of the use of library services in improving students' written communication and academic performance (Shao & Purpur, 2016).

Online Information Literacy vs. Face-to-Face Instruction

While many researchers have examined and compared the impact of information literacy instruction methods on student learning in face-toface classroom settings, many educators are taking a closer look at the impact of online information literacy tutorials (Gonzales, 2014; Stiwinter, 2013) to expand or improve library instruction; Web-based information literacy modules (Mune et al., 2015) to improve information literacy instruction and literacy development; situated learning (Catalano, 2015) to facilitate transfer of information skills; and the use of Microsoft PowerPoint presentation in delivering multimedia, such as audio and visual features (Fallahay Loesch, 2011) in an online information literacy course. To determine if there were differences or similarities in the IL methods taught in an online information literacy course compared to a face-to-face course, Gray and Montgomery (2015) administered a non-graded knowledge survey to students in two online sections and three face-to-face sections taught on campus at the beginning and end of the semester as well as a pretest and posttest to assess for student learning. The main finding was that whether the class is being taught online or in a traditional classroom setting, instruction methods and student learning outcomes are very similar (Gray & Montgomery, 2015).

Through a review of the literature on Webbased tutorials, Gonzales (2014) found, on average, that online IL tutorials were equally or more effective than face-to-face instruction in delivering information literacy to students; however, further research is needed to draw meaningful conclusions regarding ILI methods and student satisfaction, preferences, and course performance. Stiwinter (2013), who designed an interactive online information literacy tutorial for first-year composition students at a community college using Adobe Captivate software, a static website, and the Prezi presentation tool, found that 82% of students reported through a survey that the tutorial was user friendly. In addition, student learning outcomes from a pretest-posttest information literacy quiz showed an average 21-point increase in students' scores from the pretest to the posttest (62 to 83); therefore, suggesting that the tutorial was effective in promoting positive student

learning outcomes (Stiwinter, 2013). However, based on their findings, the Captivate simulations was more successful than the Prezi modules in keeping students physically and mentally engaged. Interestingly, students indicated that the Prezi's basic interactivity features were more appealing than a video or static webpage, thereby implying that students learn better when they are able to interact with the content, which provides exposure, practice, and application (Stiwinter, 2013).

Comparable to Stiwinter (2013), Mune et al. (2015) developed online information literacy modules for an online LMS at San Jose State University in California to provide effective library and information literacy instruction for underprepared first-year college students. Through the help of an Online Information Literacy Task Force, task-oriented, problem-solving information literacy modules were developed, embedded, and evaluated based on the Association of American Colleges & Universities (AAC&U) VALUE rubrics and ACRL Information Literacy Standards (2000) (Mune et al., 2015). Self-assessment quizzes were built within the LMS and were used to assess students' mastery of the course material; however, scores were not recorded. Despite efforts to solicit feedback through email regarding the content and layout of the modules, only four students responded and suggested through a group discussion with the Task Force, to limit the use of videos with long introductions, incorporate the use of visual highlights such as bold or colored lettering to differentiate topics presented, and embed images, graphs, tables, and charts to represent key ideas or concepts in class (Mune et al., 2015). Students also expressed that the videos on finding scholarly articles were not helpful, but the modules on the thesis statement and citations assisted in their learning as these were trouble areas in the course. Based on this finding, students prefer text examples of citations, thesis statements, and example papers over video content (Mune et al., 2015).

Information literacy instruction was considered from a different context when Catalano (2015) examined the efficacy of a situated learning environment on knowledge transfer with respect to information evaluation and library instruction of 85 university students enrolled in seven sections of a one-credit, nine-week Library 001: Introduction to Library Research Technology course at a four-year university in New York. Using an experimental, pretest-posttest design, Catalano (2015) examined and compared the differences in student learning using traditional methods and situated learning methods. Catalano (2015) found that students who received situated learning methods, which consisted of expert modelling, scaffolding, authentic activity, and problem-based assessments, scored higher on the posttest exam for the course compared to students who received traditional methods, which included a lecture and hand-outs. In addition, student responses indicated that the students in the situated learning group were more engaged than the traditional method group (Catalano, 2015). This finding indicates that situated learning can be an evidence-based instructional design for facilitating transfer of knowledge to real world contexts, thus improving library instruction in general (Catalano, 2015).

Conversely, Fallahay Loesch (2011) took a different approach in delivering information literacy instruction to distance education students by employing multimedia features in PowerPoint. In this study, two library faculty and a professor of mathematics and computer science from Seton Hall University, a private Catholic university in New Jersey, teamed up to create an online course with information literacy components embedded in the course design through Blackboard, an online LMS. To facilitate the course development, the Quality Matters (QM) Rubric for Online and Hybrid Courses were used to assess the quality of the design to ensure that information literacy components met ACRL IL standards (2000). Although Fallahay Loesch (2011) discussed the collaboration between the research team and the design process of the online course, no discussion was made as to whether the PowerPoint slides embedded in the course design aided student learning. Therefore, it is difficult to draw accurate conclusions regarding the effectiveness of PowerPoint and its role in student learning.

Thus, the research literature provides an overview of various information literacy tools, teaching methods, and pedagogies suggested by scholars and educators for improving information literacy instruction and student learning, that is, students' information literacy skills, including their critical thinking and problem-solving skills, their proficiency in library search tools and research databases, their writing abilities, as well as their overall performance in a class. More importantly, there are many theoretical abstractions and conceptual frameworks for designing information literacy instruction, measuring and assessing students' information literacy skills, and evaluating the effectiveness of teaching methods in improving learning outcomes within educational contexts. Based on empirical studies, to improve information literacy outcomes for first-year college students, especially literacy gains for at-risk or underperforming students, gamification can be used as a conceptual framework for pedagogy assessment for teaching and learning.

It is important to note, however, researchers have reported many challenges in assessing the effectiveness of an instructional game because there are many confounding variables that may influence student performance such as game features, characteristics of student learners, course curriculum and design, and access to appropriate technology and software (Kim, 2015). In addition to understanding and designing appropriate game elements suited for an audience (user type), researchers must also consider other variables such as gender, age, and cultural orientation before utilizing a game as a learning and instructional strategy (Kim, 2015).

GAMIFICATION PRACTICES FOR IMPROVING INFORMATION LITERACY OUTCOMES

Gamification is a relatively new term used in research, yet it is becoming a popular approach to gamifying library services or programs and improving user engagement and instruction (Kim, 2015). Many scholars, educators, librarians, and game designers have different definitions and examples of what gamification refers to in the educational context. Kim (2015) defined gamification as lightweight digital applications that apply game elements to the learning context. Examples of gamification can range from commercially produced digital or video games, information literacy video games, Web-based board games, and non-digital information literacy games such as board, card, pen-and-paper (tictac-toe, word finds, puzzles, or hangman), or dice games (Kim, 2015; Margino, 2013). As noted by Smale (2011), digital game-based learning (DGBL) is an effective learning and teaching

pedagogy for information literacy and library instruction. The benefits of game-based learning may be especially important for the Millennials, also known as Generation Y, and the Digital Natives, the cohort born between 1980 and 1995 during the boom of social media technologies and digital devices. These student learners are considered technologically savvy with using various multimedia tools and thrive on instant gratification or immediate feedback (Emanuel, 2013; Smale, 2011).

Meta-analyses conducted by Giessen (2015), Margino (2013), and Smale (2011) have shown that game-based learning has become an innovative teaching-learning pedagogical strategy employed at all levels of education. Based on their literature review study of game-based learning, Cicchino (2015), Jabbar and Felicia (2015), and Woo (2014) found that game-based learning can be used as an effective pedagogy assessment for measuring student learning, supporting student motivation, fostering critical thinking, improving cognitive success, and improving performance outcomes for all academic subjects and learning environments. Game-based learning pedagogies include inperson information literacy games, library treasure and scavenger hunts, virtual games (i.e., video games or commercially produced digital games), and hybrid games (comprising both in-person and virtual game elements) (Margino, 2013; Smale, 2011). Smale (2011) and Wanner (2015) described quiz show-style games similar to the popular TV game show Jeopardy! as a non-digital information literacy game commonly used effectively in teaching and learning. In fact, Fratto (2011) used PowerPoint games to promote active learning in a managerial accounting course, Webb, Simpson, Denson, and Duthie (2012) used gaming as an informal instructional technique for improving learner engagement and outcomes for geriatric students, and Day-Black, Merrill, Konzelman, Williams, and Hart (2015) used an interactive game as a teaching-learning strategy for digital nursing students in a community health nursing course.

Instructional Design and Learning Theories for Gamification

Current research, however, lacks empirical evidence to align game elements with the concepts surrounding rewards and motivation, student learning and assessment, and students' perception of games and cognitive development. Thus, there are many theoretical abstractions of the role game-based learning plays in improving student engagement, increasing learners perceived benefit of gaming, and positively influencing learners' motivation and cognitive knowledge of the learning objectives. Arena and Schwartz (2013), Day-Black et al. (2015), and Gauthier, Corrin, and Jenkinson, (2015) research focused on using game-based learning as an intervention tool and of assessment of student learning. Digital gaming applications has been useful in promoting learning in difficult course subjects such as statistics (Arena & Schwartz, 2014), accounting (Fratto, 2011), biological sciences (Gauthier et al., 2015), journalism (Burzynski Bullard & Anderson, 2014), and nursing (Day-Black et al., 2015); a beneficial supplemental aid in the classroom (Simkin, 2013); and a useful instructional strategy for underperforming or at-risk students (Burzynski Bullard & Anderson, 2014).

Huang, Johnson, and Han, (2013) explored the relationship among game features, learner's perceived motivational support, and cognitive investment based on Keller's (2008) proposed Integrative Theory on Motivation, Volition, and Performance (MVP). The theory of MVP proposes that the learning process is initiated by motivational stimuli and cognitive techniques for learning, thus empowering the learner to make a commitment to perform a task (Huang et al., 2013). Additionally, in their article, Siko and Barbour (2012) discussed three philosophical justifications for the use of PowerPoint as a tool for game-design instruction. However, their review of the research examining the use of homemade PowerPoint games as learning and teaching tools did not produce any statistically significant findings. Nonetheless, Siko and Barbour (2012) and Siko (2013) argued that using homemade PowerPoint games in the classroom has evolved in a manner that reflects the Technological Pedagogical Content Knowledge framework (TPACK). The TPACK framework is an interactive framework that ties in technological, pedagogical, and content knowledge in teaching, learning, and instructional design (Siko & Barbour, 2012). More specifically, Siko and Barbour (2012) theorized that educational games are aligned with Papert's (1991) constructionist pedagogy. Papert (1991), a student

of Piaget, believed that people learn through the construction of meaningful artifacts, or what is known as concrete thinking.

The first justification for using homemade PowerPoint games, as noted by Siko and Barbour (2012) and Siko (2013), is that they require a narrative or storyline, which is a motivational feature that many students love. The second justification for using such games is the use of microthemes, which forces students to write questions using little space on the slides. The final justification revolves around the process of writing questions about the content (Siko & Barbour, 2012). As suggested by Siko and Barbour (2012), employing question writing as an instructional tool can lead to increased performance on assessments and increased understanding of higher order concepts. To better understand undergraduate students' research and writing strategies and study habits, Rendahl and Kastman Breuch (2013) conducted a case study of two online first-year writing courses using an explanation from Albert Bandura's (1971, 1986) Social Cognitive Theory to support their findings.

Other emerging theoretical frameworks for assessing learning is largely based on educational data mining methods and the evidence-centered design (Gauthier et al., 2015). Gauthier et al. (2015) suggested using educational data mining, which involves tracking the frequency of users' clickstream with the interaction of game features by analyzing behavioral patterns or trends. In addition to using educational data mining techniques to track user behavior, the evidence-centered design serves as a framework for making connections between game features and students' academic performance, self-efficacy and motivation for learning, and teaching effectiveness (Gauthier et al., 2015). The evidence-centered design integrates three models: student, which defines the intervention's learning objectives; evidence, which describes the behaviors that students are learning; and task, which defines the tasks or problems needed to elicit a learning behavior (Gauthier et al., 2015).

Effectiveness of Online Literacy Tutorials/ Modules

Johnston (2010) suggested that implementing an online information literacy tutorial into the course curriculum was the most effective method for delivering information literacy instruction for first-year social work students at James Cook University. Johnston (2010) stated that the online information literacy module consisted of various tasks, such as developing effective search strategies, finding and accessing online databases and search engines, evaluating the quality of information, and using APA tools for referencing and citing sources in the appropriate format. Additionally, through this module, students had access to online materials such as podcasts, screencasts, and discussions boards through the student LMS, Blackboard. Evaluation of the effectiveness of the online information literacy module was measured through quantitative and qualitative research methods, including a survey, focus groups, empirical data from task results, and observations designed to assess students' knowledge of information literacy skills (Johnston, 2010). A class of 100 students undertook the information literacy module. Twenty-five students completed the survey, 13 on-campus students, and 12 off-campus. Unfortunately, the response rate was extremely low. However, many students who did respond to the survey reported that the module was easy to navigate, helped improve their research and referencing skills, and was a valuable learning tool for all subjects (Johnston, 2010).

Thornes (2012) also created an online tutorial to support postgraduate distance learners in the School of Geography at the University of Leeds. To accommodate differing learning styles, and encourage learning by doing, activities such as drag-and-drop exercises, quizzes, and videos were used in an integrated web-based game through the use of PowerPoint presentation tool. Unfortunately, the researcher encountered difficulties in obtaining qualitative feedback (short feedback survey) and quantitative data on the use of the tutorial. Only one of the distance-learning students completed the feedback form. Also, the tracking statistics were only stored for one month; the researcher was unable to draw generalizations about the results (Thornes, 2012).

Like Johnston (2010) and Thornes (2012), Gunn and Miree (2012), designed an online information literacy (IL) tutorial, which included a combination of instructional videos and active learning exercises. However, Gunn and Miree (2012) compared differences among students' discipline-specific information literacy skills by studying first-year and final-year undergraduate business students. As evident in their findings, firstyear and final-year business students' information literacy skills did not differ, and both groups received a significant positive impact because of taking the same IL tutorial online. Additionally, Zhang, Goodman, and Xie (2015) examined and compared the learning outcomes of 239 first-year engineering students enrolled at the University of Western Ontario in Canada. Using an online library module, which consisted of plain HTML text, interactive HTML text, images, and tutorial videos, combined with optional in-person tutorials, helped to improve information literacy skills from pretest (10.456) to posttest (13.843) (Zhang, Goodman, & Xie, 2015). Also, students reported, through two focus groups and a follow-up online survey, that they preferred the self-paced learning style of the online module, and that referring to it helped increase their research skills in the library, thus suggesting that students prefer online instruction over in-person instruction (Zhang et al., 2015). Although Johnston (2010), Thornes (2012), Gunn and Miree (2012), and Zhang et al. (2015) designed, implemented, and tested the effectiveness of an online information literacy tutorial, Arena and Schwartz (2014) studied the effectiveness of video game-based learning, while Gauthier et al. (2015) and Markey et al. (2008) studied the effectiveness of web-based games on student learning.

Efficacy of Video Games and Web-based Games

Arena and Schwartz (2014) used an arcadestyle video game called Stats Invaders! to test whether the game helped improve students' conceptual knowledge and understanding of random events and probability distributions. The game was designed to help teach statistics. Two groups of students played one of two versions of the video game, and one group of students did not play the game. Arena and Schwartz (2014) measured their overall learning gains with a posttest of explanatory knowledge using two parallel forms of a 10-item free-response test covering the concepts presented in the passage about probability distributions. Each participant received one form of the test as a pretest and the other form as a posttest. Statistical results show that students who played the game and read the passage learned more than participants who only

read the passage (Arena & Schwartz, 2014).

Gauthier et al. (2015), on the other hand, explored the educational impact of a web-based study aid-game for studying human vascular anatomy (n = 24) versus a similar non-game study aid (n = 22). The results of the pretest-posttest gains showed that students in the web-based game group had significantly higher scores compared to the control group. Gauthier et al. (2015) attributed differing study habits may have influenced the instructional tool in unexpected ways. Comparable to the Gauthier et al. (2015) study, Markey et al. (2008) assessed the effectiveness of a web-based board game for teaching undergraduate students information literacy concepts and skills. The research team provided monetary pay for winning teams to encourage participation and receive a half-letter grade increase if they answered 40% or more questions correctly in the course. Thus, 49 (65%) students signed up on 13 teams to play the game. Markey et al. (2008) logged data about game play and conducted focused group interviews. Per the daily logs, there were six successful teams that met the criteria, that is, answering the 18-question quota with 40% accuracy rate and seven teams that failed to meet the criteria. In addition to online information literacy/library tutorials and webbased games as a teaching and learning pedagogy, researchers have studied the impact of guiz-style PowerPoint games on student learning, which are increasingly becoming popular in both traditional and online learning formats.

Quiz-style PowerPoint Games as an Instructional and Learning Pedagogy

Burzynski Bullard and Anderson (2014) designed a PowerPoint quiz study game called "I'll Take Commas for \$2000," which resembles the quiz-games such as Jeopardy and Twenty Questions. Burzynski Bullard and Anderson (2014) used a quasi-experimental design to determine whether students' mastery and retention of basic grammar improves more by playing games than by instruction through a traditional lecture format. Pretest and posttest scores from grammar tests from two groups of students (game group (n = 47) vs. traditional lectures and grammar exercises (n = 45) group) enrolled in Beginning Editing classes at a Midwestern journalism college were examined (Burzynski Bullard & Anderson, 2014)). In addition to pretest and posttest measures, students in all sections of both courses (n = 92) took a selfadministered survey through Survey Monkey to gauge students' perceptions of learning and performances after the grammar lessons. This study was based on the constructivist theories of cognitive development, which emphasizes social interaction and student-driven knowledge construction as essential to the learning process (Burzynski Bullard & Anderson, 2014).

Grammar test scores were analyzed using a two-way analysis of variance (ANOVA), which examined the effect of Time (pretest, posttest) and Instruction Type (games, no games) on test scores (Burzynski Bullard & Anderson, 2014). Burzynski Bullard and Anderson (2014) reported no significant difference between the two groups' pretest scores, suggesting that all students had the same basic knowledge of grammar skills at the beginning of the course. A review of the descriptive statistics indicated that all the perception scores appeared to be high. This meant that the students had a positive attitude toward using technological tools for learning, and they believed the Twenty Questions game contributed to their learning (Burzynski Bullard & Anderson, 2014). Similar to Burzynski Bullard and Anderson (2014), Fratto (2011) designed a quiz-style PowerPoint game using Twenty Questions to promote active learning in a managerial accounting course at Robert Morris University using Blackboard. Responses to a survey regarding students' perception of the Twenty Questions game using a 4-point Likert scale, on average, students found the game useful and they believed the game positively contributed to their learning (Fratto, 2011). Fratto (2011) recommended using quiz-style PowerPoint games as an active learning strategy for promoting meaningful learning for all undergraduate courses.

Likewise, Aljezawi and Albashtawy (2015), Karshmer and Bryan (2011), Simkin (2013), and Webb et al. (2012) developed a quiz-style PowerPoint pedagogy game like the popular television game show Jeopardy! and used it as a learning and assessment tool for a variety of academic courses. For instance, Aljezawi and Albashtawy (2015) compared students' performance, satisfaction, and retention of knowledge between a Jeopardy!style game format and a didactic lecture format in teaching models of organizing patient care to fourthyear nursing students at Al al-Bayt University in Jordan. A total 66 students completed the study and pretest results showed no significance difference between the two groups in their achievement scores (Aljezawi & Albashtawy, 2015). However, posttest scores and the retention test for the students in the quiz group scored significantly better than those in the lecture group. In addition, students' responses to a satisfaction questionnaire, a 5-point Likert scale survey, suggested that students were significantly satisfied with the quiz-style game format compared to the lecture format (Aljezawi & Albashtawy, 2015).

Using Bloom's Taxonomy to create questions and categorize them into four information literacy categories along with integrating ACRL IL standards for information literacy instruction, Karshmer and Bryan (2011) found that employing a library Jeopardy! game was an effective formative assessment in assisting students with library navigation. A total of 361 freshman students completed the library session evaluation form and rated the Jeopardy! game as the most useful compared to the videos and library session (Karshmer & Bryan, 2011). Additionally, Simkin (2013) conducted eight experimental trials in five separate undergraduate information systems classes to determine the effectiveness of using a Jeopardy! quiz-style PowerPoint game in assessing teaching effectiveness and measuring student performance. Using a pre-game and post-game design, Simkin (2013) compared the treatment group (Jeopardy) and the control group (non-Jeopardy), and based on matched-pairs test, no significant differences in test scores were found. In addition to the in-class multiple-choice exam to measure the game's teaching effectiveness, Simkin (2013) administered an in-class survey to assess student perceptions of the quiz-game, and most students indicated that the Jeopardy! game was fun. However, due to low response rates, it is difficult to say if students valued the Jeopardy! game or not. These findings demonstrate the need for more empirical studies to identify game features or factors that lead to better learning gains (Simkin, 2013).

Furthermore, to improve learner engagement and outcomes in a geriatrics course at Medical College of Wisconsin in Milwaukee, Webb et al. (2012) used a Jeopardy! quiz-style game show model similar to Karshmer and Bryan (2011), and Simkin (2013); however, Webb et al. (2012) found through paper-based pretests and posttests, graduate students' short and long-term medical knowledge increased significantly with the use of the Jeopardy! game. In addition, based on the student survey which included Likert scale ratings, students positively rated that the quiz-game added educational value to their learning (Webb et al., 2012). According to Webb et al. (2012), quiz-style PowerPoint games can be used as an effective teaching strategy to promote learning, increase student engagement, and improve student motivation and satisfaction in a course.

TURNING RESEARCH INTO ACTION FOR IMPROVING INFORMATION LITERACY OUTCOMES

On a national level, academic institutions, the U.S. Department of Education (2015), and the American Library Association (2000, 2015) are currently seeking new developments in information literacy assessment, library instruction, and digital media resources to raise the national literacy proficiency levels among college students in higher education. In fact, the U.S. Department of Education (2015) is urging institutions of higher learning to integrate innovative technologies in their classrooms to improve student attendance, retention, and graduation rates. Schools remain slow in adopting these changes due to various reasons such as budget constraints, faculty resistance to make changes, lack of support from administrators for revising the curricula, infrastructure issues or technological barriers, and poor communication and collaboration between stakeholders (Gee, 2007, 2008, 2010, 2012; Squire, 2010, 2013). As a result, faculty may resort to traditional methods of delivering information literacy instruction to students, which based on previous empirical studies from the research literature, do not lead to successful learning outcomes (Fain, 2011; Loo et al., 2016).

To develop deep and meaningful learning, active learning strategies have shown to promote learning, increase student engagement, foster critical thinking, encourage problem-solving, support student motivation, and enhance student satisfaction of learning experience in a course (Detlor et al., 2011-2012; Hsieh et al., 2015; Loo et al., 2016). Active learning strategies for information literacy instruction can include non-digital, inperson, computer-based, and virtual games for various academic courses and students (Margino, 2013; Smale, 2011). To improve information literacy outcomes for first-year college students, especially literacy gains for at-risk or underperforming students, gamification can be used as a conceptual framework for pedagogy assessment (Day-Black et al., 2015; Gee, 2012; Giles, 2015; Squire, 2013).

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