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Learning Through Quests and Contests: Games in Information Literacy Instruction

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Article

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Abstract

Games-based learning is an innovative pedagogical strategy employed at all levels of education, and much research in education, psychology, and other disciplines supports its effectiveness in engaging and motivating students, as well as increasing student learning. Many libraries have incorporated games into their collections and programming. College and university libraries have begun to use games for information literacy and library instruction. Academic librarians use commercially-produced games, create their own games, and employ game principles and mechanics to enhance their traditional instructional offerings. While there may be impediments to implementing games-based learning for information literacy, the promising benefits of this approach outweigh the obstacles. Using games in library instruction capitalizes on the many similarities between games and the way that students do research, and has the strong potential to increase student engagement in information literacy training.

Introduction

Gaming in libraries has become popular over the past decade and much has been written about games in all types of libraries (Gallaway, 2009; Levine, 2006, 2008, 2009; Mayer & Harris, 2009; Neiburger, 2009). While the use of games in public libraries often seems like a natural fit, using games in academic libraries is perhaps a less obvious choice. However, with games-based teaching and learning at all levels of education receiving attention and research from both the academic and professional worlds, incorporating games into academic libraries is a logical step.

Information literacy and library instruction is a vital component of academic librarianship, and games-based learning has much to offer in this arena. This review of the literature begins with a presentation of the major educational and psychological research into games-based learning. I discuss recent applications of games-based learning to information literacy and library instruction, and highlight examples of digital and non-digital games as well as game principles used in instruction. While there are several potential barriers to games-based learning, the benefits of using games for information literacy instruction far outweigh the drawbacks.

Games-Based Learning

A criticism frequently voiced about games-based learning arises from the notion that playing games is strictly a leisure activity, while education is (or should be) serious work. As Rieber, Smith, and Noah (1998) note: "The commonsense tendency to define play as the opposite of work makes it easy to be skeptical that play is a valid characterization for adult behaviors" (para. 8). However, there is a large and growing body of research that supports the efficacy of games in teaching and learning. Games can "provide structure and organization to complex domains" (Rieber et al., para. 21), and "create *intrinsic motivation* [emphasis in original] through fantasy, control, challenge, curiosity, and competition" (Squire, 2005, para. 5). These elements of games are also critical components of learning.

It is impossible to discuss research into games-based learning without mentioning one of the field's most prominent scholars: James Paul Gee, Presidential Professor of Literacy Studies in Education at Arizona State University. Gee (2005) observes that many of today's video games are "hard, long, and complex," yet still immensely enjoyable (p. 34); indeed, gamers will play for hours, extremely focused on the game. Gee suggests that "good video games incorporate good learning principles, principles supported by current research in cognitive science" (p. 34).

Many features of games facilitate learning (Gee, 2005, pp. 34-37); for example:
- Games allow players to take on a new identity, which enables learners to make "an extended commitment of self."
- Games are interactive, and players must perform some action in order to receive feedback.

- Games encourage risk-taking; players can repeat a task several times and "fail forward," that is, use what they have learned from that failure in their next attempt.
- Games are scaffolded (to use the instructional design term) into well-ordered problems; players form hypotheses and gain competencies in the early stages of a game that will be used and built on in later stages.
- Players learn by doing—"performance before competence." Many video games, for example, include an explicitly designed training level as the first section of the game.

Gee expands these attributes into 36 learning principles present in games in his seminal work *What Video Games Have to Teach Us About Learning and Literacy* (first published in 2003, revised 2007). Many other attributes of games promote learning: they offer multiple ways to learn, provide an opportunity for active learning, and encourage experimentation and discovery (Gee, 2007, pp. 221-227).

Shaffer, Squire, Halverson, and Gee (2005) stress one benefit of games-based learning: it immerses players in a community of practice (2005, p. 107). When combined with the ability to take on a new identity, this immersion leads players to situated understanding of a body of knowledge (Shaffer et al., 2005, p. 106). For example, when a player acts as a biologist, historian, or urban planner in a game (performing tasks that mimic those performed in the real world), she has the opportunity to learn by doing. Players also gain content knowledge, as facts difficult to memorize through rote learning "comes easily if learners are immersed in activities and experiences that use these facts for plans, goals, and purposes within a coherent domain of knowledge" (Shaffer et al., 2005, p. 109).

The benefits of games-based learning may be especially pronounced with so-called digital natives, the 18-26 year olds who constitute the majority of undergraduate college and university students. Researchers have studied differences in the ways that learning was structured in the past compared to the preferences of current students. For example, learning a task by reading the manual rather than assuming that the interface will teach you how to use it, as is standard in most video games. It has been suggested that digital natives may learn best in ways that games—especially digital games—can teach (Prensky, 2001, p. 2). Many features that digital natives are most comfortable with are built into video games:

> Digital Natives are used to receiving information really fast. They like to parallel process and multi-task. They prefer their graphics before their text rather than the opposite. They prefer random access (like hypertext). They function best when networked. They thrive on instant gratification and frequent rewards. They prefer games to 'serious' work. (Does any of this sound familiar?) (Prensky, 2001, p. 2)

Some of the most promising uses of games for teaching and learning are the new opportunities they may provide for assessment. As Gee (2005) and others note, assess-

ment measures are inherent in the structure of games (Ellis, 2008); it is usually impossible for a player to progress in a game until she has mastered the current task or level. A recent article in the *Chronicle of Higher Education* highlights games used as "stealth assessment" (Kaya, 2010). Competencies that are difficult to measure with traditional assessments, such as problem-solving, critical thinking, and inquiry skills, may be evaluated by observing student actions within the context of gameplay (Kaya, 2010, para. 5). Faculty may even adjust the gameplay to address differing levels of competency, in order to give students more time to work on skills or concepts they experience difficulty mastering (Kaya, 2010, para. 18). With the increasing need to demonstrate the value of higher education, especially in the current economic climate, games have the potential to make a significant contribution to assessment strategies.

Information Literacy Games

Published material on games in academic libraries primarily focuses on three topics: game collections for libraries (both digital and non-digital) with related outreach and gaming events; collection development for the evolving disciplines of game studies and game production; and using games for information literacy and library instruction (Branston, 2006; Harris & Rice, 2008; Wieder, 2011). Interest in games-based learning in college and university libraries is high, as evidenced by the increasing numbers of articles, books, and presentations on the topic (McDevitt, 2011).[1] This discussion below addresses the use of games-based learning in information literacy and library instruction. While this review is thorough, it is not comprehensive, as it focuses on the scholarly literature, primarily books and articles, published through the end of 2010.

Commercially-Produced Digital Games

The production of video games for computers, consoles, arcades, handheld devices, and cellphones is a booming industry buoyed by the growing population of gamers of all ages and backgrounds. Many libraries are experimenting with using digital games for information literacy instruction. Some academic librarians use commercially-created video games to teach information literacy concepts. Waelchli (2008) maps the ACRL Information Literacy Competency Standards to individual elements of three popular video games of different genres: *Final Fantasy*, an adventure game;[2] *Halo*, a first-person shooter;[3] and *Madden*, a football game (pp. 214-215). VanLeer (2006) examines the popular massively multiplayer online role playing game (MMORPG)—*World of Warcraft*[4]- and finds that gameplay meets most of the ACRL information literacy stan-

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[1] This forthcoming book of games for use in information literacy and library instruction—*Let the Games Begin! Engaging Students with Interactive Information Literacy Instruction*—includes a chapter written by the author titled "Quality Counts: Evaluating Internet Sources."

[2] An adventure game is described as "a video game in which the player assumes the role of protagonist in an interactive story driven by exploration and puzzle-solving instead of physical challenge" ("Adventure Game," n.d.).

[3] This kind of video game "centers the gameplay around gun and projectile weapon-based combat through the first-person perspective" ("First-person shooter," n.d.).

[4] A MMORPG "is a genre of role playing video game in which a very large number of players interact within a virtual game world" ("Massively multiplayer online role-playing game," n.d.).

dards for finding, evaluating, and using information (p. 52-53). Schiller (2008) undertakes a detailed analysis of the video game *Portal* and also finds much evidence of information literacy within this popular game.

Other academic libraries are experimenting with modifying ("modding," in gaming terminology) existing commercial video games to shape them into a learning experience that more explicitly teaches information literacy competencies. Librarians at the University of Calgary are at work converting the engine that runs the acclaimed video game *Half-Life 2* into an information literacy game titled *Benevolent Blue*. Modding a game to incorporate information literacy can take advantage of features of the game that have already proved popular and engaging with players: narrative, player actions (in this case, the typical actions of a first-person shooter game), and the physical game space (Clyde & Thomas, 2008) that can leverage the research behaviors built into many current video games.

Information Literacy Video Games

Most academic libraries using video games for information literacy instruction create their own digital games specifically for student use. In some cases librarians partner with others at their institutions, for example, students or faculty in new media or computer science departments, while in other instances these games are created solely by librarians. An early example of a digital game intended to provide students with an introduction to library research was *The Data Game* from Colorado State University. *The Data Game* was an online game that consisted of a set of four tutorials presented in the style of popular television game and quiz shows (Thistlethwaite, 2001, p. 13).

A few years later Fletcher Library at Arizona State University created an online information literacy game titled *Quarantined! Axl Wise and the Information Outbreak.* Development began with the initial creation of a board game called *Information Pursuit*, designed to evaluate student responses to using games in library instruction, and culminated in the release of *Quarantined!*, the digital game. Both the board game and the digital game were specifically designed for introductory English Composition students. Students played *Information Pursuit*—a question-and-answer style board game—during their library sessions and responded positively. This encouraged the Fletcher Library Game Project to develop *Quarantined!*, a digital adventure game in which players learn information literacy competencies while trying to contain a viral outbreak on campus. Students also played *Quarantined!* during their library sessions; their responses were mixed, with some students finding the game to be too long and complex (Allgood & Gallegos, 2007; Gallegos & Allgood, 2008).

Librarians at the University of North Carolina at Greensboro (UNCG) created a Web-based board game called *The Information Literacy Game*, designed to meet information literacy learning goals for first-year students. Up to four players play by rolling a digital die and moving around the board by correctly answering questions in four categories. Students who played the game during library instruction sessions reported that they both enjoyed the game and learned about the library while playing. Additionally, the

game's creators provide Creative Commons-licensed source files for the game on the UNCG website. Anyone is free to download and modify the game for their own institution (Rice & Harris, 2007; Rice, 2008).[5]

Brown, Ceccarini, and Eisenhower (2007) describe their development of an information literacy MMORPG for the first-year writing program at George Washington University. They plan to develop a journalism game called *Muckrakers* in which students will "compete for the feature story in their magazine's next issue" (Brown et al., 2007, p. 230). A compelling feature of this game for librarians and course instructors is that scoring takes advantage of peer evaluation and thus is not overly burdensome (Brown et al., 2007, p. 230). Unfortunately, while the team was able to finish planning the game, the available funding was ultimately insufficient to finish a playable version. The game team plans to explore additional grant funding or possible partnerships with other institutions in the future in order to continue development (Brown et al., 2007, p. 231).

While they do not usually include all aspects of information literacy instruction, student orientations and library tours can provide a valuable introduction to the library for new students, and digital games can be used to help orient new students to the library. At Ohio State University, a team of librarians and student programmers created a game titled *Head Hunt* to supplement the campus summer orientation program for all first year students (O'Hanlon, Diaz, & Roecker, 2007, p. 105). To guide development of the game, librarians began by surveying current first year students to explore their prior experiences with the library and determine what additional information they would like to know about the library (O'Hanlon et al., 2007, p. 106). *Head Hunt* is a mystery game. Students must find the missing head of Brutus Buckeye, the OSU mascot, which is hidden somewhere in the library. By watching videos and playing through several mini-games students learn how to use the library while finding clues that help them solve the mystery, with prizes awarded for winners who submit their scores (O'Hanlon et al., 2007, p. 107).

Librarians at Carnegie Mellon University enlisted students enrolled in the Masters of Entertainment Technology degree program to help develop digital information literacy games. The team plans to create a game with six modules, each addressing an ACRL information literacy standard (Beck, Callison, Fudrow, & Hood, 2008, p. 139). Two modules were completed during the timeframe dictated by the academic schedules of the students participating in the project (Beck et al., 2008, pp. 141-142). The two resulting *Library Arcade* mini-games are designed to teach students how information is organized in an academic library using the Library of Congress Classification System (Beck et al., 2008, p. 139), and how to find relevant information for a research topic (Beck et al., 2008, p. 140).

The University of Florida's Marston Science Library developed an information literacy game to teach students how to do research in the library called *Bioactive* (Gonzalez et al., 2008, p. 165). *Bioactive* is a game in the genre of interactive fiction, which is "char-

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[5] Source files for *The Information Literacy Game* are available at
http://library.uncg.edu/game/mygame.asp.

acterized by a predominantly text-based game where the player, acting as the main character, navigates through a world using textual commands to explore regions and solve puzzles" (Gonzalez et al., 2008, p. 168).[6] A freely-available and relatively easy to use software package, Inform 7, was used by librarians to develop the Web-based game (Gonzalez et al., 2008, p. 168). During the game, students must complete four tasks to move through a story about bioterrorism, opening new browser windows to use library resources as they progress through the game (Gonzalez et al., 2008, p. 170). Librarians promote the game in the first-year writing courses as well as via the student newspaper and other campus marketing (Gonzalez et al., 2008, pp. 171-2), and have made the game source files available for other libraries to adapt for their own library in-struction needs (2008, p. 173).[7]

McCabe & Wise (2009) describe an IMLS-funded project to develop information literacy games at James Madison University. All undergraduates at JMU must pass a test of information literacy competencies during their first year at the university. Librarians identified two areas of student weakness on the test and created games for students to play to increase their skills in these areas (p. 9). The resulting games include *Citation Tic-Tac-Toe*, which teaches players how to identify citations in whole and in part, and *Magnetic Keyword*, in which players practice and refine their "ability to break a topic into keywords" (McCabe & Wise, 2009, p. 9). One interesting and useful feature of this pro-ject is the incorporation of assessment into the project plan (McCabe & Wise, 2009, p. 9); librarians have found that student skill levels rise after playing both games (McCabe & Wise, 2009, pp. 13-14).

At Lycoming College, Broussard (2010) developed a Flash-based digital game called *Secret Agents in the Library*. The game focuses on finding information (ACRL Informa-tion Literacy Standard Two) and "was specifically designed for use in the freshman composition course in the context of class-related library instruction" (Broussard, 2010, p. 23). Students work in teams to complete the game; the team with the highest score wins (Broussard, 2010, p. 24). After gameplay is complete, the librarian engages stu-dents in a short discussion and administers a review quiz using a classroom response system (Broussard, 2010, p. 25). After her experience developing this relatively simple online game for library instruction, Broussard concluded that the potential return on in-vestment is much higher for short, simple games than for more complex games (Brous-sard, 2010, p. 27).

One of the most ambitious information literacy digital game development projects has been in progress for several years. A research team led by Karen Markey at the Uni-versity of Michigan School of Information created a Web-based board game called *De-fense of Hidgeon: The Plague Years* (Markey et al., 2008a, 2008b, 2009). This game is intended to teach students how to do research, beginning with finding background in-formation and topic overviews and continuing on to using library catalogs, databases,

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[6] Classic examples of interactive fiction include *Adventure* and *Zork*. For more discussion, the authors refer to Nick Montfort's book *Twisty Little Passages: An Approach to Interactive Fiction*, published in 2003 by MIT Press (Gonzalez et al., 2008, p. 165 and 174).
[7] Source files for *Bioactive* are available at http://www.uflib.ufl.edu/games/bioactive/mutate.html.

citation indexes, and other research tools. Students play in teams and advance along a game board (rolling a digital die) as they complete research tasks (Markey et al., 2008b, para. 5). After development, the game was tested by students in an introductory information literacy course; evaluation included both gameplay statistics as well as student surveys (Markey et al., 2009, p. 306).

After testing and evaluating *Defense of Hidgeon*, Markey's team decided to create "a new information literacy game that is a pervasive and unobtrusive presence beside the online tools students use to research, write and document a writing assignment" (Markey et al., 2008b, para. 53). Student discussions after playing *Defense of Hidgeon* revealed a clear preference for educational games that are directly related to their coursework (Markey et al., 2010, para. 1). In response the team developed a new game, *BiblioBouts,* in which students search for, compile, and evaluate sources on their research topics (Markey et al., 2010, para. 6, 8). During gameplay students use Zotero, the free online citation management system (Markey et al., 2010, para. 4) to complete the game by creating a bibliography of sources that they may use for their coursework (Markey et al., 2010, para. 8). Evaluation of the first round of testing *BiblioBouts* is currently underway, with a second round in progress at several colleges and universities (Markey et al., 2010, para. 59).

It is difficult to determine how many of these digital games for information literacy and library instruction are still being used. Just as traditional curricular materials evolve and change over time, we can expect that games-based pedagogies are also in constant flux. As the content has become dated in some of these games, they may have been retired from service. It is also possible that some games were incorporated into other online information literacy modules or tools. As of May 7, 2011, Carnegie Mellon's *Library Arcade* games, the University of Florida's *Bioactive*, and Ohio State University's *Head Hunt* are still available on their websites. While James Madison University's games are also still online, they do not appear to be linked from the library website. However, since these games complement the information literacy assessment at JMU they may not be marketed to the entire university community. Lycoming College's *Secret Agents in the Library* continues to be featured on the library website, as do several other short information literacy and library games. *The Information Literacy Game* is still available on both the UNCG website and at the learning objects repository MERLOT (Multimedia Educational Resource for Learning and Online Teaching), and it has been downloaded and modified by several additional libraries. *Defense of Hidgeon* is also still available online, and, as mentioned above, *BiblioBouts* continues to be used, tested, and modified.[8]

Non-Digital Information Literacy Games

Digital games receive far more mainstream media attention than non-digital games; however, board, card, pen-and-paper, or dice games can also be used effectively in teaching and learning. These games feature many of the same learning principles emphasized by Gee (2005) and other researchers, and academic librarians have success-

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[8] See Appendix 1 for a list of active game URLs.

fully incorporated many kinds of non-digital games, from simple to complex, into information literacy instruction.

Quiz show-style games are a popular choice for librarians who wish to use non-digital games in library instruction. Leach and Sugarman (2006) discuss their use of a game based on the popular TV game show *Jeopardy!* at Georgia State University. Librarians project a website that hosts the game board while students compete to answer questions read by the librarian (Leach & Sugarman, 2006, p. 197-198). Librarians at Penn State Berks have also played *Jeopardy!* in library instruction, using a template created as a slideshow in PowerPoint to project the game board (Walker, 2008, p. 383). Walker (2008) notes that awarding candy and other small prizes to students encourages participation (p. 386). Quiz show-style games can be used both to introduce new material and to review content covered in a prior session, and typically require very little time to explain in the classroom since most students are familiar with these types of games (Leach & Sugarman, 2006, p. 199; Walker, 2008, p. 385).

Librarians have also used non-digital games in course-integrated library instruction. Smith (2007) describes the introduction of classroom games into a Chemical Information Research Skills course at the University of Notre Dame. A number of simple pen and paper games were modified to include information literacy topics of relevance to the course, including tic-tac-toe, crossword puzzles, word finds, and word jumbles (Smith, 2007, p. 3-4). Students received small prizes for completing each game, which increased their motivation to play through the games in class (Smith, 2007, p. 4).

At Nassau Community College, Spiegelman (a librarian) and Glass (a mathematics and computer science professor) created games to encourage information literacy competencies in math and computer science classes. They developed writing assignments that "included reality show techniques in which students had to work in teams, locate information, and voted on the best results" (Spiegelman & Glass, 2008, p. 524). Students posted the results of their research to a blog or wiki and vote on their classmates' work. As the course librarian, Spiegelman was also able to work with students who had questions about their research (Spiegelman & Glass, 2008, p. 524).

To replace a library tour for students in a required Introduction to College Life course at Queensborough Community College, Marcus and Beck (2003) described the development of a treasure hunt, that is, a game that requires students to search for clues in the library to solve a mystery. They suggest that games-based learning is especially appropriate for general library orientations in which students have no immediate assignment or course-related reason for visiting the library; students are motivated to play the game by the opportunity to receive small rewards or prizes (Marcus & Beck, 2003, p. 24). Further, a self-guided library treasure hunt requires much less work by instruction librarians to implement than the traditional library tour (Marcus & Beck, 2003, p. 25). On the short test administered after the library orientation, students who played the game scored higher than those who received a traditional library tour (Marcus & Beck, 2003, p. 31).

Librarians at Niagara University also redesigned their required library orientation for first year students to include a game. They created a Library Mystery Tour to introduce students to library resources and services and aligned the learning goals and objectives for the tour with the ACRL Information Literacy Standards (Kasbohm, Schoen, & Dubaj, 2006, p. 38-39). The game engages students to solve the mystery of the missing valet of author F. Scott Fitzgerald (Kasbohm et al., 2006, p. 38); students receive small prizes for solving the mystery (Kasbohm et al., 2006, p. 41). Pre- and post-test results suggest that students are more familiar with the library and its resources and services after playing (Kasbohm et al., 2006, p. 45).

At Trinity University in Texas, librarians developed an alternate reality game (ARG)[9] called *Blood on the Stacks* to increase engagement during the annual new student orientation (Donald, 2008, p. 189). While an ARG is similar to a scavenger hunt, a unique feature is "the immersion players experience because elements of the game world and real world overlap." For example, players encountered real-life game characters—in this case, librarians (Donald, 2008, p. 190). The game occurs over three days and requires groups of students to use a custom game website, the library website, and the physical library to solve the mystery of a theft of an Egyptian artifact from a library exhibit (Donald, 2008, p. 194). Student groups score points for completing the game tasks and answering bonus questions about the library; the two groups with the top scores receive a catered midterm study break (Donald, 2008, p. 198). The orientation was very successful: 75% of incoming students participated (Donald, 2008, p. 199), and when surveyed after the game, most students reported that they felt more comfortable using the library (Donald, 2008, p. 200).

Games are also used by academic librarians during participation in college or university-wide outreach, as at Western Michigan University during a college recruitment event. Prospective students are divided into teams to complete several mini-games in the library involving research resources, library services, and information literacy (Behr, Bundza, & Cockrell, 2007, p. 7). Student evaluations of the event were positive and several students even submitted applications for jobs in the library once they had matriculated at the university (Behr et al., 2007, p. 9). Librarians also note the positive response to this event from the university community and emphasize that participation in outreach events can raise the library's profile on campus (Behr et al., 2007, p. 12).

More recently, Johnson, Buhler, and Hillman (2010) described participating in the campus-wide alternate reality game *Humans vs. Zombies* at the University of Florida. Librarians reached out to the student organizers of the game and added a library "mission" to the overall game structure, complete with two information literacy learning objectives (Johnson et al., 2010, p. 31). While the mission was not a required component of the broader *Humans vs. Zombies* game, about 20% of registered players (183 students) took part (Johnson et al., 2010, p. 34). The program was a success, and "proved

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[9] ARGs have been described as "interactive narrative[s] that uses the real world as a platform, often involving multiple media and game elements, to tell a story that may be affected by participants' ideas or actions" ("Alternate reality game," n.d.).

to be an effective way to engage students and teach traditional library skills" (Johnson et al., 2010, p. 36).

Game Principles for Information Literacy Instruction

Game mechanics and principles are the structures of and actions or strategies used while playing a game, and may also be used in information literacy and library instruction. Many mechanics from both digital and non-digital games can easily be incorporated into information literacy and library instruction. For example, students may be asked to search for information to solve a mystery, often called a "knowledge quest" (or treasure/scavenger hunt, as discussed above), or to gather evidence to use to solve a problem (Doshi, 2006, para. 7-8), both common features of many board and video games.

Since many students are familiar with digital games, academic librarians may wish to use "video game strategies during instruction to create a relevant and meaningful experience for students" (Waelchli, 2008, p. 212). Waelchli (2008) describes his use of video game strategies for library instruction at the University of Dubuque. Information literacy concepts taught included evaluating information, finding research sources, and a review of the research process (pp. 220-221). For example, a PowerPoint presentation on the research process features multiple possible paths, and a student response system (commonly called "clickers") is used to allow students to vote to determine each step of the process, similar to the branching that occurs when playing through an adventure video game (Waelchli, 2008, pp. 221-223). Waelchli (2008) suggests that using multiple strategies at the same time has the greatest effect on learning (p. 219).

Martin and Ewing discuss using game principles to increase student engagement and motivation in information literacy and library instruction. Principles to incorporate include: rules and goals, challenges (especially if scaffolded to increasing levels of difficulty), the ability to exert control over the progress of the game, and fantasy, in which "real-life consequences are lessened" (Martin & Ewing, 2008, p. 214-216). One specific game mechanic recommended by Martin and Ewing (2008) is the power-up: "abilities or tools obtained by the player that produce an added advantage;" for example, additional weapons or greater speed (p. 221). Power-ups that may be relevant to library instruction include the unlocking of Boolean operators and truncation symbols, which can be introduced to students if they encounter difficulties with the search process (Martin & Ewing, 2008, p. 221).

Potential Barriers to Games-Based Learning

Despite the many benefits of using games in teaching and learning, there may be obstacles to overcome when incorporating information literacy games into the library classroom. Games take time to learn, for both instructors and students, time that may be perceived as better spent on the subject matter of the course or lesson. Further, game development can be very time-intensive, especially for video games (de Freitas, 2006, p. 16). It is not unusual for a project team to spend a year to design, develop,

and release one or two online games (Beck et al., 2008; Gallegos, Allgood, & Grondin, 2007); the development cycle for other digital information literacy games is even more lengthy (Clyde & Thomas, 2010; Markey et al., 2010). Given the amount of time that may be used to create information literacy games, it is possible that "wasted efforts will be the greatest fear of educators and librarians involved in game development" (Branson, 2006, para. 15).

Games usually involve materials (game boards, dice, cards, computers, etc.) that may range from inexpensive to costly (de Freitas, 2006, p. 16). There are also the costs of game development (deWinter et al., 2010, para. 5-6). Indeed, many of the information literacy video games discussed above required significant financial investment and were often funded via grants (Beck et al., 2008; Markey et al., 2008a, 2010; Thistlethwaite, 2001). Pedagogical and technical support may be necessary for both instructors and students (de Freitas, 2006, p. 16), which carries additional costs. While relatively inexpensive and user-friendly applications for developing digital games do exist,[10] issues of time and technical skill may limit opportunities for many librarians to use them. As Martin and Ewing (2008) suggested, "creating digital games for library instruction may not be feasible with tight budgets and limited staff" (p. 212).

Instructors interested in using games in teaching must also consider issues of access to required game materials and supplies. Will students play games in a traditional classroom, a computer lab, at home, or outside of school, and will materials be available in those locations (de Freitas, 2006, p. 16)? Again, access may be particularly problematic for digital games, which could ostensibly be played on a game console, computer, handheld system, or cellphone. While common, these technologies are still unevenly distributed throughout the college and university student population (deWinter et al., 2010, para. 17).

While it is not always possible for students to learn in the ways that they prefer, it is worth asking whether our students are interested in games-based learning. Some information literacy games are designed to be played as part of a curriculum, either in an entire course or as individual class sessions, and some are deployed outside of class and curricular time. It seems safe to assume that the games that we hope students will play on their own time must be most engaging. Despite the strong attraction of games, it has been noted that students are generally uninterested in playing information literacy games outside of class unless their participation is graded (Markey et al., 2008b, para. 48). Perhaps a grade signifies that the game activity is a meaningful and important component of the course, and of course there is the motivational force of the grade itself. In addition, many of the games discussed above provide external motivators for students in the form of small prizes.

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[10] Examples include Scratch, developed at MIT (http://scratch.mit.edu/), as well as many more recent commercial software programs, some of which are available for free. Adobe's Flash application has also been used for well over a decade to create games and other interactive multimedia content for Web sites (http://www.adobe.com/products/flash.html).

Conclusions: Why to Use Games for Information Literacy Instruction

Given the possible impediments discussed above, why should we strive to incorporate games-based learning into information literacy and library instruction? One of the most compelling reasons is that information literacy competencies and research behaviors are an intrinsic part of many games (Branston, 2006; Doshi, 2006; Martin & Ewing, 2008; VanLeer, 2006; Waelchli, 2008, 2010). Consider the popular *Legend of Zelda* video game series by Nintendo. These adventure games require players to travel around a large virtual world gathering information and items to use to complete puzzles, defeat enemies, and eventually finish the game. In many ways this is similar to the process that students must go through when completing a research project: they search for and gather information on a topic, decide which sources are relevant and useful, and use that information to accomplish their goal, for example, writing a paper. VanLeer (2006) asserts that "games provide an *information pull* [emphasis in original], because players must figure out what they need to do, and what tools they need to accomplish their goals. They go into the game seeking information about their tasks" (p. 52). Research shares these attributes; doing research is, on one level, a game.

Using games in our classrooms can also help overcome challenges inherent in library instruction. Much of our students' explicit and focused exposure to information literacy takes place in one or two classroom sessions—the infamous "one-shot"—the limitations of which are well established. Without much time or contact with students it can be difficult for librarians to keep students interested and engaged in research and library instruction. Incorporating games into library instruction allows librarians to include opportunities for active learning and "instruction is more effective for students when it includes a high level of student participation" (Leach & Sugarman, 2006, p. 194). Research tools and information literacy concepts are not intrinsically interesting to most students, and activities that increase interaction in the classroom can increase student motivation and engagement (Branson, 2006, para. 9; Doshi, 2006, para. 3).

Like all methods of information literacy and library instruction, games-based learning must be tied to specific learning goals and outcomes for class sessions or a course. Academic librarians using games in the classroom "should select, adapt, and direct the game so that it is enjoyable for the students but also has a definite purpose and defined learning outcomes" (Leach & Sugarman, 2006, p. 200). An additional benefit of many games is that they provide instruction librarians with valuable feedback on student comprehension of topics discussed during class sessions (Leach & Sugarman, 2006, p. 196), thus topics that are unclear or confusing may be reviewed with students immediately.

Academic librarians should incorporate games into information literacy and library instruction. While many information literacy games created by librarians are lengthy and feature-rich, it is important to realize that it is not necessary to develop a complex game. As demonstrated by many of the games discussed above, it is possible to create short games for instructional use—both digital and non-digital—with a small investment of time and funding. Further, the use of game principles and mechanics for information

literacy instruction can be implemented with very little overhead; for example, using commonly available materials to create dice, card, or quiz-based games, among others. The benefits of games-based learning—increased student engagement, motivation, and, ultimately, greater learning—are too compelling to ignore. Games-based learning has the potential to transform information literacy and library instruction.

Appendix 1: Information Literacy and Library Instruction Game Websites

BiblioBouts (http://www.bibliobouts.org/), School of Information, University of Michigan

Bioactive (http://uflib.ufl.edu/games/bioactive/), University of Florida

Citation Tic-Tac-Toe (http://www.lib.jmu.edu/tictactoe/), James Madison University

Defense of Hidgeon (http://www.storygameproject.org/), School of Information, University of Michigan

Head Hunt (http://library.osu.edu/headhunt/), Ohio State University

The Information Literacy Game (http://library.uncg.edu/game/), University of North Carolina at Greensboro

Library Arcade, including *I'll Get It!* and *Within Range* (https://libwebspace.library.cmu.edu:4430/libraries-and-collections/Libraries/etc/), Carnegie Mellon University

Magnetic Keyword (http://www.lib.jmu.edu/games/MagneticKeyword/), James Madison University

Secret Agents in the Library and others (http://www.lycoming.edu/library/instruction/tutorials/), Lycoming College

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