College Student Perceptions of Learning Academic Research Skills through an Online Game

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Abstract: A research team at University of Michigan's School of Information has undertaken the 3-year BiblioBouts Project to design, develop, test, and evaluate an online game to teach incoming undergraduate students information literacy skills. While many universities and academic libraries aspire to comprehensive Information Literacy teaching goals, the challenge still remains of reaching a large number of students with a limited library staff with limited time and resources. To address this problem, the BiblioBouts Project enlists social gaming to teach information literacy skills to undergraduates while making it engaging and fun. After alpha testing in the fall of 2009, focus groups and individual follow-up interviews were conducted to evaluate the game's effectiveness. Preliminary findings on student perceptions of the academic research skills learned from the game and its effect on their information seeking behavior are presented.

1. Social Gaming for Teaching Information Literacy Skills

While many universities and academic libraries aspire to comprehensive Information Literacy (IL) teaching goals, the challenge still remains of reaching a large number of students with a limited library staff with limited time and resources. These goals rarely translate into reality. In fact, only a minority of institutions feature first-year experience programs where information literacy content is mandatory (Boff & Johnson, 2002). To address this problem, a University of Michigan research team is investigating how online social gaming can be used to teach information literacy skills to undergraduates while making it engaging and fun. Based on prior development experience with a story-based online game (Markey et al., 2010), the BiblioBouts game was designed around an in-class research paper assignment so that game play is integrated into the students' existing coursework. The overarching goal is to create an open-source learning game that is empirically tested and demonstrates results in improving students' IL skills. After development and testing is completed, the BiblioBouts game will be available to any interested members of the information literacy community.

BiblioBouts is a structured as a collection of mini-games or "bouts" which can be incorporated as an online accompaniment to the traditional in-class research paper assignment. The game actively engages students in the research process, demonstrating that research is not a singular skill but a set of discrete and interrelated. Through a series of "bouts," or game rounds, students are introduced to a step-by-step research process: searching for sources on a broad topic, selecting sources, evaluating sources for credibility and relevance, narrowing down the scope of the research topic, and selecting the best citations for that topic in the form of a bibliography of quality sources. BiblioBouts gives students repeated practice in each step of the process. The Donor and Closer bouts focus on searching online sources (scholarly and non-scholarly) for sources on a broad research topic and then selecting several to "put into play." In the Rating & Tagging, players evaluate each source through a series of questions asking the student to rate the extent to which they believe that the source is written by an expert, is trustworthy and is scholarly. In the final bout, Best Bibliography, players select sources from the shared library of rated and evaluated sources, encouraging them to think critically about the quality of the sources they choose for their bibliography. Throughout the game, players compete against each other in the game, earning points for meeting and exceeding individual quotas and earning extra points based on the quality of ratings they receive from other players and how active they are in participating in the game.

In the fall semester of 2009, the alpha version of the BiblioBouts game was pilot tested in an undergraduate course at the University of Michigan. The course instructor incorporated BiblioBouts into the course syllabus, requiring students to play and grading them on the extent to which they played the game and the quality of their game play. The purpose of this paper is to examine the game's impact on student research skills. This study presents preliminary findings on student perceptions of the academic

research skills learned from the game and its effect on their information seeking behavior. Two research methods were employed to gather data: focus group interviews and follow-up individual interviews using Instant Messaging (IM) chat. This paper addresses four research questions pertaining to student perceptions:

1. What is the perceived value of the BiblioBouts game for students?
2. How does playing the game affect the research behaviors of students?
3. To what extent have their information searching behaviors changed as a result of the game?

Confirming the usefulness of an online game in teaching students basic IL skills presents a new modality for broadening the reach of IL instruction to many more students who cannot be reached via traditional in-person instruction sessions. An online social game presents opportunities for students to participate in active learning through self-discovery, getting results by trial and error, following hunches and reinforcement through repetition, collaborative problem solving and participating in community learning environments. Thus, the results of this study are potentially of interest to a wide audience of librarians, information literacy instructors, faculty involved with undergraduate student research papers, information literacy organizations and educational policy professionals.

2. Literature Review

Several theoretical models were useful in analyzing the student interviews conducted to assess the impact of BiblioBouts. Much research has been conducted on documenting and evaluating the IL skills of college students and their modes of Information Seeking Behavior (ISB) and this research formed the basis for the analysis of the player interviews. In addition, specific cognitive models - the Principle of Least Effort, Satisficing, Competency Theory, Metacognition and Library Anxiety - provided useful insight into the behavior students discussed in their interviews. Since online social gaming for education is a hybrid pedagogical format, multiple modes of analysis were employed. Each of these models is a useful lens for identifying challenges and obstacles that students face when learning to conduct library research.

2.1. Information Literacy and Information Seeking Behavior Skills

Research shows that students who participate in information literacy classes demonstrate measurably improved skills (Wang, 2006) and that top tier students are more likely to report experiencing formal information literacy instruction (Gross & Latham, 2007). However, many students do not receive IL instruction at all, and there is evidence that many students are information illiterate when they enter college (Gross & Latham, 2007). Studies show that most students are confused by what college-level research entails, do not understand what quality research resources are and how to locate them on the Internet, are unable to narrow down topics to make them manageable and tend to become overwhelmed by the plethora of available resources (Head, 2007). Students often do not understand the difference between searching using a Web browser and using an online database (Jenson, 2004) or the difference between scholarly and popular journals (Caspers & Bernhisal, 2005). This unsophisticated use of online search tools can be partially attributed to college students' overwhelming reliance on Google to the exclusion of many other academic search tools. When conceptualizing online searching, "students see Google as being 'the' Internet, and they use these two terms interchangeably, seeing them to be one and the same thing" (Julien & Barker, 2009, p. 14). This often means that they make very little use of the advanced search facilities which are available, which is consistent with research that shows most online searchers do not use these features (Spink et al., 2001). Instead, "young scholars are using tools that require little skill: they appear satisfied with a very simple or basic form of searching" and assume that "search engines 'understand' their queries" (Rowlands et al., 2008, p. 297).

Young people who have grown up with a plethora of information sources readily available online view information credibility differently than older generations, and use different evaluation criteria (Rieh & Hilligoss, 2008). Research shows that young people spend little time evaluating information for relevance, accuracy or authority (Rowlands et al., 2008). Students have difficulties with relevance judgments (Heinstrom, 2005), and struggle with the basic task of narrowing down an assignment topic (Head, 2007). Julien and Barker (2009) noted that "understanding of critical evaluation criteria such as authority, accuracy, objectivity, currency, and coverage" was not evident among students, and that "Overall, students gave less emphasis to the *process* of finding information than to the end product of the search" (p. 15, emphasis in original).

The research habits of today's students are markedly different than their predecessors, as their research is often peer-based and tends not rely on conventional models of authority or expertise (Ito et al., 2008). Rieh and Hilligoss (2008) noted that "young people's strategies for seeking information and deciding whether to use certain information is deeply influenced by others with whom they feel socially close and with whom they share common ground" (p. 65). Manuel (2002) states that today's students "usually find peers more credible than teachers" and "opportunities for peer learning are incredibly important for Gen Yers" (p. 208). Today's students may be skeptical toward their teachers' assessments of what is "worth doing," and may be more motivated by and receptive to work that their peers see as "fun," or as work worth the effort (Manuel, 2002). This lack of critical engagement with the information seeking process shown in the literature on college student ISB is a motivating principle of the BiblioBouts project.

2.2. Cognitive Models

2.2.1. Principle of Least Effort

Originating in the work of Zipf (1949), the Principle of Least Effort (PLE) suggests that information seekers will often chose easily available sources of information, even when they clearly of lesser quality than other, harder to find sources (Rosenberg, 1966). Rosenberg suggests that ease of use of a method for information gathering is more important to users than the anticipated quality of the results. Gerstberger and Allen (1968) state that information seekers base their choice of potential information sources on "least average rate of probable work" (p. 277). The literature on PLE shows that most researchers, even experienced scholars, rely on information access systems that are perceived as easy to use (Mann, 1993). Valentine (2001) suggests that while professors may have expectations that their assignments will be learning experiences for students, students themselves often have other priorities and only want to do "what the professor wants" in order to complete an assignment. Valentine suggests that students will rely on the most time-efficient research methods, using the most familiar strategies and the easiest to obtain information first. Helping students overcome this tendency towards investing the least amount of effort is a challenge to teaching new IL skills.

2.2.2. Satisfacing

Related to PLE is the concept of "satisificing," a term coined by Simon (1956), which suggests that information seekers rarely conform to the idealized model of effective, motivated searchers who will follow all the steps of an idealized ISB model, but will instead accept the first satisfactory alternative over the best possible alternative (Buczynski, 2005). Quality of information results is often not the sole or primary motivation in college students' information seeking behavior, although this fact is not reflected in traditional theoretical models of ISB which emphasize a motivated, efficient and goal-oriented search process. In a longitudinal study of undergraduate information seeking behavior, Warwick et al. (2009) found that students completed information-seeking tasks with the minimum amount of effort judged necessary. Using "strategic satisificing," the subjects "estimated what the minimum literature requirements were and chose specific goals that they could fulfill easily and quickly with their existing

skills" (p. 2412). These students avoided the library, relied on familiar strategies to find satisfactory information with a minimum of effort, and were unwilling to move beyond their current skill level. New skills were only adopted when immediately required by an assigned task and students "deployed considerable ingenuity in finding ways to avoid or limit complexity" (Warwick et al., 2009, p. 2414). Helping students learn new methods of information seeking and evaluation must overcome this tendency to satisifice.

2.2.3 Competency theory

Competency Theory suggests that students who lack IL skills do not realize it and therefore are unlikely to seek out instruction (Gross & Latham, 2007). Students with low level skills hold inflated views of their own competence in information seeking and don't know their own weaknesses (Gross & Latham, 2007). Studies show that students tend overwhelmingly to self-identify as expert Web searchers, and often overestimate their abilities to find and evaluate online information (Manuel, 2002). Level of expertise is another important factor. Non-experts tend not to employ the search strategies of experts (author searching, citation searching, footnote chasing, journal runs, and known-item searching) but instead tend to rely on non-expert strategies such as subject and keyword searching (Drabenstott, 2003). In a study investigating the relation between standardized Information Literacy Test scores and Library Anxiety Scale scores of college undergraduates, researchers found that low-skilled students are unlikely to self-identify as lacking skills in either a classroom or library context, but at the same time are unable to assess the skill levels of others (Gross & Latham, 2007). Self-teaching or learning from friends were the most frequently reported methods reported by these students for learning research skills. The authors noted that "students who are unaware of a deficit in their IL skills are unlikely to seek skill remediation on their own or to engage with instruction when forced to take it" (Gross & Latham, 2007, p. 334). In addition, students often over-estimate their own abilities and simply do not know what they don't know (Brown, Murphy, & Nanny, 2003; Jenson, 2004). This tendency to overconfidence and inaccurate self-assessment is a challenge to teaching students new skills.

2.2.4. Metacognition

While critical thinking can be seen as a central aspect of information literacy (Bawden & Robinson, 2002), another equally important factor is Metacognition (Land & Greene, 2000; Quintana, Zhang, & Krajcik, 2005). In the context of online research, Land and Greene define metacognition as "the process of reflecting on, or monitoring the effectiveness of, the search process and then refining the process when necessary" (p. 57) while Quintana et al. define "metacognitive regulation" as "planning cognitive tasks, monitoring one's progress to meet goals, taking appropriate steps to solve problems, and reflecting on past performance for future improvement" (p. 236). These skills, while challenging to beginning researchers, are crucial to developing an academic research skill set.

2.2.5 Library Anxiety

The concept of Library Anxiety, first described by Mellon (1986), captures the feeling of discomfort many students feel about library research, and the associated emotions of perceived inadequacy, embarrassment and intimidation in the library environment. Students lacked knowledge about where sources were located and knowledge about how to begin the research process. As students transition from the high school library to the academic research library, they may be affected by unfamiliarity with new surroundings and general anxiety about success. Qun and Onwuegbuzie (1999) expand on the feelings of inadequacy students feel when comparing themselves to the perceived proficiency of other students, as well as feelings of familiarity and comfort with the library surroundings. Students also report being intimidated by librarians and fearful of asking questions lest they appear stupid or inadequate (Van

Scoyoc, 2003). Onwuegbuzie, Jiao and Bostick(2004) provide a detailed assessment of recent research into the library anxiety phenomenon.

2.3. Summary

The literature on IL and ISB skills and the associated cognitive models suggests that today's college students have difficulty with applying critical evaluation to online sources and lack the skills necessary to be effective users of the information that they are able to find. Many challenges to learning new skills and conducting effective library research that many students experience have been identified. These findings have implications for the design and implementation of instruction programs intended to reach low-skilled student, who may need "an intermediary instructional layer" (Jenson, 2004, p. 112) or "a new, different type of intervention" (Gross & Latham, 2007, p. 347). Online social gaming presents a new type of instructional intervention that can address many of these challenges, offering fundamental training in IL skills and critical evaluation which is integrated into coursework at the students point of need. An online social game can introduce students to resources that they may not have found on their own, thus moving them away from the easiest and most familiar online tools and towards greater use of scholarly sources. It can help students to conceptualize research as an ongoing process rather than a one-shot activity, while also incorporating features of collaborative peer-based learning that many of today's students prefer. While not all work can be made fun, increasing student receptiveness to skills they do not see as worthwhile can make an impact on their success in skill acquisition.

This literature on IL and ISB skills and the models of the Principle of Least Effort, Satisficing, Competency Theory, Metacognition and Library Anxiety informed the researcher's analysis of the interview transcripts for ways that the BiblioBouts game supports students in overcoming many of the challenges to identified in the literature, and for evidence of learning and changes in research behavior as a result of playing the game.

3. Methodology

In the fall of 2009, the BiblioBouts game was pilot tested in an introductory freshman course at the University of Michigan titled "Introduction to Information Studies." The course and included a required research paper. BiblioBouts was integrated into the syllabus as part of the research paper assignment, and the researchers conducted an in-class presentation and demonstration of the game to the students. Email support was offered for any problems or questions students had during game play. The game was played for three months (October-December) during class, culminating in a completed bibliography on the student's research topic. Thirty students participated in the game. This study presents initial findings on student perceptions of the academic research skills learned from the game and its effect on their information seeking behavior and information literacy skills

3.1. Focus Group Interviews

Shortly after game play concluded in the pilot class, twenty-five students who played the BiblioBouts game were recruited to for a paid focus group interview to discuss their experiences playing the game, what they learned, and how they would improve the game. Respondents participated in one of five focus groups, each consisting of 5 to 6 students and two researchers. Interview subjects were a mix of freshmen and sophomores. Interviews lasted one hour. The semi-structured interviews utilized a written interview protocol, while also allowing the interviewers to ask follow up questions and probe for more information on specific issues raised. Questions focused on what students learned from playing BiblioBouts, how they might apply what they learned to their coursework in the future or to their own personal research and their understanding of the step-by-step research model (for the entire interview protocol, see Appendix A). These interviews were transcribed for analysis and coding. Content analysis was conducted on these

transcripts to identify major themes and subthemes. These included problems of registration and game play, incentives for playing, suggested improvements, levels of previous IL instruction and impact of the game on student research practices.

3.2. Individual Follow-Up Interviews via Instant Message

Three months after playing the game in the pilot class, students who had participated in the focus groups were contacted and invited to participate in individual follow-up interviews to explore how the experience of playing the game affected their subsequent research behavior. IM chat was chosen as a method of conducting the follow-up interviews as a complement to the online nature of both the game play. While the focus group methodology is well established, interviewing via IM chat may be less familiar, and the literature on the use of online IM chat as the interview method is scarce. There are many studies on chat reference training (e.g., Luo, 2009) and studies of the types of questions of asked and linguistic analysis of the language used in IM reference chat (Rourke, 2010). Although there seems to be limited research into the effectiveness of IM as an interview methodology, there are a few studies that have shown valid reasons for employing this methodology. IM interviews are easier to schedule and conduct, since they do not require physical co-location, and demand less physical preparation and no travel time (Kazmer & Xie, 2008). The IM mechanism automatically records the interaction text, which reduces the risk of transcription errors (Steiger & Gortiz, 2006) and results in transcripts which are less susceptible to questions of accuracy (Kazmer & Xie, 2008). The turn-taking nature of IM chat allows the researcher time to review the transcript while the subject frames their responses, and gives the interviewer more time to formulate follow-up questions (Lüders, 2007).

Along with the technical advantages, the IM methodology has other benefits for researchers. Since IM use is widespread among teenagers (Steiger & Gortiz, 2006), college undergraduates are likely to be comfortable with the technology and willing to provide information in the chat environment (Kazmer & Xie, 2008). In some aspects, IM chat is similar to in-person interviewing. Lüders (2007) points out that the "near-synchronous quality of IM in many ways resembles face-to-face dialogues, and makes it possible to tailor interviews according to the experiences of the informants" (p. 33). Likewise, Kazmer & Xie (2008) note that the "ad hoc conversational nature of IM interviews lets them resemble oral interviews" (p. 259) and emphasize that "because IM is synchronous, it is less edited and more like conversation" (p. 274). This allows the interviewer to instantaneously respond to questions from the respondents and provide clarifications or follow-ups (Steiger & Gortiz, 2006).

Six follow-up interviews were conducted via IM chat with three freshmen and three sophomores. Once a mutually convenient interview time had been set, both interviewer and interviewee logged onto the Gmail email service and initiated a chat session. Questions from the interview protocol were copied and pasted directly into the chat interface. A careful turn-taking procedure was observed to insure that there was no overlapping of questions and answers. These semi-structured interviews were based on an interview protocol. Questions focused on the students' subsequent research habits since playing BiblioBouts and what impact BiblioBouts may have had on their information seeking behavior (for the entire interview protocol, see Appendix B). The entire IM exchange was automatically saved by Gmail, and was exported as a text file for later analysis. Content analysis was conducted on these transcripts to identify major themes and subthemes. These included reliance on previous habits of research vs. new skills learned from BiblioBouts, changes to their current research practices, student awareness and usage of relevance and credibility criteria and library resources used by students in their research.

Interviewees often answered in several separate clauses or phrases that reflect the informal tone of IM chat, and this structure is reflected in the transcripts.

4. Findings

Responses received from the both the focus group and individual follow-up interviews are presented below as they relate to the study's research questions.

4.1. Research Question 1: What is the perceived value of the BiblioBouts game for students?

In focus groups, some students reported that BiblioBouts game play gave them an overall exposure to the academic research process. They commented that the measured, focused nature of the bouts that make up the game gave them opportunities to practice their skills. One student summarized what he learned from the game:

> Basically how to do it better and faster and more efficiently, just from the process of having to do it a lot for the game I think gave me a lot of practice that I otherwise hadn't had in using the library as a resource.

This student acknowledged that he learned more effective techniques for research and recognized that the game gave them practice conducting the process of research. The importance of this reinforcement through practice was mentioned by other students:

> I have had to use sources from databases before last year. So I have had some practice of going about it. But since it was so infrequent, I almost forgot how to use it or how to even access it.

This emphasis on reinforcement was echoed by another respondent:

> It reinforced how I would go through my research and make it more methodical … it solidified my methods of doing research, it solidified the approach of doing research and it also would give me a platform tailored to those methods.

The opportunity to gain repeated practice in a structured, step-by-step process is one of the primary features of the BiblioBouts game. The BiblioBouts game is divided into separate bouts – Donor, Closer, Rating and Tagging, Sorter, Best Bibliography – which emphasizes to students that they have to perform a sequence of tasks in order, each with separate deadlines, before they can progress in the game. Other interviewees commented on this structured research process embodied in the game:

> I really think that step by step process helped me a lot and even—I mean at the very least, having the deadlines there to keep you going through it helps a lot. And I think it kind of keeps you organized, too, maybe in a way that I hadn't always been.

This step-by-step research process characterizes the structure of BiblioBouts. While students play the game, compete against each other, score points, and complete their assignments, they are also learning the fundamental structure of the research process.

Students also recognized that the game emphasized evaluating the quality of sources. As players enter their responses for each source, they gain repeated practice in making credibility evaluations. Interviewees recognized that they had learned this important skill through playing the game:

> I was able to actually like see the process I should go through and be able to get more information to back up my research and make sure it was

> credible information instead of just like grabbing something that looked it went along with what I was trying to say. So I think it made my papers stronger in that aspect.
>
> I think it definitely made me think about what information and/or sources are 'credible.' I believe it was very helpful. It made me stop and think about a site before using it in a report. I was able to see where other individuals obtained information and will use some of these sites in the future.

The phrase "stop and think" indicates a state of metacognition, of reflection on the research process and the student's own process. This student's mention of the value of learning where other players in the game searched for and found information echoes the findings in the literature that today's students enjoy collaborative peer-based learning. Since students are used to sharing and exchanging information, they may be more comfortable learning from the examples of their peers rather than from direct instruction from a teacher. Other interviewees referred positively to this style of learning as "groupwork" or "mind share." One student commented that observing what sources other players used "helped open me up to a bigger variety of sources." Other follow-up interview responses mentioned "the main benefit of BiblioBouts for me was to see others sources and be able to search them" and that "I was able to benefit from others by seeing the sources they found." One interesting take on this was expressed by a student who reflected on what he learned from this group experience:

> I'm not sure it changed the way I search for information as much as it opened my eyes to the benefits of knowing how to research... in itself it didn't teach me a lot about searching but I saw the results of other peoples searching and I was impressed and I realized everyone isn't equal when it comes to research.

The comment that "everyone isn't equal" shows a growing maturity level in the ability to evaluate the skills of peers, which is one of the important elements of Competency Theory. When students are not able to assess the skill level of other students, they may accept whatever results are produced; however, learning that for the same search, different people get different results of varying quality helps a student to be more competent in evaluating quality of sources.

4.2. Research Question 2: How does playing the game affect the research behaviors of students?

The analysis shows that the BiblioBouts introduces players good research habits through exposure to scholarly databases and repeated practice in evaluating the quality of sources found. This can result in increased awareness of the relative quality of information sources as demonstrated by this comment by a focus group interview participant:

> I just know like how to like find reliable sources now, which is just really helpful. Like in the future I'll just have a much easier time finding sources and knowing that they're credible and just like I won't waste my time using like Google and all of that stuff.

Although students are accustomed to using Google, the game' ability to expose students to quality sources in library-accessible databases made an impression on this BiblioBouts player:

> I mean I just think that like usually I use Google just, you know, and like comparing the results I would get from Google to these databases is a huge difference and like I really realize that now, that the material that I was getting was not that reliable and not that scholarly and to be writing research papers and stuff I need to be using like databases and stuff like that.

While it is important for students to understand the value of scholarly sources, it is also important that they learn that not all scholarly sources will be equally applicable to their topic. In addition to judging credibility, students must also judge relevance. The BiblioBouts game emphasizes this point by asking players this series of questions for each source they rate in the game's Rating & Tagging bout: "To what extent do you think this source contains useful information for this topic?," "To what extent do you think that this source's information is accurate?," and "To what extent do you think this source's quality is good enough for you to use in your coursework?" Follow-up interviewees were asked about their use of these relevance criteria in their subsequent research.

> I use that type of criteria for all my searches now, be it Google, scholarly, or whatever. I always consider how credible the source is, what the intended audience is, and things like that… (BiblioBouts) forced me to think about things I may not have considered before.

This attention to sources was echoed by another interviewee, who stated that "I pay more attention to the source of the information now."

Another feature of BiblioBouts is that game play is integrated with a specific class assignment which helps students to make the connection between using databases to find information and integrating that information into their coursework.

> To me it's so easy to do a Google search that most people don't really think twice. If you're assigned something, you basically just go to Google and type it in. But I think after—after having used that almost near exclusively—I mean I did a Google search and found a couple of things—but the databases I think were most important. Just having an experience using those is going to be a big help for me because now it's kind of my go-to thing whenever I get assigned a research paper is to use the databases.

This was echoed by the response of a follow-up interviewee:

> I feel like it was the education I received about searching databases that helped me the most.

Another student mentioned that he had learned "some of the common mistakes undergrads make when they are finding sources," which he described as follows:

> I saw a lot of—a lot of papers that were scholarly but irrelevant and I saw a lot of things that weren't very scholarly that were relevant or it looked like people had —there were a lot of sources that had the search terms in it but people didn't dig a little bit deeper to see whether that was actually relevant.

This understanding of the difference between a simple match on keywords and a deeper understanding of whether a source is relevant demonstrates that these students have begun to learn the essence of information literacy. This player's observation suggests that BiblioBouts may be effective in improving student's critical thinking skills.

Not all students felt that they learned from BiblioBouts or saw the value of the game. Generally such students made comments that revealed exposure to previous library instruction, either in high school or as college freshmen. One student reported that "we already know how to do that from high school." Another student elaborated:

> I guess part of it is I had really good English teachers in high school. That process was already drilled in my head.

Another student mentioned having a "research mentor" as a freshman. Since BiblioBouts is intended to teach basic academic research skills to incoming college students, students who have already learned these skills may not see as much benefit in the game:

> For my freshman English class, we go to the library and have a librarian give a similar talk on how to search. And I had already kind of talked to the librarian on my own and had been told about the good databases to use for like this particular thing. Maybe for me it wasn't extremely new stuff.

However, several students had not received any library instruction and were on their own in learning these skills. One student majoring in business reflected on the lack of instruction that he had received, and indicated that he acknowledged a need to learn more beyond his own self-taught skills:

> I did receive some guidance. But many teachers assumed that we could learn on our own. I have not had much structured teaching about these resources.

The BiblioBouts game will be most effective for students who have not previously received IL training. However, these findings demonstrate that the BiblioBouts game contributes to reinforcing skills even for students who have already had prior library instruction. The importance of practice and of integrating research skills into specific assignments is fundamental to the BiblioBouts game. Results of the focus group interviews indicate that most students indeed learned from recent game play as they had a chance to exposure to the structured step-by-step research process, the specific criteria for evaluating the credibility and relevance of sources, and repeated opportunities to practice these skills.

4.3. Research Question 3: To what extent have their information searching behaviors changed as a result of the game?

In response to the follow-up interview question "Looking back, did playing BiblioBouts change the way you search for information?" students offered responses that indicated they had retained some of the essential lessons of the game:

> I use the library more now, and more efficiently. It's become my dominant source of getting information (for academic purposes) rather than websites obtained from a Google search. It helped me do that transition, especially coming out of high school

> It made me think more about the trustworthiness of my sources, and I got better at searching library databases

These responses indicating an increased comfort with using library resources suggest that BiblioBouts may be effective in helping overcome the Library Anxiety issues discussed in the literature review. The game's ability to give students repeated practice with accessing scholarly databases may provide students with enough exposure to feel less intimidated by unfamiliar library resources and more competent in academic research. Developing the critical thinking skills of evaluating sources and assessing information quality is one of the most important goals of the BiblioBouts game. This comment echoes the statements of focus group participants about learning to evaluate credibility of sources without simply following the Principle of Least Effort and automatically accepting the first results.

As with the focus group subjects, not all follow-up interviewees indicated that BiblioBouts had changed their research practices. Some indicated that they still relied on old habits, as described in the research literature. Even the repeated practice of using the structured process of the BiblioBouts game in the context of an in-class assignment was not enough stimulus to overcome ingrained habits. When asked if BiblioBouts had changed his research habits, one student replied :

> Not really. (I) still use Google for big picture ideas and library databases for more in depth or to meet requirements.

Another student revealed their reliance on the Principle of Least Effort in their use of Google and Satisficing with the first results they find:

> I rarely go past the first page of results. Usually the best websites or most relevant are near the top.

Some interview responses echoed the description of Competency Theory in the literature, in which students have an over-inflated assessment of their own skill level. When follow-up interviewees were asked "Since playing BiblioBouts, have you sought out any additional guidance about conducting library research?" a freshman responded "no, I haven't needed it" and a sophomore responded "not really because I don't need it yet." These habits cannot always be changed, and an online game may not be the most effective way to convince students to change their ways. In person, sustained reinforcement and feedback from a teacher or librarian may be required in that instance. However, for other students, BiblioBouts appears to have been an effective learning experience. The game allows them to receive skills practice embedded in a course, in an assignment-specific context that demonstrates the practical value of the skills learned. While BiblioBouts cannot meet all the library instruction needs of students, it serves as an introduction to the basics of academic research, and does provide a useful and valued experience to those who have not received instruction before.

5. Discussion

Overall, the results of the post-game focus groups and follow-up interviews suggest that BiblioBouts had a positive impact on the academic skills of the college students who played the game. The responses of the focus group and follow-up interview subjects suggest that pilot test players have applied the fundamental academic research skills learned from BiblioBouts to their subsequent assignments. An important factor in the level of self-reported learning was whether students had already experienced library instruction in high school or not, which is to be expected. Prior exposure to the concepts of information literacy may lessen their impact and students' receptivity to IL training, but the game can still offer valuable reinforcement of previously learned skills. For those students who had not received prior training, the findings of these interviews demonstrate a positive impact on basic academic research skills,

understanding of the research process, and critical thinking about quality of sources. Positive comments such as “it was very useful for my paper,” “overall it was helpful, I would use it again for another big writing assignment” and “I definitely benefited from playing” provide evidence that learning occurred and that students benefited from the experience. The BiblioBouts game suggests a new approach to introducing students to library resources and information literacy skills.

The findings of this study suggest that these students took the shortcuts and made the compromises often cited in the literature of student information seeking behavior. Some students described following the Principle of Least Effort (Rosenberg, 1966) when searching for information and Satisficing (Buczynski, 2005) with the results of their searches. Some comments reflected the predictions of Competency Theory (Gross & Latham, 2007) that students over-estimate their level of research skill, cannot effectively evaluate the skills of their peers, and do not see themselves as needing instruction. Playing the BiblioBouts game helped some students learn the critical thinking skills of Metacognition (Land & Greene, 2000 through learning the criteria of source evaluation and a structured research process, while some others overcome Library Anxiety (Mellon, 1986) by becoming familiar with search skills and library databases. These challenges remain important obstacles to the successful teaching of information literacy skills to today’s students, and can be dealt with in innovative ways through the use of online social gaming.

6. Limitations

There are some limitations to the generalizability of this study. More motivated students are more likely to have participated in playing the game while less motivated students may have dropped out or not participated. These participants may also have been more motivated learners and researchers before they began playing the game and they may have volunteered for interviews more than the less motivated. Thus, their views may be disproportionately represented in the focus groups and follow-up interviews, and the results of the study may not extend to all students who played the game. Additionally, the time- and labor-intensive nature of the interview methods necessitated a small number of subjects; focus groups and individual interviews cannot be used to reach all students in a large class. The self-reported nature of the interview responses may not accurately reflect the students’ experiences, although this is always a limitation of qualitative data.

7. Conclusion

Overall, the results of this study demonstrates evidence of the game’s positive effect on players’ research behavior, their perceived value of the game, and their subsequent change in information searching behaviors. Online social gaming offers one method by which students can be guided toward learning better skills through repeated practice with a structured, step-by-step process that reinforces the importance of critical thinking. Since today’s students tend to prefer peer-based learning over direct instruction, they appreciate the opportunity to see for themselves what sources other searchers found and to learn that not all search results are equal in quality. And ideally, they can still have fun as they do it. Additionally, the experience of the researchers suggests that IM chat can be utilized effectively for conducting interviews with college-age students who are technologically savvy.

Since this study was based on the alpha version of the game and was tested on a pilot group, there is much opportunity for further research. As the game is refined and improved based on player feedback, further testing to validate this study’s initial findings will be needed. Once the finalized version of the game is completed, further research will be required into how this innovative online IL tool can be best delivered to a college audience, with the ultimate goal of creating an open-source learning tool available to anyone.

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APPENDIX A:

BIBLIOBOUTS PROJECT
FOCUS GROUP INTERVIEW QUESTIONS FOR STUDENTS

1. How adequately did we (instructor, librarians, researchers) prepare you for playing BiblioBouts?

Probes: How could we improve the process of getting you online? How many of you watched the videos? How were they helpful? Would you want more videos? What would the new videos show you? Did you read the "How to Play" instructions? How were these instructions helpful? What pre-game preparation was or wasn't adequate? Game objectives? Using Zotero? Using library databases? Scoring? Game quotas? How to win? Why wasn't it adequate?

2. What did you learn from playing BiblioBouts?

Probes: Selecting a topic, Using Zotero to keep track of the information you find, Using library databases, Finding information online, Knowing where to find good information after exhausting Google, Judging the information you find, Adjusting a topic, Sorting the information you find into subtopics, Choosing the best information

3. What did you learn from playing BiblioBouts that you will apply to your coursework in the future or to your own personal research?

Probes: Selecting a topic, Using Zotero to keep track of the information you find, Using library databases, Finding information online, Knowing where to find good information after exhausting Google, Judging the information you find, Adjusting a topic, Sorting the information you find into subtopics, Choosing the best information

4. Would you rather research a course assignment on your own or play BiblioBouts while researching the assignment? Why?

Probes: Are grades and course assignments the only incentive for playing BiblioBouts? Why or why not? What incentives would prompt you or your friends to play BiblioBouts? Can you think of other situations when people would want to play BiblioBouts? What would motivate them to play BiblioBouts?

5. BiblioBouts is made up of several mini-games. Put these mini-games together and the result is a step-by-step approach to conducting library research. Do you think that playing BiblioBouts was an effective way to learn about this step-by-step approach?

Probes: Do you think that playing BiblioBouts was an effective way to practice conducting library research? Why or why not? How do you want to learn about how to conduct library research? How do you want to get practice doing library research?

6. How would you improve BiblioBouts?

Probes: What mini-games need improvement? How did you feel about the quotas? Why?
What was worst about BiblioBouts: Searching for information, Finding full-text articles online, Downloading articles, Keeping track of what you find online, Knowing where to find good information after exhausting Google, Judging the information you find, Sorting the information you find, Choosing the best information for your paper, What was best about BiblioBouts? If you didn't play a particular mini-game, tell why you didn't play it. If you didn't play BiblioBouts at all, tell why you didn't play it.

7. Are online games like BiblioBouts the best way to learn about conducting library research? Why or why not?

Probes: What other ways could you learn about conducting library research? What ways would you prefer?

8. What other library-based tasks do you think would be appropriate to learn by playing games?

Probes: What would you like to learn about by playing new games? What academic topics would you like to learn about by playing games?

9. Is there anything you would like to add?

APPENDIX B:

BIBLIOBOUTS PROJECT
FOLLOW-UP PERSONAL INTERVIEW QUESTIONS FOR STUDENTS

1. Since playing BiblioBouts, have you been tasked with an assignment requiring you to conduct library research? Tell me about the assignment.

Probes: What details of the assignment do you recall? What did you turn in for a grade? How well did you do on the assignment?

2. How did your experience playing BiblioBouts make you feel about doing the assignment?

Probes: More confident, better prepared, more knowledgeable, more efficient, etc. Do you think you did better on the assignment than you would have done minus the BiblioBouts experience?

3. To complete the new assignment, did you enlist BiblioBouts' model of conducting library research? Why or why not?

Probes: Did you choose a topic, search databases for citations on the topic, search and download full texts, judge citations and full texts, adjust your topic, reconsider your initial judgments about citations and full texts in light of your adjusted topic, feel that you had chosen the best information for your adjusted topic?

4. To complete the new assignment, did think back to one or more BiblioBouts' mini-games? Which mini-game(s) did you think about and why? How did the mini-games help you to complete the assignment?) If you did not think back to the BiblioBouts mini-games, why do you think that they didn't they help you?

Probes: Did the mini-games help you with selecting a topic, using the databases that the experts us, finding full-length articles online, downloading full-length articles, keeping track of citations and full-length texts, knowing where to find good information after you exhaust Google, judging citations and full texts, judging citations based on these criteria, adjusting your topic, choosing the best information.

5. Do you think you did better job completing the new assignment than you would have done minus the BiblioBouts experience? Why or why not?

6. Did you like playing BiblioBouts? Why or why not? Now, after N months has passed, do you feel differently about your experience playing BiblioBouts? What is different? What is the same? Why? Has the experience of the new assignment contributed to a different feeling? Why or why not?

7. Since playing BiblioBouts, have you felt the need to learn about conducting library research? How have you have acted on such a need?

Probes: For example, have you taken library workshops, used the library's online tutorials, consulted a librarian? If you haven't followed through, tell me what might prompt you to do so.

8. Is there anything you would like to add?