Bridging the Information Literacy Gap with Clickers

by Patricia A. Deleo, Susan Eichenholtz and Adrienne Andi Sosin

A Class Performance System (CPS) is applied as an assessment tool to assist in determining the level of information literacy knowledge already possessed by adult students enrolled in a graduate Educational Leadership and Technology program. The CPS data collected reveals that students possess varying degrees of technology expertise and information literacy skills. Study results suggest that clickers facilitate differentiated information literacy pedagogy and increase engagement for graduate students.

BACKGROUND

The ability to access library resources is critical to students’ abilities to understand disciplinary concepts and to locate literature about topics of importance. This study concentrates on multiple sections of one graduate course, Computer-Based Technology in Education, which is the initial course in the professional sequence in the Educational Leadership and Technology program at a medium-sized suburban college of education. In the beginning of the semester, the University’s education librarian normally conducts an information literacy session to provide an introduction to library resources and enable successful completion of an assignment that requires prospective educational administrators to use their previous experiences to determine a researchable problem, devise a research question and compose a literature review of scholarly journal articles. Students must search library databases to identify and locate scholarly journal articles containing empirical research, cite them using the American Psychological Association (APA) format, and read, summarize, synthesize, compare, and evaluate them in an original written paper. Proficiency with computer applications that include Microsoft Word, Excel, PowerPoint and Adobe Acrobat are also necessary to complete the course requirements.

Instructors’ and librarians’ experiences with graduate education students who demonstrated that they were inadequately prepared with sufficient information literacy skills provided the impetus for this research.

PURPOSE OF THE STUDY

This study examines the innovation of incorporating a Class Performance System, (CPS), a combination of hardware and software designed to provide the instructor immediate feedback from the students, into information literacy pedagogy. While various manufacturers have different models, most CPS systems are commonly called clickers, noting that each student gets a handheld instrument that emits a signal to a base station. The CPS provides a pedagogical tool that furnishes on the spot information from student responses, enabling the teacher to evaluate the accuracy of the response and have the opportunity to immediately correct misunderstandings and reinforce conceptual knowledge. As an experiment in improving pedagogy with
educational technology, the University procured several class performance systems, (CPS), units manufactured by eInstruction.

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The research questions posed here are “(1) Are clickers useful in identifying a student’s information literacy knowledge?” (2) Are clickers useful in identifying a student’s computer skills? (3) “Will the data collected support a differentiated pedagogical approach to information literacy?” These questions seek to identify whether and how clickers can improve the quality information literacy instruction offered to graduate candidates in education.

**Information Literacy Instruction**
A common university expectation of students in higher education is information literacy. The Association of College and Research Libraries (ACRL), suggests that information literacy in every discipline is an instructional imperative. The Information Literacy Competency Standards for Higher Education defines an “information-literate student as someone who:

1. Determines the nature and extent of the information needed.
2. Accesses needed information effectively and efficiently.
3. Evaluates information and its sources critically and incorporates selected information into his or her knowledge base and value system.
4. Individually or as a member of a group, uses information effectively to accomplish a specific purpose.
5. Understands many of the economic, legal, and social issues surrounding the use of information and accesses and uses information ethically and legally.”

Standards for teachers and school administrators, as outlined by the National Council for Accreditation in Teacher Education (NCATE), compliment ACRL’s guidelines. For teacher and administrator candidates, the candidate’s knowledge base should include information literacy skills such as the “ability to use tools and processes of inquiry, critically analyze the information, collect the appropriate data from appropriate sources, and integrate technology and information literacy in instruction.” Henderson and Scheffler suggest that teacher education programs be required to ensure that teacher candidates comprehend the wide range of information literacies, demonstrate information literacy skills, and integrate information literacy strategies into P-12 instructional activities.

**Digital Natives and Digital Immigrants**

Kaufman suggests that although we live in an “information age,” most of society suffers from “information incompetence.” In Marc Prensky’s metaphor of “digital natives” and “digital immigrants” one assumes that young people are digital natives and mature adults are digital immigrants. However, older students, especially career-changing adults who seek advanced degrees in education may be inappropriately categorized as digital immigrants, and youth are often erroneously assumed to have technological expertise they do not possess. Hoffmann and Goodwin report that students commented that there was too much material covered in one library session and students often lacked retention. Even technologically competent students overestimate their ability to effectively search for and access information. Students perceive their inability to access information as resulting from too-demanding assignments rather than their own lack of competence. According to findings from a study of graduate education students conducted by Sosin and Deleo, graduate students display over-confidence with regard to both their research and technology skills. Students may not be aware of their own incompetence in using electronic sources as their primary method of obtaining information. Only when they find themselves unable to access the computer’s power to evaluate and select appropriate sources, do students become frustrated and reach out for support. It was observed in previous one-shot library instruction classes that inappropriate assumptions apply to information literacy competencies.

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Attention to the differential level of each student’s information literacy capabilities is necessary in designing information literacy instruction. Therefore, we adopted the theory and concepts of differentiated instruction, which are rooted in Barone’s statement “not all learners are alike.” Methods of differentiating instruction have become an important aspect in K-12 pedagogy. “Teaching to the middle” as discussed by Tomlinson, is not an effective pedagogy. Therefore, action research to determine the potential outcomes of CPS to differentiate and improve information literacy pedagogy is potentially informative to librarians, instructors and students.
THE PROBLEM

That effectively engaging adult students in information literacy development can be laden with obstacles such as:

• Adult learners vary greatly in information literacy knowledge.

• Adult learners, with limited computer experience, often evidence technological anxiety.

• Technology capabilities are now required to conduct library research.

• Discrepancies and inconsistencies often exist between faculty expectations and what the students actually accomplish in scholarship.

It is very difficult to ascertain a class' computer skills in a one-shot library session. In past semesters the librarian's expectations were too high, and therefore did not cover areas of information literacy that were assumed that these graduate students already possessed. Because the student's abilities varied greatly from semester to semester, the librarian often assumed students already knew the material, or incorrectly started with basic information literacy concepts obtained in previous learning experiences. The classes were often filled with observed boredom if the cohort consisted of younger teachers. We heard whispered comments such as “We know this already”. If the cohort consisted of teachers returning to school after twenty or more years, we heard “She’s going too fast”, or “Did you get that?” It appeared that the student's age and time away from a technology-required learning environment had a direct impact upon their skills needed to successfully complete Computer-Based Technology in Education.

Information literacy classes where technology skill competence widely varies among students complicates the pedagogical situation. How can a librarian effectively teach students at different levels of technology prowess to use the library's resources in a single two-hour class? What level of technology expertise should the librarian assume students possess? Is it accurate to assume that graduate students should already be able to search databases? Through collaborative observation, over several semesters, we have discovered that making assumptions about student technology or research skills is not effective, predictable, or advisable.

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PARTICIPANTS

Participants, (N = 28), for this study were certified teachers enrolled in three sections of a Master of Science degree program in Educational Leadership and Technology (EDL) during the Spring and Fall semesters of 2007, and the Spring semester of 2008, at a suburban university. Students, enrolled in the Educational Leadership and Technology Program, are returning to school, some after a long absence, to obtain the skills necessary to become school administrators. The group was diverse in age, computer skills, information literacy expertise and educational backgrounds.

As the entry requirements for the Educational Leadership program requires prior proficiency in academic tasks as evidenced by grade point average for prior study, as well as three years of teaching experience, faculty feel reason to assume that previous successful academic performance indicates prior proficiency with information literacy skills. However, receipt of unsatisfactory research papers have indicated otherwise.

METHOD

At our University, the librarian and course instructor normally collaborate to deliver an information literacy class with lecture and hands-on exercises that introduce library resources such as:

• Use of the online catalog, library and interlibrary loan procedures

• Online database search strategies

• APA citation formats

• Location of education-related resources within the library

• Identification of the acceptable level of scholarship of periodicals in the relevant discipline (e.g. the difference between peer-reviewed journals and popular magazines).

During the library lesson, the librarian offers search demonstrations and students have hands-on opportunities to use the techniques described. They are encouraged to describe their topics of interest, share research questions, and generate keywords, synonyms, and descriptors that they think might be useful to locate relevant sources. When time allows at the end of the instructional session, the librarian offers individualized supportive guidance, provides commentary, and attends the process as the students pursue their own topical searches.

PROCEDURE

Clickers were initially adopted as a pre-lesson assessment tool to assist the librarian in setting an appropriate starting point at the students’ levels; twenty multiple-choice questions were designed to determine the extent of students’ knowledge of library resources and information literacy. Included in the CPS software is an ability to generate several types of reports that display statistics about each question, identify each student’s answers, and summarize how the class performed as a whole. The “question report” for each class furnished the librarian with itemized details in a question-by-question analysis.
format. It includes the class’ performance, itemizes each question, includes the multiple-choice answers, identifies the correct answer, and provides a bar graph and percentages of each answer selected. Each student is only identified by a *clicker* number, which enables responses to each question to be associated with final test scores.

Some of the CPS questions posed in the *clicker* sessions asked students to:

- Distinction characteristics of the Library of Congress Classification System and the public library’s use of the Dewey Decimal System.
- Discover student’s knowledge of locating books in an online catalog.
- Create a bibliography using APA citation format.
- Distinguish primary and secondary sources of information.
- Differentiate Internet protocols and use of search engines.
- Distinguish between popular and scholarly periodicals.

(See Supplementary material for the complete set of questions.)

At the beginning of the class, students are introduced to CPS by a brief description of the software’s capabilities. *Clicker* devices are distributed to students who are alerted that the CPS software will anonymously record their answers. The librarian reads each question aloud as they are displayed sequentially on individual computer screens at each seat or on a single projection screen at the front of the room, depending on room configuration. Students are given ample time to select from a multiple-choice array and record their responses by “clicking” the device. After completion of the CPS quiz, a hands-on, librarian-led database demonstration was designed to reinforce searching for journal articles with either a posed or a student-generated question to reinforce the skills taught during the lesson. At the end of the library session students are asked to assess their experience with *clickers* by completing an evaluation form. These evaluations provide information about student attitudes towards the materials presented, their perceptions of the CPS, and offer the student the opportunity to express opinions. Additional sources of data for this study are incidental comments by students to the course instructor and/or the librarian.

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**RESULTS**

Data collected from use of the Class Performance System software from students in three semesters of the course Computer-Based Technology in Education demonstrated that even experienced teachers in a master’s degree program preparing them for school administration positions do not possess the level of information literacy they need to successfully conduct research.

In response to, “Do I consider myself information literate?” the majority answered “yes.” Yet when asked to define information literacy, just over half of all the cohorts answered correctly (see Tables 1–4). Thirty-seven percent, the average for all three cohorts, did not know that the online catalog was where they should begin to search for books and periodical titles, and only an average of 45% knew anything about the Library of Congress Classification System.

All students were asked to complete an evaluation form designed to determine how they felt about using *clickers* and the class in general. These evaluation forms were thematically analyzed. Two major themes arose: personal engagement and applications to teaching practice.

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<table>
<thead>
<tr>
<th>Table 1</th>
<th>Class Performance Responses</th>
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<tbody>
<tr>
<td><strong>Correct Answer Percentages</strong></td>
<td></td>
</tr>
<tr>
<td><strong>CPS questions 1–5</strong></td>
<td>Spring ’07 ( N = 12 )</td>
</tr>
<tr>
<td>Do I consider myself information literate?</td>
<td>100%</td>
</tr>
<tr>
<td>What is information literacy?</td>
<td>33%</td>
</tr>
<tr>
<td>To locate a book you would begin to search in</td>
<td>33%</td>
</tr>
<tr>
<td>Non-fiction books in the Dewey Decimal System are arranged by subject and the call numbers</td>
<td>67%</td>
</tr>
<tr>
<td>The Library of Congress Classification System is arranged by subject and the call numbers</td>
<td>0%</td>
</tr>
</tbody>
</table>

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Sample comments about personal engagement include the following:

- “It allowed us to focus on each question and the professor to focus her attention more on certain questions based on our response.”

- “I was fascinated by the CPS. Liked the idea that it was both children and adult friendly. I think it can make a difference in teaching and learning skills in our schools. After answering the questions about technology awareness, I was able to evaluate myself.”

- “I was disappointed to learn that this class was only a one shot!”

- “I was impressed with the CPS. I found it very focused and interactive. It enabled the professor to focus her attention more on what the class as a whole didn’t know rather than spend time on what the class already knew.”

Comments about applications in teaching include:

- “Children would find this a helpful and exciting way to learn.”

- “I think it would be useful for test preparation.”

- “I could think of games to play with this technology like Jeopardy and assign teams…”

Comments that mentioned both themes include:

- “I loved the way it kept us engaged and loved the gradebook feature.”

- “Found it engaging and thought the generated reports were a great way to assess students.”

A number of the comments mentioned the cost of the clickers software and hardware. All students are experienced classroom teachers, so the clickers generated interest in the product for use in their own classrooms. During the session, and in evaluative commentary, students expressed the opinion that the product price would pose an obstacle to its purchase by their school district, even though they saw how clickers could beneficially engage K-12 students.

**DISCUSSION**

According to Duncan, using clickers to measure the degree that students already possess information literacy gives the librarian an opportunity to have students confront their misconceptions. The game-like nature of the CPS software makes the information literacy session interactive and engaging. As the students use the clicker hardware to register their answers as each response is scored, the session becomes more like a game, allowing students to participate actively and enjoyably. The results of the session could then be used to assess students’ knowledge and understanding of information literacy concepts and skills.
question is displayed, the class results are immediately tabulated and appear on a bar graph. When the class scored well, students and instructor recognized mastery. When the class scored poorly, the CPS software exposed shared misconceptions. As Wood reported on his use of clickers, “Those who did not ‘get it’ realize they’re not the only ones.”

The display of results on individual questions opens opportunities for the librarian to elaborate and respond to students’ misconceptions. After the final question a CPS generated report is available to show the total class performance. Class discussion of the CPS report initiated additional and unanticipated requests for the librarian’s support, and recognition that there are unmet instructional needs that are common to a number of the students. The immediate feedback supplied by the CPS software gave each student a more realistic notion of his/her own capabilities in information literacy. Myths were debunked, assumptions challenged, and correct responses acknowledged.

Based on our observations clickers provided a number of positive results for the students. Carnaghan and Webb suggested that clicker usage can suppress oral participation; however, the librarian in our study found graduate students in this study focused and engaged in a way that previously had not been experienced. The CPS requires 100% class participation. Everyone was forced to attend to each question. Universal participation was easy to determine because the system displayed each response received. This caused students to be engaged and invested in the learning experience; they became responsible for their classmates’ participation as well. When a student failed to select his answer in a timely fashion other students called out “Who has clicker number 5?” Instead of the pace being set by the instructor, the class proceeded at their own pace.

The immediate feedback display provided by the Class Performance System permitted both students and librarian a chance to address weaknesses in information literacy skills, reveal misconceptions, and replace inadequate knowledge as it fosters greater engagement. While using clickers, students appeared more relaxed and unafraid to comment aloud. When students discovered they had answered a question correctly, they often cheered and congratulated each other. When students supplied wrong answers, they expressed disappointment and were genuinely interested in finding the reason for the correct response. Students who were normally silent, as reported by the course professor, with the support of immediate feedback, asked questions of the librarian during and following the CPS portion of the lesson.

**Instructional Modifications**

During the Fall ’07 semester a decision was made to add the “turn and talk” method to the CPS pedagogy. After each student had clicked in their answers to a question they were instructed to turn to their nearest classmate and discuss that question and the answer they had chosen. In an investigation of participatory learning, Huss reports, “Students become more active participants in their own learning as they gain experience contributing to a discussion and actively listening to classmates, building on the ideas and contributions of others.” As a result of inserting “turn and talk” into the CPS procedure, the engagement level of the class rose significantly. Some students debated and defended their chosen answers, while others rethought their choices. The process generated a higher level of anticipation for feedback as well. Remarks included, “Let’s see who’s right”, or “I bet you’re right” or “Now that you said that, I know my answer’s wrong”. This procedure was considered successful by the course professor and the librarian in developing greater participation, attentiveness, and knowledge acquisition of the content presented.

**Conclusions**

While the University has adopted instructional standards for information literacy, these apply only to undergraduate students, and at present there is no established program to meet these goals. University orientation and freshman seminars include library instruction but graduate students only receive library instruction at the request of the course professor. While it is not unusual to create partnerships between librarians and teaching faculty to infuse information literacy skills more effectively into the curriculum, this collaboration has been especially innovative. Our shared goals and commitment are to strengthen all students’ abilities to access scholarly, education-related literature, critically evaluate their sources, and then meaningfully incorporate information into a scholarly review of literature.

As we have worked together to support developing greater information literacy we have found reasons to examine the instructional content, the amount of class time allotted, and the methods used to integrate information literacy skills, which have resulted in adoption of CPS clickers as a regular feature of library orientation sessions with undergraduate freshmen audiences as well as graduate students. Thus, this collaboration between an education librarian and two graduate faculty members on effective approaches to information literacy has resulted in instructional alterations that have extended to a broader group of students.

Unfortunately, acquainting students with library resources and information literacy skills cannot be a lengthy process. In the Education Leadership course, curriculum content is privileged; only one class out of fifteen in the course may be allocated to information literacy skills development. Therefore, in library instruction, the necessity for brevity with companion necessities for skill development, depth and coverage are worthy of further study. A recommendation for two library sessions for the Educational Leadership and Technology program would be ideal. Clickers and the “turn and talk” methodology could be used in library session one, and then a differentiated class could be developed from the resulting data to create a second library session, focusing on the areas identified as weak in the first session. The best use of the results of this study could be the initial design of a mandatory, for-credit information literacy course for graduate students.

**Implications for Practice**

Information literacy pedagogy must not remain stagnant. Our immediate concerns include continuing and refining CPS technology in information literacy instruction, and increasing the amount of attention and time allotted to information literacy skills across the curriculum at all levels.
of study. The same pedagogical issues regarding teaching information literacy and technology to graduate students parallel the issues of teaching any subject in any diverse classroom. How can educators’ best teach diverse groups with educational background differences? How can educators create environments that foster students’ desire to reach beyond their comfort levels?

As reported by Trees and Jackson, continued use of clickers in future information literacy sessions will be predicated upon student behavior. Student’s willingness and the librarian’s skill at conducting the clickers session will be the larger issue, not the technology. Use of “hands-on” activities such as database searches cannot be replaced by “clickers”, but the lesson may be augmented with clicker technology and use of the “turn and talk method” to increase student engagement. Collaborative discussions and planning between the librarian and education professors can result in “differentiated instruction” for each individual in an information literacy class, based upon the instantaneous assessment of needs.

An implication from this study for librarians is that, even though technology skills of most adults have increased over the recent past, there still remains a difference between what the users think they know and the skills they possess. Our challenge is to meet the needs of digital immigrants as well as digital natives, in order for all participants to make progress at all skill levels. We may see the gap between digital immigrants and digital natives decrease as access to computers becomes ubiquitous. Yet while skill disparities within any group remain, this research addresses how instructors effectively employ CPS technology. We find that clickers can be instrumental in differentiating information literacy instruction, and recommend that librarians investigate clickers for their own information literacy instructional programs. In this way, instructors and librarians can continue to innovate, differentiate, and improve instruction with approaches and teaching methods such as clickers in order to make information literacy instruction more effective, meaningful and engaging.

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APPENDIX A. SUPPLEMENTARY DATA

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.acalib.2009.06.004.

NOTES AND REFERENCES