

Technology and Learner Motivation in Library Instruction: A Study of Personal Response Systems

By Michelle Hudson, Laurie McGowan,
and Cheri Smith

Imagine you are a Junior in college, it is the first week of class, you are taking a required course for your major (Psychology), you've barely had enough time to look at the syllabus, and your professor has told you that you will be making a visit to the library to learn about doing research. When you get to the library, the room is small, crowded, and dimly lit. You've already been in this room once, twice, maybe three times before. You've also already done library research for a First Year Composition class. What could you possibly learn that is new? How will this information relate to this class? Why are you here? Worse still, how will you manage to stay awake during this class?

Negative student perceptions make learner motivation a special challenge in library instruction. Using Keller's ARCS model as a guide, we postulated that the use of Personal Response System (PRS/clickers) technology would be effective in arousing learner attention, demonstrating relevance to student learning goals, inspiring confidence in learners' ability to master the material, and creating learner satisfaction with the library instruction experience. We expected that clickers would increase learner motivation and would result in better learning outcomes.

Background

Librarians at the Hesburgh Libraries, University of Notre Dame, teach about 400 structured library instruction sessions each academic year. Approximately 25% focus on students in First Year Composition classes. The remainder is typically comprised of discipline-specific sessions, taught by a Librarian subject specialist. The purpose of library instruction is to prepare students to find and use information for research. Depending on the class level,

objectives range from formulating basic search strategies to demonstrating competence with advanced features of discipline-specific databases.

Library instruction sessions are initiated by request of teaching faculty for a specific class. With the exception of four credit-based classes, most library instruction occurs on a one-time basis, within either a 50- or 75-minute timeframe. Students generally meet at the library in lieu of regular class time. Classes are conducted in dated, windowless classrooms, equipped with SmartBoards, laptops and Personal Response System technology. Some professors are proactive in scheduling the instruction session to coincide with a research task but many do not prepare students for what to expect. In this context, the librarian-instructor is uniquely challenged to create engaging, meaningful and efficient instruction for unfamiliar students and deliver it within a very short period of time. We know from many years of documenting student comments that students are generally unsure of what to expect from library instruction and that they do not approach the experience with great motivation to learn.

Keller's ARCS Model

When considering how we might assess learner motivation, we relied on Keller's ARCS Model (1987a, 1987b) for guidance. "The ARCS model is based on a synthesis of motivational concepts and characteristics into the four categories of attention (A), relevance (R), confidence (C), and satisfaction (S). These four categories represent sets of conditions that are necessary for a person to be fully motivated..." (Keller, 2000, p. 2)

Keller (1987a) further defines the major

categories as follows:

Attention: Capturing the interest of learners; stimulating the curiosity to learn

Relevance: Meeting the personal needs/ goals of the learner to effect a positive attitude

Confidence: Helping the learners believe/feel that they will succeed and control their success

Satisfaction: Reinforcing accomplishment with rewards (internal and external) (p.2).

Jacobson and Xu (2002) refer to Keller's ARCS Model in their survey of education literature related to learner motivation in credit-based information literacy classes. Given that many librarians are unfamiliar with the demands of motivating students in a semester- or quarter-long course, the authors provide a clear example of each ARCS element and then relate it to a realistic scenario in designing and teaching an effective information literacy class. Though this article does not refer specifically to the use of clickers, it presents an overview of prescriptive instructional solutions designed to address learner motivation needs.

Do Clickers Affect Learning?

Preliminary research into the use of clickers to enhance student engagement in large lecture classes showed positive results. Mayer (2009) proposed that clickers could be used to promote a generative learning environment in large lecture classes by increasing opportunity for student-instructor interaction. Although they found substantial literature concerning self-reported student reactions to clickers, the Mayer team was unable to find any prior published peer-reviewed evidence that clickers contributed to instructional effectiveness. This team also expected that learning outcomes of lecture classes that incorporated questioning methods without the use of clicker technology would not differ significantly from those using clickers. At the end of the three-year study, they "found evidence that a personal response system can be used in ways that promote

academic performance in large lecture classes at the college level. ... Interestingly, the clicker group outperformed both the control group and the no-clicker group, suggesting that the implementation of the questioning method was less intrusive with clicker technology." (Mayer, 2009, p. 56)

In a similar study, Gauci (2009) introduced an active learning approach to large lecture classes with the use of clickers. With access to student achievement scores from a prior prerequisite lecture class, investigators were able to demonstrate that "improved exam performance was more likely due to PRS participation than to prior knowledge and understanding." (p. 69) In addition to overall higher final examination scores, this study showed a correlation between individual class participation rates and higher exam scores (Gauci, 2009).

Petersohn (2009) launched a pilot study of the use of clickers in library instruction sessions. A comparison of post-test results of classes incorporating clickers and classes using simple paper tests showed significantly higher scores in the clicker class. She discusses the role of instructional design in attempting to ensure that the classes were "pedagogically equal for the study" (p. 318) and suggests that future research on the effects of clickers in other learning domains or at higher learning levels should incorporate this factor when designing the study. She referred to Gagne's well known Events of Instruction as a rubric to determine that the instructional phases were equivalent in both classes. Coincidentally, she found that, "What became evident in incorporating the use of the CPS [clickers] into the session ...is how neatly the technology fit into the lesson planning" (Petersohn, 2009, p. 318).

Using Clickers and Keller to Increase Motivation

Hesburgh Libraries purchased personal response systems (clickers) with the intent that they would aid in development of a systematic assessment program for library instruction. They were used nominally in pilot sessions to test system performance and librarian and student acceptance of the technology. Initial results were good, though there were some

challenges to setup of the system and effective operation within an already limited instruction timeframe.

Similar to the instructional practice recommendations of Jacobson and Xu (2002), we posited that clickers could enhance learner motivation in library instruction sessions and that the result would be apparent in better learning outcomes. We felt that clickers would be particularly useful in obtaining and sustaining the students' *attention* in the following ways:

- The novelty of technology gains attention early.
- The potential for a spot quiz encourages sustained attention.
- The discussion of responses maintains attention.
- Lack of response, though anonymous, is immediately obvious to all.

We felt that both the use of clickers and the use of a paper pre-test would positively influence students' beliefs that the library instruction would be *relevant* to their personal goals or motives because:

- The pre-test establishes accountability for content and need for engagement.
- The pre-test content will demonstrate relevance to the information needs of a particular group.

Moreover, clickers would be particularly effective in demonstrating relevance because they enable immediate viewing and discussion of class responses. Students have the opportunity to articulate their own research experiences and to compare with those of their peers.

Both clickers and the paper pre-test would contribute to student's feeling an appropriate level of *confidence* that they will master the content:

- The pre-test introduces objectives so that students know what to expect.
- The pre-test reveals knowledge gaps.

Clickers would enhance the confidence-building aspects of the class with these unique

characteristics:

- Feedback from discussion helps to clarify fuzzy concepts.
- Students have the ability to compare results with their peers.

Finally, we expect that students experience *satisfaction* from successful completion of learning activities regardless of technology because they realize that newly learned skills will contribute to research success. However, classes that incorporate clicker technology will offer greater opportunity for discussion of peer responses and will give students a greater sense of control of their own learning.

Methodology

Our study attempts to measure motivation based on Keller's ARCS model, and learning outcomes based on four selected Association of College and Research Libraries (ACRL) information literacy standards for psychology undergraduate majors. See Table 1. (Association of College and Research Libraries, 2009) We hypothesized that the use of clickers would increase motivation, and that higher motivation would be correlated with higher learning outcomes.

The motivation instrument depended on self-reporting. It consisted of four 5-point Likert scale items, 1 item to identify year in school, 1 item to determine if the student had prior library instruction, and space for open-ended comments. Each of the first four Likert scale items focused on one component of the ARCS Model of Motivation. The librarian-instructor distributed a paper form of the instrument at the end of each section of the class. See the complete instrument at Appendix 1. The pre-test/post-test method was used to measure learning of the four selected ACRL Psychology Information Literacy Standards. The test instruments included multiple-choice items on the topics of peer review, interlibrary loan, controlled vocabulary, and Boolean operators. See table 2 for the list of selected standards.

Data were gathered from three sections of a 300 level psychology research methods class in the spring semester of 2010. Research Methods is a required course for psychology

Table 1

ACRL Psychology Information Literacy Standards tested
Standard One – 2.c. – Understands the role of <i>peer review</i>
Standard One – 3.a. – Understands that scholarly material can be obtained beyond local holdings (<i>interlibrary loan</i>).
Standard Two – 2.a. – Uses appropriate psychological terminology for searching databases...using keywords, synonyms, and <i>controlled vocabulary</i> .
Standard Two – 2.b. – Creates and uses effective search strategies..., such as <i>Boolean operators</i> ...

majors. On average, class composition is 39% juniors, 32% seniors, and 27% sophomores. Typically 85% of the students in this class are enrolled in the College of Arts & Letters, 9% come from the College of Business, and 5% come from the College of Science or the College of Engineering. The goals of the class are to teach students to design and execute psychological research and to format their research in American Psychological Association (APA) style. Students must conduct literature reviews on a topic of their choosing using PsycINFO and other databases as appropriate. Each section of the class comes to the library for one 75-minute session to learn advanced methods in searching PsycINFO, the library catalog, Web of Science, and Google Scholar. The students also learn about Boolean searching, using the thesaurus in PsycINFO, and library services such as interlibrary loan, Ask-A-Librarian, and research consultations.

We created three conditions (one for each section of the class) to test the effectiveness of clickers to motivate and learn. Condition 1 completed the ACRL standards based pre- and post-tests using clickers. Condition 2 completed the ACRL pre- and post-tests in paper format, and Condition 3 completed only a paper post-test. As mentioned before, all conditions were given the ARCS-based Likert scale reactionnaire in paper format at the end of the classes.

We expected that Condition 1 (clickers pre- and post-tests) would have the highest scores on the ARCS-based motivation reactionnaire because the use of clickers would gain their attention, establish the relevance of the class content. Additionally the use of clickers would allow students in this condition to see their

scores on the ACRL test immediately, and this would adjust their confidence to an appropriate level- either raising it, or lowering it, based on their performance. Being able to see scores immediately and discuss the results would also serve to increase levels of satisfaction. All of these factors would result in increased motivation, so we also expected the greatest improvement of scores between pre- and post-tests on ACRL- based learning outcomes.

We expected that students in Condition 2 (paper pre- and post-tests) would have lower scores on the ARCS reactionnaire than Condition 1. The act of answering the ACRL-based questions on paper would gain some attention, but the absence of technology might mean that attention could not be sustained as long. Students in this condition would not be able to determine their knowledge gaps because they would not be able to see their scores on the ACRL pre-test. Additionally, students would not be able to compare their scores with their classmates in this condition, resulting in lower levels of satisfaction and confidence. The paper pre-test in this condition would, however, help to establish the relevance of the class content for students. Because of the lower levels of motivation, we expected that students in Condition 2 would have smaller improvements between pre- and post-tests on the ACRL-based tests as compared to students in Condition 1.

Students in Condition 3 were expected to have the lowest scores overall on the ARCS reactionnaire. The absence of a pre-test in this condition would provide no opportunity to establish relevance, gain attention, foster discussion of test results, or establish any levels of confidence. In addition, the absence of technology would result in decreased attention. We also expected that these lower rates of motivation would result in the lowest scores on the ACRL post-test. We would not be able to measure gains in learning outcomes in this condition due to the absence of a pre-test.

Were the groups equivalent on basic student characteristics?

Student characteristics between groups were generally equivalent. An independent samples

t-test revealed no significant difference between pre-test scores for Condition 1 (clickers) and Condition 2 (paper pre-test). Condition 3 (no pre-test) did not have a pre-test to establish a baseline, but it is unlikely that these students differed, given that all students are in a psychology research methods class at the same university.

Does the clicker treatment have an effect on ARCS or performance?

An ANOVA with post-hoc Least Significant Difference analysis shows that Conditions 2 and 3 did significantly better on the post-test than did Condition 1 $F(2,87)=3.4$, $p=.035$. A paired-samples t-test shows that the score between the pre- and post-test for Condition 1 decreased by .1, but this was not a significant change. The paired-samples t-test for Condition 2 shows that the score improved significantly by .5 points between the pre- and post-tests, paired $t(26)=-2.5$, $p=.019$. See Table 2.

Table 2

	Experimental Condition								
	Condition 1			Condition 2			Condition 3		
	Mean	N	Std. Dev	Mean	N	Std. Dev	Mean	N	Std. Dev
Total post-test score	2.77	31	.884	3.33	27	.734	3.22	32	.941
Attention	3.63	30	.809	3.81	27	.786	3.91	32	.466
Relevance	4.37	30	.556	4.41	27	.572	4.44	32	.619
Confidence	4.23	30	.626	4.22	27	.698	4.03	32	.538
Satisfaction	4.13	30	.571	4.26	27	.656	4.28	32	.523

Other factors

Prior library instruction: An independent-samples t-test of 72 randomly chosen cases (36 in each group) showed that students who indicated having prior library instruction had significantly lower scores on the post-test than did students who indicated having no prior library instruction, $t(70)=-2.839$, $p=.006$, by a mean difference of .583. Additionally, students who reported having had prior library instruction reported significantly lower scores on the "Attention" question of the reactionnaire by a mean difference of -.4, $t(70)=-2.584$, $p=.012$.

Conclusion and Discussion

Practical & theoretical implications: Clickers did not have an effect on learning outcomes in our

study. Students in the experimental condition that included a clicker pre-test did not improve between the pre- and post-tests, and they did not do significantly better on the post-test than did the other two conditions. Additionally, students who received a paper pre-test did not do significantly better on the post-test than did students who were not pre-tested at all.

When reviewing the papers of those who found positive effect of clickers on learning outcomes, we note that both Mayer (2009) and Gauci (2009) added clickers to what had previously been straight lecture classes. In doing so, they amended the pedagogy to include active learning elements while also adding a new technology. In contrast, prior Psychology Research Methods library instruction sessions already offered a generative learning environment where, after presentation of a concept, students attempted the search task on their own using laptop computers. This may explain why we did not find higher learning outcomes in the clicker classes. Similarly, we expected that the addition of a pre-test to conditions 1 and 2 would affect self-reported scores in attention, relevance, and confidence but this is not supported by the results (although several students commented that they enjoyed using the clickers). We will continue to test the Psychology Research Methods library instruction classes in the coming semesters to increase the sample size. We will refine the items used on the motivation instrument to clarify expression of the individual ARCS components. Additionally, we will increase the number of objective response items on the pre- and post-tests.

Future directions

Some of the results from the study will inform design for future library instruction. We are particularly interested in the finding that students who have had prior library instruction tend to be less attentive. Though the *attention* score and post-test score do not correlate significantly in this sample ($p=.09$), the factors of the *attention* score and post-test score in reference to prior library instruction seem to indicate that students who had prior library instruction paid less attention in class. They also did significantly worse on the post-test than did students who indicated

no prior instruction and reported higher *attention* scores. Every teaching librarian has anecdotal evidence of the negative effect of overconfidence on learning but we now have data to support those suspicions. In order to overcome this motivation deficit, we will try to ensure that students have accurate expectations about the learning goals of the session before they arrive in the classroom. It is possible that students with prior library instruction experience assume that the content, even for upper level, discipline-specific sessions, is always the same. Lazonder (2003) acknowledges a similar motivational challenge in designing web searching instruction. He suggests, “[h]aving students perform a complicated search task prior to the instruction may arouse proper task motivation” (Lazonder, 2003, p. 184). Data from our study support the need for a pre-class assignment.

Although we were not able to confirm the effectiveness of clickers for learner motivation within a particular context, the study has been valuable to us in illustrating that the effectiveness of a given educational technology will vary according to instructional context, learner characteristics, course content, etc. Research involving educational technology should focus on a relevant instructional method rather than the technology itself (Mayer, 2009; Petersohn, 2008). Re-iterations of this study can help us to select emerging educational technology (mobile devices, document sharing software, etc.) that is the most appropriate and effective for a given instructional situation. Future studies of clickers in library instruction may include:

- Do clickers lend themselves to formative evaluation in the classroom and allow instructors to tailor instruction on the fly?
- Can clickers realistically be used in the library instruction context to foster discussion or encourage participation?
- Can clickers facilitate peer teaching in the library instruction context?

Additionally, study results will inform the next analysis phase of the instructional design cycle, providing us with more clarity about instructional needs than we have been able to garner from anecdotal communications.

Results showing lower attention levels and lower post-test scores from students who had prior library instruction are an excellent example of the value of this kind of study to inform instructional design in order to overcome an identified instructional problem.

References

- Association of College and Research Libraries. (2009). *Psychology information literacy standards*. Retrieved 06/15, 2010, from http://connect.ala.org/files/29837/info_lit_psych_pdf_4a60828636.pdf
- Gauci, S. A., Dantas, A. M., Williams, D. A., & Kemm, R. E. (2009). Promoting student-centered active learning in lectures with a personal response system. *Advances in Physiology Education*, 33(1), 60-71.
- Jacobson, T. E., & Xu, L. (2002). Motivating students in credit-based information literacy courses: Theories and practice. *Portal : Libraries and the Academy*, 2(3), 423-441.
- Keller, J. M. (2000). How to integrate learner motivation planning into lesson planning: The ARCS model approach. Paper presented at the VII *Semanario*, Santiago, Cuba. Retrieved from <http://mailer.fsu.edu/~jkeller/Article/Keller%202000%20ARCS%20Lesson%20Planning.pdf>
- Keller, J. M. (1987a). Strategies for stimulating the motivation to learn. *Performance and Instruction*, 26(8), 1-7.
- Keller, J. M. (1987b). The systematic process of motivational design. *Performance and Instruction*, 26(9-10), 1-8.
- Lazonder, A. W. (2003). Principles for designing web searching instruction. *Education and Information Technologies*, 8(2), 179-193.
- Mayer, R. E., Stull, A., DeLeeuw, K., Almeroth, K., Bimber, B., Chun, D., Bulger, M., Campbell, J., Knight, A., & Zhang, H. (2009). Clickers in college classrooms: Fostering learning with questioning methods in large lecture classes. *Contemporary Educational Psychology*, 34(1), 51-57.

Petersohn, B. (2008). Classroom performance systems, library instruction, and instructional design: A pilot study. *Portal: Libraries & the Academy*, 8(3), 313-324.

Authors



Michelle Hudson
Science and Social Science Data Librarian
Yale University
(203) 432-4587
michelle.hudson@yale.edu

Michelle Hudson, MLS, is a Science and Social Science Data Librarian at Yale University.



Cheri Smith
University of Notre Dame
Coordinator for Instructional Services and
Psychology Librarian
Hesburgh Libraries
Notre Dame, Indiana 46556
(574) 631-4271
csmith@nd.edu

Cheri Smith, MLS, is a Reference Librarian in the Information, Research, and Instructional Services (IRIS) Department at Hesburgh Libraries, University of Notre Dame. She also serves as Psychology subject liaison and Coordinator for Instructional Services.



Laurie McGowan
University of Notre Dame
Instructional Designer
Hesburgh Libraries
Notre Dame, Indiana 46556
(574) 631-4406
mcgowan.35@nd.edu

Laurie McGowan is a Senior Library Specialist in Instructional Services at Hesburgh Libraries. She has a graduate certificate in Instructional Systems Technology from Indiana University Bloomington, and is currently pursuing a Master's Degree in that field.

Appendix 1



Hesburgh Libraries
University of Notre Dame

Library Instructional Services is conducting a study about motivation in library instruction sessions. Responses are completely anonymous and will be used strictly for calculating general statistical outcomes. We are grateful for your participation by answering the following questions. The results will enable us to refine our instructional methods for future classes.

Please circle your answers.

1. This class held my attention.

Strongly Disagree -- Disagree -- Neither Agree nor Disagree -- Agree -- Strongly Agree

2. The information presented in this class will help me complete my research paper.

Strongly Disagree -- Disagree -- Neither Agree nor Disagree -- Agree -- Strongly Agree

3. As a result of this class, I am confident that I can find resources for my research paper.

Strongly Disagree -- Disagree -- Neither Agree nor Disagree -- Agree -- Strongly Agree

4. This class helped me acquire a useful skill set for research in psychology.

Strongly Disagree -- Disagree -- Neither Agree nor Disagree -- Agree -- Strongly Agree

5. What year are you in school?

1st -- 2nd -- 3rd -- 4th -- 5th

6. Have you attended a prior library instruction session?

Yes -- No

Thank you for your time. Please add your comments here or on the other side of this page.