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Information Literacy Follow-Through: Enhancing Pre-Service Teachers' Information Evaluation Skills Through Formative Assessment

Sara Seely
Boise State University

Sara Fry
Boise State University

Margie Ruppel
Boise State University

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Sara Robertson Seely, Sara Winstead Fry, and Margie Ruppel
Boise State University

Abstract

An investigation into pre-service teachers' information evaluation skills at a large university suggests that formative assessment can improve student performance. Pre-service teachers were asked to apply information evaluation skills in the areas of currency, relevancy, authority, accuracy and purpose. The authors compared the pre-service teachers' and researchers' evaluations and used Perreault and Leigh's Index of Reliability to analyze final projects from two semesters. When asked to evaluate the sources cited in a final project for an Education methods course, pre-service teachers who received formative feedback from librarians improved in most information evaluation areas. Formative assessment is explored as a tool for improving information literacy instruction.

Introduction

Librarians and university faculty share the goal of cultivating college graduates who have mastered the skills and theories necessary for their chosen profession, including the information literacy skills for finding and evaluating sources. Information literacy instruction for pre-service teachers is important for two primary reasons: 1) teachers need high-quality sources in order to develop content knowledge, actualize research-based teaching practices, and enrich lesson planning; and 2) teachers need a model and the tools to teach information literacy skills to their students. This is echoed in the Information Literacy Standards for PK-12 Pre-Service Teachers: "In the classroom PK-12 teachers will then be able to serve as powerful models for their students in how to critically navigate the current maze of information and to use information to construct credible arguments" (Association of College and Research Libraries 2011, 1).

In the field of education, librarians and teacher educators often collaborate on integrating information literacy skills into the pre-service teacher curriculum. In this article, a teacher educator and two academic librarians detail their experiences with combining an information source quality evaluation activity and formative assessment in the context of an social studies curriculum and instruction course. This study seeks to investigate whether formative assessment and additional guided practice improves pre-service teachers' ability to evaluate the quality of the information sources they select and reference in a course project.

Pre-service teachers benefit from learning a method for increasing their content knowledge since elementary teachers' background on social studies topics if often inadequate (May 2005). Once in the classroom, elementary teachers need to be able to locate and evaluate information in order to educate themselves on a topic in preparation to teach it. The authors of this study, two academic instruction librarians and one teacher educator, recognized this need and developed a library instruction curriculum within a social studies methods course in order to meet the information literacy learning needs of pre-service teachers. In the literature review that follows, we establish the need for collaboratively developed information literacy instruction in teacher programs and describe the instructional strategies implemented in this study.

Literature Review

Information Literacy Instruction for Pre-service Teachers

A review of the literature shows that developing effective information literacy instruction for pre-service teachers has concerned librarians for decades. Johnson and O'English provide an overview of articles that address information literacy in pre-service teacher from the 1980's to 2002 (Johnson and O'English 2003). Johnson and O'English find examples of both insufficiencies in the integration of information literacy in pre-service teacher

training programs and standards, as well as integrated information literacy programs that "produce new teachers who are equipped to collaborate with school librarians and to teach information literacy skills (Johnson and O'English 2003, 129). Studies have also shown that in the absence of an integrated and assessed information literacy instruction program, both library collections and librarians have the potential to become overlooked as meaningful sources. For example, in a study of the information seeking behavior of education undergraduate students, when given the choice, the students preferred Internet sources to library sources, though students "realized that library sources were more credible than Internet sources" (Martin 2008, 9). Furthermore, Martin found no relationship between students who reported having library instruction at some point in their teacher education program and their library use (Martin 2008).

And yet, a recent metasythesis of literature on the preparation of information literate teachers found that teacher education programs have made progress towards supporting information literacy initiatives since the publication of the ACRL's *Progress Report on Information Literacy* in 1998 (Duke and Ward 2009). Duke and Ward outline five central themes in the literature on information literacy and teacher education since 1998, two of which are pertinent to this study: 1) *Information literacy skills, education and democracy* - the notion that integrated information literacy instruction produces teachers who are able to find, evaluate, and incorporate information into their professional practice and model information problem-solving for their students; and 2) *Collaboration* - the notion that innovative teacher education programs model collaborative efforts between librarians and teacher educators in order to integrate information literacy into the curriculum (Duke and Ward 2009, 254). The study that follows presents an information literacy program that is both integrated and collaboratively developed in order to reach pre-service teachers with effective information literacy instruction.

Critical Evaluation of Sources

The current study focuses on pre-service teachers' ability to critically evaluate the sources included in a final project for a Social Studies Methods course. Several previous studies have addressed pre-service and practicing teachers' concepts of information literacy (Branch 2003) (Probert 2009). Additional studies have examined pre-service teachers' information seeking behavior, including evaluation skills, when looking for and making use of professional literature to enrich their teaching practice (Williams and Coles 2007) (Emmons and Keefe and Moore and Sánchez and Mals and Neely 2009). Few studies have focused specifically on pre-service teachers' information evaluation skills, although a study by Wang found that pre-service teachers have an "over-confidence" in their information literacy capabilities than they can demonstrate (Wang 2007, 498). Wang also found pre-service teachers over-estimated their ability to critically evaluate information found on the web, where "only 32% of the students were familiar with standard evaluation guidelines" (Wang 2007, 599). This evidence points to the need for additional instruction for pre-service teachers in order for them to successfully find and evaluate information in an electronic environment.

Formative Assessment

Assessment is a tool for both improving librarians' instructional practice and increasing student learning (Oakleaf 2009). Formative assessment is the evaluation of student work before the submission of a final draft in order to provide an opportunity for both teacher and student to check on the learning process (Johnson and Jenkins 2009). Summative assessment, on the other hand, is the final evaluation of student work at the end of the learning experience (Johnson and Jenkins 2009). Formative assessment was used in this study at the student level in order to provide pre-service teachers with individual performance feedback on a specific task. A strength of formative assessment is that it can provide teacher communication to a student at a point in their learning process when they can choose to self-correct or further develop their skills, and therefore increase achievement (Black and Wiliam 1998).

A few articles in library science literature explicitly address use of formative assessment with students during informaiton literacy instruction in higher education. McFarlane used formative assessment in a credit-bearing information literacy course to gain insight into the student learning process (McFarlane 2005). Forrest developed a series of online formative assessments for undergraduates to provide feedback on citation practices, and students reported the practice supported their learning (Forrest 2007). Librarians might consider formative assessment as an instructional strategy that has the potential to positively impact student information literacy learning.

Research Methods

This study compares student performance between spring 2009 and fall 2009 when the investigators collected data from two sets of pre-service teachers. This investigation used quantitative methods to assess pre-service teachers' evaluation skills as demonstrated within the context of a final project, or summative assessment, in an elementary social studies curriculum and instruction methods course.

Using the same instrument, the authors asked each set of pre-service teachers to evaluate the information sources they included in the final project using the following critera: currency, relevancy, accuracy, authority and purpose (Meriam Library 2009). The information evaluation criteria developed by Meriam Library was chosen because it thouroughly covered the information evaluation process and was used extensively throughout the information litearcy instruction program at Boise State University.

During the spring and fall semesters, the librarians taught the pre-service teachers how to find and evaluate the quality of books, articles and websites in order to increase their content knowledge on a social studies topic. For the course final project, the pre-service teachers were asked to find, evlauate and cite a variety of information sources. For this study, the investigators used the same criteria to evaluate each of the cited materials the pre-service teachers included in their final project.

Findings from the spring semester indicated that, despite the information literacy instruction, most students struggled to identify and use high-quality sources. The authors made changes to their instruction during the fall semester that aimed to better support the pre-service teachers information literacy learning. Specifically, the librarians implemented formal and informal formative assessment. The authors will discuss student performance in relation to the changes made to the instructional intervention during the fall semester.

Participants

The participants were enrolled at a large land-grant university in the western United States and were seeking K-8 elementary teaching certification. All participants were enrolled in a required social studies methods course. Participants were recruited from the class, which had a total enrollment of 26, during two different semesters. In all, 15 (spring semester) and 24 (fall semester) pre-service teachers seeking certification in elementary education or dual certification in elementary and bilingual or special education agreed to participate in the study. Table 1 provides a summary of demographic information about the participants. These demographics were typical for elementary pre-service teachers at the university. (Insert table 1)

Data Sources

There were two data sets in this investigation; both were collected in the spring and fall semesters of 2009. The first data set consisted of pre-service teachers' source-quality evaluations, which were based on Meriam Library's guidelines, for the two sources used in their final project (Meriam Library 2009). The second data set consisted of the investigators' evaluations of each pre-service teacher's sources using the same evaluation criteria: currency, relevancy, accuracy, authority and purpose. For analysis purposes, the authors were considered the expert evaluators because, unlike the participants, the authors have extensive training in research through advanced degrees, and have years of professional experience applying information literacy skills to our work.

The authors independently rated the quality of each source by examining the sources each participant used for the course final project. Specifically, the authors visited the websites; obtained and read a copy of the journal articles and researched the publication; read a description of each book; and, when available, read academic reviews of the book. Next the authors met to compare ratings; the inter-rater reliability rate was greater than 95%. Finally, the authors resolved rating discrepancies by discussing the reason for the rating and coming to a consensus for the source.

Context and Procedures

To prepare for the social studies methods course final project, pre-service teachers read juvenile or young adult literature with social studies topics or themes and kept track of their content-related questions. Pre-service teachers who selected a middle-level title read one book for the final project. Those who selected from the shorter primary and intermediate options read two books.

After reading the book(s), the pre-service teachers prepared a two-part final project: (1) a summary of background information about the book's social studies content, and (2) instructional recommendations for how to use the book with K-8 students. The goal was to make the final project as authentic as possible so the pre-service teachers would learn a model for enhancing content knowledge they could apply to their future inservice teaching. In order to prepare the participants to be successful on the final project and to ensure that they had the requisite skills to conduct background research, the participants completed a 2-hour information literacy instruction session co-taught by the librarians and teacher educator.

The information literacy instruction was designed around a work of children's literature, *Eagle Song* (Bruchac 1997). On the day of the information literacy instruction, participants spent the first 30 minutes of class discussing *Eagle Song* in literature circles (Wilhelm 2002). The next 30 minutes was devoted to a whole-class conversation about how to use the book *Eagle Song* to teach social studies in the elementary classroom. After these discussions, the participants were well prepared to engage in the 2-hour information literacy workshop.

The workshop began by giving students the chance to generate content-related questions about *Eagle Song*. The participants had many questions about the content since most were from the western United States and none had more than cursory knowledge of the Iroquois. Questions included: "What are longhouses?" and "How are present-day reservations governed?"

The information literacy workshop provided instruction and practice in finding and evaluating relevant academic sources for use in preparing the final course project. Librarians modeled for the students how to access journal articles and online encyclopedias. In addition, librarians gave students a quick overview of looking up books in the online catalog. After demonstrating how to locate sources, the librarians trained students in a model for evaluating resource quality that used five criteria: (a) currency, the timeliness of the information; (b) relevance, the importance of the information for the researcher's needs; (c) authority, the source of the information; (d) accuracy, the reliability, truthfulness, and correctness of the information; and (e) purpose, the reason the information exists (Meriam Library 2009).

The participants learned how to apply the Meriam Library's evaluation model to two types of sources they were required to use for their summative assessment: an article from a peer-reviewed journal and a website from a reputable source. The workshop included time for the participants to find and evaluate sources that answered the content-related questions they had about *Eagle Song*.

After completing the 2-hour information literacy workshop, participants were instructed to apply the searching and evaluation process to their independent work on their final course project. In order to avoid the minimal impact one-time library instruction can have on student resource selection (Martin 2008) and provide participants with ample opportunity to ask follow-up questions once they began their independent work, the librarians attended the next two regular class sessions. The librarians were also available for one-on-one consultation after class and during office hours. These procedures were consistent for both the spring 2009 and fall 2009 semesters.

The investigators implemented two additional components to the information literacy instruction in the fall 2009 semester: formative assessment and additional time for guided practice during the information literacy workshop. In spring 2009 semester, only 8 minutes were provided for guided practice. In the fall 2009 semester , the portion of the information literacy workshop in which the librarians modeled how to find and evaluate sources was condensed so the participants could spend the last 20 minutes of the workshop to begin their search for appropriate sources. During this time, the librarians and professor were available to support their work and answer questions.

The librarians implemented two types of formative assessment during the fall 2009 semester. The first took place at the end of the information literacy workshop. Students were given scrap pieces of paper and asked to list one thing they learned from the workshop (something that is now clear), and on the other side list anything that they still had questions about (something that is still muddy). Students submitted these pieces of paper and the librarians viewed their responses in the days following the workshop. This informal "clear and muddy" assessment revealed that students felt confident using databases and narrowing their searches, but several noted they were still having trouble determining the quality of different sources.

The second piece of formative assessment data was more formal: written feedback on a first draft of selected sources for use in the final project. This formative assessment occurred during the two weeks following the information literacy workshop. Students were required to submit their research questions, a bibliography of sources, and source quality evaluations to the librarians for review and written feedback. The librarians responded within one week, providing them with written feedback about the quality of the sources they selected and suggestions for next steps in their research. The timely nature of the feedback provided participants with the opportunity to use different sources if their original ones were problematic.

After reviewing the clear and muddy assessments and the draft sets of sources submitted by the students, the authors noticed patterns in misconceptions and errors and deemed a follow-up session to be critical to students' success. Librarians visited the class in a follow-up session, during which they provided students with approximately 20 minutes of further instruction. Librarians had noticed during the formative assessments that students struggled to find scholarly journal articles about various historical topics, so librarians recommended additional databases to locate journal articles about historical topics. Librarians were also able to review with the pre-service teachers how to locate the author of a website and determine the authority of an author, both areas about which pre-service teachers had questions.

Data Analysis

The authors' initial step in the data analysis involved preparing tables to compare pre-service teachers' evaluations of source quality with the invesigators' evaluations of source quality for each semester. Next, the percentage of agreement was calculated between the researchers and participants for each source and criteria. The authors then used Perreault and Leigh's Index of Reliability (I_r) to determine if each percentage of agreement was statistically significant (Perreault and Leigh 1989). The I_r was selected because the measure was developed for use with judgment-based nominal-scale data and is robust with small sample sizes. Complete agreement between two judges (in this case the researchers and the pre-service teachers) would yield an I_r of 1. Ten separate I_r values were prepared: one for each of the five evaluation categories (currency, relevancy, accuracy, authority, and purpose) and for each of the two sources (journal article and website). Along with the I_r, we calculated a 95% confidence interval to determine whether the reliability index was significantly different from 1.

Results

Table 2 summarizes the Index of Reliability (I_r) results, including the percentage of agreement, I_r, standard error of estimate, and a 95% confidence interval (CI), for journal articles and the five information evaluation criteria by semester. (Insert table 2)

For the spring 2009 and fall 2009 semester data, there was a low level of consistency between the pre-service teachers' and the experts' evaluations of source quality values for the relevance of journal articles. There was essentially no improvement in the I_r values for this criteria from the spring semester to the fall semester 2 (I_r - Spring = .65; I_r - Fall = .66), indicating the fall semester pre-service teachers were not better able to evaluate the relevance of journal articles than the spring semester pre-service teachers. However, the pre-service teachers in the fall semester were more successful evaluating source quality for four of the criteria - currency, accuracy, authority, and purpose - than the spring semester pre-service teachers. Table 3 presents the Index of Reliability (Ir) results for websites. (Insert table 3)

The I_r values for website quality evaluation were higher in the fall semester for every criterion as compared with spring semester. The upper confidence intervals (CI = 1) for all values indicate that the difference between the participants' and the experts' evaluations of resource quality were not significantly different from 1. Therefore, the

fall semester pre-service teachers were more successful evaluating resource quality for websites for all criteria - the currency, accuracy, authority, relevance, and purpose - than the spring semester pre-service teachers.

Discussion

Although the investigators did not use a true control-experiment group design for this study, the participants were similar enough between the spring and fall semesters that the positive improvement in most areas of pre-service teachers' evaluation skills seems attributable to the changes implemented in the fall semester, namely, formative assessment and additional time for guided practice.

Because the investigators did not collect qualitative data about pre-service teachers' thinking process during source selection, one can only speculate about why the fall semester pre-service teachers did not evaluate the relevance of journal articles more consistently with the experts. The authors propose that because both sets of pre-service teachers were less familiar with journal articles than websites, finding a journal article that addressed one of their research questions was the more challenging task, and the pre-service teachers were inclined to use whatever article they found as long as it was somewhat related to their research topic. Meriam Library defines relevance as the degree of the importance of the information fournd in the source relavite to the researcher's information needs (Meriam Library 2007).

When completing the evaluation of the relevance of the journal article to each pre-service teacher's information needs, the authors read the article to determine if it answered one or more of the pre-service teacher's research questions. If it did not, the authors gave it a low rating for relevance, hypothesizing that pre-service teachers included articles that were related to their topic but did not answer their specific research questions. This possibility offers an opportunity for future qualitative research about pre-service teachers' information seeking behavior using in-depth individual and/or focus group interviews to uncover thought processes and approaches.

Through the process of formative assessment, librarians were able to help pre-service teachers put their evaluation skills to use. Some students successfully located high-quality journal articles and web sites, while others struggled to apply the criteria of currency, relevancy, authority, accuracy, and purpose to the process. Pre-service teachers and librarians both appreciated the chance to practice evaluating specific sources using a "practice makes perfect" philosophy. In the end, the authors realized it helps to work one-on-one with students and provide individualized help when applying the principles for evaluating information.

In two surprising instances, however, students seemed resistant to the process. One student chose to disregard the formative feedback received from the librarian and used a magazine article written for children instead of the suggested journal article. In another situation, a student was angry that meeting with a librarian was required, insisting that it was unnecessary additional coursework and that she could locate high-quality sources on her own. This reaction is in line with Wang's findings that education undergraduates can over-estimate their information literacy abilities (Wang 2007, 599).

In this study, formative assessement proved to be an effective vehicle for librarians to provide a meaningful instructional response for students. Instead of offering a one-time library workshop and hoping for the best, through formative assessment, librarians were able to evaluate student performance and provide both individualized and global feedback on their work. Librarians saw patterns in student misconceptions or errors and summarized common mistakes during a 20-minute in-class visit, post formative assessment. During this follow-up instruction, librarians were able to provide reminders and clarifications prior to pre-service teachers submitting their final projects, which is a relevant and meaningful instructional role for librarians.

The authors were aware of the importance of information literacy to pre-service teachers prior to this project in order to help pre-service teachers generate content knowledge. After seeing the benefits of their instruction and formative assessment, the authors realize it is even more crucial than originally believed to teacher information-seeking and information evaluation skills.

One of the librarians was further encouraged by the results of the study when a student stopped by the reference desk to tell the librarian how useful the library instruction had been to her. She said she now applies it to other projects and always brainstorms the information needed before she types search terms in a search box. Particularly

rewarding was hearing the student say that the techniques help her find sources that are so much more relevant than what she was finding before she went through the library instruction session. In the end, this is the overall goal: to help pre-service teachers locate more relevant and higher-quality sources in order to enhance their learning and teaching.

Conclusion

This research project taught the authors that students struggle with two major areas: 1) distinguishing between popular magazines and scholarly journals, and 2) finding authoritative web sites. In the future, the authors plan to retain an information evaluation element in the social studies methods course, accompanied by formative assessment, but in the form of a required lab. The Technology Integration Lab will be an online companion to the social studies methods course and will include a 3-week research series taught by the librarian using a combination of online and in-person sessions. Topics will include locating journal articles, books and websites; a Big 6 Information Skills unit (Eisenberg 2008); and an evaluating information unit. During this 3-week series, the librarian will have continuous contact with the students, and will integrate both formal and informal methods of formative assessment into the curriculum. The librarian and teacher educator will work closely to ensure formative assessment and guided practice are implemented when and where they are needed.

This study illustrates that formative assessment of information literacy learning is a meaningful assessment practice that will support student learning and the improvement of teaching practices. For example, implementing a simple formative assessment practice, such as the "clear and muddy" exercise discussed above, provides an opportunity for librarians to check student learning and follow-up with tailored instruction that fills in the gaps in student understanding, helping them along towards mastery of a concept or skill. Formative assessment can document student learning and inform instruction and information literacy program development.

Table 1

Pre-Service Teacher Demographic Information by Semester
Spring 2009 (n = 15) Fall 2009 (n = 24)

	Spring 2009	Fall 2009
Non-traditional*	13	18
Post-baccalaureate	6	5
Women	14	23
Minority	2	1

* Non-traditional students were defined as 24 years of age or older.

Table 2
Summary of Index of Reliability (I_r) Results for Journal Articles by Semester (Spring and Fall)

Criteria and Semester	% Agreement	I_r	Standard Error	95% CI
Currency – Spring	46.67	.65	.12	.41 - .90
Currency – Fall	70.83	.83	.10	.65 - 1
Relevance – Spring	46.67	.65	.12	.41 - .90
Relevance – Fall	45.83	.66	.12	.42 - .90
Accuracy – Spring	20.00	.38	.13	.13 - .62
Accuracy – Fall	66.67	.81	.10	.61 – 1
Authority – Spring	53.33	.71	.12	.48 - .94
Authority – Fall	66.67	.81	.10	.61 – 1
Purpose – Spring	53.33	.71	.12	.48 - .94
Purpose – Fall	70.83	.83	.10	.65 - 1

Table 3
Summary of Index of Reliability (I_r) Results for Websites by Semester (Spring and Fall)

Criteria and Semester	% Agreement	I_r	Standard Error	95% CI
Currency – Spring	60.00	.76	.11	.54 - .97
Currency – Fall	75.00	.86	.09	.68 - 1
Relevance – Spring	40.00	.60	.13	.35 - .85
Relevance – Fall	91.67	.96	.05	.85 - 1
Accuracy – Spring	46.67	.65	.12	.41 - .90
Accuracy – Fall	75.00	.86	.09	.68 - 1
Authority – Spring	46.67	.65	.12	.41 - .90
Authority – Fall	66.67	.81	.10	.61 - 1
Purpose – Spring	46. 67	.65	.12	.41 - .90
Purpose – Fall	75.00	.86	.09	.68 - 1

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