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Utilizing a Co-Teaching Model to Enhance Digital Literacy Instruction for Doctoral Students

Paige M. Alfonzo and Jennifer Batson
University of Mary Hardin-Baylor, Belton, Texas, USA

palfonzo@umhb.edu, jbatson@umhb.edu

Abstract

Students in post-secondary education often lack the digital literacy skills required for advanced level research. Digital skills are particularly important for doctoral students whose in-depth research requires the use of technological tools such as databases, content management systems, and citation management programs. Although widely researched in the undergraduate education context, digital literacy instruction has received less attention concerning doctoral students. In addition, little attention has been paid to the effectiveness of citation management tools on educational research. To address these questions, a faculty librarian, library intern, and professor at the University of Mary Hardin-Baylor employed a co-teaching model of instruction in an attempt to improve digital searching and citation management to the incoming doctoral cohort. This paper presents a case study that discusses the findings from a mixed-methods approach involving closed-ended and open-ended assessments to determine effectiveness. The co-teaching model offered significant benefits over previous doctoral library instruction methods.

Keywords: digital literacy, citation management, co-teaching, doctoral student learning

Definition of Relevant Terms

1. **Citation Management/Manager-** Any reference management software that enables researchers to digitally collect, organize, and share bibliographic references (Reitz, 2014).
2. **Co-Teaching-** Involves two or more library and/or faculty members who, together, develop and teach one or more information literacy sessions.
3. **Digital Literacy-** “The ability to use information and communication technologies to find, understand, evaluate, create, and communicate digital information, an ability that requires both cognitive and technical skills” (American Library Association, 2013). The Association of College & Research Libraries (ACRL) (2000) states that information literacy has significant overlap with digital literacy skills (defined as “information technology skills”), and are “interwoven with, and support, information literacy.” Digital literacy involves a wide range

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of skills including the ability to use software applications and other technologies to manage digital information, and the use of search logic such as Boolean search operators, truncation symbols to search databases and search engines.

4. **Information Literacy (IL)-** “A set of abilities requiring individuals to ‘recognize when information is

needed and have the ability to locate, evaluate, and use effectively the needed information”” (Association of College and Research Libraries [ACRL], 2000).

5. **Point of Need Instruction-** Instruction provided at the time where it is most relevant.
6. **Zotero** - Free citation management software used in many universities to manage references for scholarly writing. It was “developed by and for academic scholars and provides a platform that can be used to teach students how to manage voluminous citation data” (Kim, 2011, p. 412).

Introduction

Many doctoral students returning to college after an absence, as well as students entering directly from undergraduate programs, do not arrive with adequate digital literacy skills. Using databases to find resources and citation management applications to track research are important minimum skills for successful doctoral degree completion. Most current research refers to digital literacy and adult education in the framework of the digital divide or undergraduate education. This study approaches the problem in the context of highly educated, non-traditional age doctoral students, who may lack adequate research skills. This case study discusses the implementation and outcomes of a co-teaching model introduced to provide effective digital literacy instruction to the Ed.D. students at the University of Mary Hardin-Baylor (UMHB).

The Problem

A large fraction of doctoral research involves the use of digital technology. It is essential to equip doctoral students with the necessary tools and skills to perform advanced level research successfully. While it is not exclusively the librarians’ responsibility to teach these skills, as experts in information retrieval and holders of a master’s degree in library information science, librarians are ideally suited for helping students find and gather information from various resource systems. Time allotments for database research instruction at many colleges and universities are limited. The predominant form of library instruction at UMHB is in the form of a one-hour, single session, bibliographic methods tutorial. Librarians and faculty determined that a more thorough method of instruction would be beneficial. A faculty librarian, library intern, and education professor at the University of Mary Hardin-Baylor used co-teaching and a workshop model to address the problem. We integrated digital literacy instruction involving electronic database research and a citation management software program (i.e., Zotero) into the education process to prepare the students for the intense research required to obtain advanced degrees.

Review of the Literature

The ability to use digital resources is critical to the research necessary to attain a doctoral degree. Skills include using content management software, citations to both record and find resources, and information retrieval logic such as Boolean search operators and truncation symbols to find digital information. The literature indicates that while doctoral students require these skills, many are not familiar with modern research databases and often lack the library research skills needed for advanced level digital research (Beile, 2008; Cooke, 2010; Tuñón & Ramirez, 2010). Compounding the problem is the fact that faculty may not be prepared to teach these skills, especially given the rapid change in library technology. As cited in Johnson, Brown, and Becker’s report (2013), digital media literacy continues its rise in importance, [however] training in the supporting skills and techniques is rare in teacher education and non-existent in the preparation of most faculty (p. 9). Librarians have the ability to provide “more direction and guidance in how to use the resources...as [graduate students] search for the specialized information needed for theses or dissertations” (Cooke, 2010, p. 217-218). While librarians are taking a more active role in assist-

ing faculty with digital and information literacy (IL) instruction (Gullikson, 2006; Walter, 2008), they are often not utilized to their fullest potential (Badke, 2005; DaCosta, 2010). Librarians and faculty co-teaching digital literacy skills is a solution to the problem of getting the digital literacy instruction to the students in the way most conducive to learning.

Co-teaching provides significant benefits for both professors and the librarians. In particular, librarians can gain insight on subject specific needs and provide individualized answers to questions about information technology. Professors are relieved from teaching IL skills that are often outside their specific area of expertise and can see how search techniques and citation management skills enhance research. Medaille and Shannon (2012) state that “co-teaching provides instructors with feedback and different points of view while also giving them the freedom to emphasize certain content areas” (p. 135). The librarian can emphasize digital literacy skills that directly support the instructional goals of the course at the *point of need*. Research suggests that point of need support is an important element in teaching digital literacy skills (Hall, Nix, & Baker, 2013; Tuñón and Ramirez, 2010; Walker, 2013). For doctoral students, co-teaching permitted the introduction of key skills at the point the students began to see the need for them, while researching for a literature review.

With the dramatic increase of articles found online, the ability to locate information in databases rather than just on the shelf is critical. Understanding the difference between a keyword and subject search or the benefits of using truncation symbols, Boolean operators, and synonyms can mean the difference between a successful search and frustration. Doctoral students, especially those returning after years out of the academic environment benefit from instruction in these digital literacy skills.

Another application that directly involves the need for digital competency is citation management tools. The ability to use software applications and other technologies to manage digital information is included in ACRL’s (2000) list of Information Literacy Competency Standards for Higher Education as a skill to enable students to achieve a wide variety of academic goals. As scholarly literature continues to become available digitally, opportunities arise for more efficient knowledge management methods (Dreher & Dreher, 2011). The manual methods of accessing, managing, sharing, and storing digital articles can be labor-intensive (Dreher & Dreher, 2011) and unnecessary due to the availability of electronic citation management software which are fast becoming standard research tools (Childress, 2011). Using citation management software “strengthens students’ citation knowledge and removes tedious hand formatting of bibliographic entries” (Kim, 2011, p. 412) which saves time by streamlining the management of large volumes of literature and allowing researchers more time to focus on content rather than technicalities. The proliferation of citation management software has increased the role of librarians in the areas of instruction and technical support of these resources, and it increases opportunities for librarians to meet their students’ needs (Childress, 2011; Fernandez, 2012). Kim (2011) states that “Zotero can be used to help students strengthen their citation knowledge, create personalized citation libraries that are consistent with professional expectations, and eliminate tedious hand formatting of bibliographic entries allowing for more rigorous attribution and raise student enthusiasm for proper uses of literature citations” (p. 415). Research on the use of reference management tools has received little attention in the literature (Childress, 2011; Kim, 2011), but is useful for researching methods of improving digital literacy.

Method

The doctoral program at UMHB is research intensive. Many incoming doctoral students do not have the required skills to conduct digital research and knowledge management efficiently. The purpose of this study was to examine the effectiveness of using a co-teaching model of instruction to optimize digital literacy skills for the incoming cohort of doctoral students at UMHB.

Sample

The sample was the incoming doctoral cohort of 20 students. The cohort included 14 female and 6 male students with an age range of 25 to 52. The participants mean age was 40 with 77% over 35 years of age. The participants self-identified as 2 Black, 1 Hispanic, and 17 White/Caucasian. The majority of students work full time in public education. The doctoral program is set up on a weekend cohort format. The program includes a two-week summer institute and “a total of 11 class weekends each academic year” (University of Mary Hardin-Baylor, n.d.) to accommodate for students’ professional responsibilities. Students who complete coursework and dissertation research earn a Doctorate of Education, Ed.D.

Workshop Design and Delivery

In collaboration with the professor, the librarian designed a series of five workshops during the course of a week (see Table 1). The focus was library orientation, citation introduction, and bibliographic management. The students at the doctoral level were generally proficient in the research process but, as non-traditional age students, were less familiar with computer skills and software for research. Therefore, the workshops emphasized digital resource management instruction.

Day/Time	Workshop	Group
Day 1 11:00am-12:00pm	Library orientation, basic database research	1 (beginners) and 2 (advanced)
Day 1 3:20pm-4:30pm	APA formatting and citation basics	1 and 2
Day 2 9:30am-10:30am	Zotero- Managing resources	2
Day 2 11:00am-12:00pm	Zotero- Managing resources	2
Day 3 9:30-10:30 am	Zotero- Building a bibliography	2
Day 3 11:00am-12:00pm	Zotero- Building a bibliography	1
Day 4 2:00pm	Zotero- Advanced	2

The librarian created a pre-assessment, post-assessment, and follow-up assessment using Qualtrics software. The professor reviewed and edited them. The librarian also created a PowerPoint presentation for each workshop. Students were required to download the citation management software Zotero onto their devices.

Pre-Assessment

The assessment was adapted from the “Information Literacy Assessment Scale for Education” (ILAS-ED), created in 2005. The original assessment consists of 46 multiple-choice questions,

22 of which reflect cognitive content (Beile, 2008). The Association of College and Research Libraries' (ACRL) information literacy standards form the basis for the questions (Association of College and Research Libraries, 2000). The instrument assesses pre-service teachers' information literacy levels.

To assess entering doctoral students, the ILAS-ED was modified and parsed down to 9 questions to accommodate student time constraints. Twenty students received an online pre-assessment two weeks before the workshops and 18 responded. The librarian and professor collaborated on the assessment modifications. The workshops incorporated the results of the pre-assessment in the design of the presentation.

The first question gathered age demographics. The second question assessed student perception of their searching abilities based on a rated sliding scale of *poor* (0-2.9), *fair* (3-4.9), *good* (5-6.9), *very good* (7-8.9), and *excellent* (9-10). The majority of students rated their database and Internet searching skills as *good* and their catalog searching skills as *fair*.

Questions 3 through 6 assessed students' ability to find library materials and journal articles utilizing keywords, subject headings, and search operators such as truncation symbols and quotation marks using multiple-choice responses. The majority of students understood databases, truncation symbols, and keyword and subject searching. However, most could not determine how to use a citation to search the library's catalog. All questions received some incorrect answers.

Questions 7 through 9 asked students' preferred method for resource management and scholarly communication, and background using cloud storage, search engines, and citation management tools. The majority of students preferred a digital method when saving citations. The majority of students preferred to use cloud storage either *sometimes* or *often*.

Workshop 1: Library Orientation

All students attended a library orientation on the first day. Many of the students had not used a library in several years, so awareness of the available library services was important. The orientation covered location information, journal and database access, interlibrary loan, and other basic services. Also included was the use of search techniques such as using Boolean operators and truncation symbols.

Workshop 2: American Psychological Association Citation Style

The doctoral students use the American Psychological Association (APA) citation style for their coursework and dissertations. Due to the complexity of APA style and difficulty other cohorts had experienced with it, the professor requested a workshop session dedicated to APA instruction.

The librarian taught the APA session on the first day and lasted one hour. All students were required to attend. The focus of the session was to present the most common APA mistakes that graduate students make rather than basic citation instruction. Most students had knowledge of basic APA citation, but were unaware of specific style and grammar rules. Topics included reading digital articles to extract citation information, avoiding passive voice, formatting in-text citations, eliminating dangling modifiers, using people first language, maintaining gender neutrality, organizing headings and using Microsoft Word's advanced grammar and style settings.

Workshop 3: Zotero

Zotero is a free citation management software program that allows the user to gather and store bibliographic resources such as journal articles and books ("About," n.d.). It also has functionality to generate in-text, footnote, and bibliographic citations, and store PDF files. Since Zotero

offers a robust citation management platform for no fee, it has garnered use by many academics and researchers. It has the benefit over proprietary citation management programs with a university license in that scholars do not lose their resource library if they leave the university. Users have the option to download Zotero as a Firefox plugin or as a separate program (known as Zotero Standalone). Like most freeware programs, technical support is available through forums. This differs from proprietary programs such as Refworks and Endnote that provide technical support and customer service teams. Without standard technical services, it was even more vital to provide instruction as some individuals have difficulty combing through forums and troubleshooting issues.

For the Zotero workshops, the students self-selected one of two groups: advanced or beginner. Separate training provided tailored instruction and more individualized attention with a smaller class size. While one class was in the workshop, the other attended another seminar. Instruction occurred over 3 days. On day 1, the librarian covered the basics of Zotero including adding resources into the program from various platforms and in various file types. The librarian focused on integrating Zotero into Microsoft Word for in-text citation and bibliography generation on day 2. The third day consisted of advanced Zotero features that students had the option to attend.

The Zotero classes took place in a classroom setting with students using their personal laptops, the one they would actually use for their research. Instructors could troubleshoot any problems due to different platforms before the students left the class. PowerPoint presentations guided live demonstrations, allowing students to perform the steps with the instructor. This more active model replaced a static lecture-only model of instruction. While the presenter was instructing, the library intern or professor helped individual students who were having difficulty. If a student had a question that required the librarian's attention, the professor would take over the class instruction. After the lecture portion, students completed a hands-on activity to enhance comprehension and retention. This "practice by doing" model appeared to encourage student confidence with Zotero.

Post-Assessment

To evaluate the long-term effectiveness of the methods, students took a post-assessment approximately one month after the conclusion of the workshops. The post-assessment was the same instrument as the pre-assessment with some minor modifications. Reworded questions avoided repetition and memorized answers. Fifteen of the original 20 participants responded.

The first question consisted of three parts and pertained to students' comfort level with searching the library's databases, catalog, and searching the Internet for information. The average rating increased when compared to the replies on the pre-assessment. The majority of students rated their database and Internet searching skills higher, *very good*, and their catalog searching skills as *good*.

Similar to the pre-assessment, questions 2 through 6 on the post-assessment analyzed students' ability to find library resources and utilize advanced search techniques when conducting research. The results were very similar to the pre-assessment. There was no measured improvement on the question assessing students' ability to select the best method for retrieving an article from a given citation. In addition, there was a decrease in correct answers on the question assessing students' ability to search by subject to find resources on a specific topic. These results might be due to the limited time allotted for database instruction and/or the lack of students' actual research exposure.

Question 7 asked for students' preference regarding citation management. All but one of the respondents chose Zotero as their preferred method, versus only 33% in the pre-assessment. Questions 8 through 11 asked for student feedback regarding class and instructor quality and question as well as additional comments. The respondents rated the instructor and class quality an average

score of 4 out of 5 (with 5 being the highest). In response to recommended workshop topics for the future, 2 students requested additional Zotero instruction be offered.

Follow-Up Assessment

The instructors anticipated that students would continue to use Zotero during the fall semester for coursework. At the conclusion of the first fall semester, students completed a follow-up assessment. The follow-up assessment consisted of 1 question with 3 parts. Participants provided answers based on a sliding scale (see Table 2). The assessment was used to determine how often students use Zotero to gather and cite resources and how often they use library databases for their research. The majority of students (65%) used Zotero to gather and store resources either *often* or *all of the time*. Fifty-five percent used Zotero to cite sources either *often* or *all of the time*. Finally, 40% selected *never* or *rarely* when asked if they used Zotero's citation feature. All participants use the library databases for their research either *often* or *all of the time*.

Table 2: Follow-Up Assessment (n=20)

#	Question: During your first semester at UMHB, did you:	Never	Rarely	Sometimes	Often	All of the Time	Mean
1	Use Zotero to gather and store your resources?	1	2	4	3	10	3.95
2	Use Zotero to cite your sources?	2	6	1	2	9	3.50
3	Use library databases for your research?	0	0	0	2	18	4.90

Follow-Up Workshop: Advanced Zotero

Six months after the initial workshop offerings, the librarian and library intern co-taught an advanced one-hour Zotero workshop. Students again divided into beginner and advanced groups. The librarian gave a brief lecture for the first 20 minutes about some advanced Zotero features and the remainder of the class consisted of a question-and-answer time. Lecture topics included PDF annotating, creating group libraries for collaboration, and utilizing Google Scholar and World Cat for resource metadata retrieval. The advanced class expressed interest in the group folder feature and used the instruction independently to set up a cohort group folder before leaving the one-hour class.

Findings

The most significant finding was the increase in student use of the citation management software, Zotero, to manage digital information. On the pre-assessment, only 33% of students indicated that they would use a citation manager to keep track of articles, while on the follow-up assessment that percent increased to 93%. Interest in Zotero was so high the librarian and library intern held a follow-up workshop. The increase on the assessment results and interest in citation management instruction indicates that the co-teaching model was successful for teaching this component of digital literacy to doctoral students. In addition, student comfort searching a library data-

base increased from an average of 6.17 out of 10 to 8.07 out of 10. Student comfort with the library catalog increased to a lesser extent, from 4.83 to 6.4. Although the instructors would prefer a greater degree of comfort with the databases and catalog, the increases occurred in spite of the relatively small proportion of the workshop dedicated to these skills. The greater flexibility during class instruction and individualized assistance to students who required the help that co-teaching allowed were essential to these gains.

The instructors observed that the co-teaching model allowed for a smoother class flow, which allowed the instructors to provide effective digital literacy instruction and maximize the time spent teaching the digital tools required for digital literacy competency. The instructors also observed that the presence of more than one instructor increased one-on-one instruction for struggling students, allowing time for all students to learn the citation management technology. The librarian/professor collaboration, brought about by the co-teaching model, before the workshops provided the opportunity for tailored sessions that directly addressed the cohort's specific digital literacy needs.

The workshop format allowed additional time for digital literacy instruction than had been previously practiced, thereby allowing more time for software and database comprehension and use. Previously, incoming doctoral students attended either a 15-minute library presentation during orientation and/or a one-hour information literacy instructional session. The one-hour sessions did not allow adequate time to address all the aspects that needed to be covered. The hands-on activities seemed to increase student confidence and allow for more in-depth comprehension. Students' active involvement allowed for replicating and expanding on the information and techniques presented. The students left able to use the skills on their own computers. While the workshop format was an improvement from previous library instructional sessions, the time allotted for digital research was limited. Students attended the workshops prior to performing any doctoral research making difficult to create "point of need" database instruction.

Practical Implications and Limitations

This was a preliminary, micro-level study, consisting of a small sample size ($n=20$) that was conducted for a limited period. Although some bias is possible due the qualitative nature of the assessments, the results indicate the potential of the co-teaching model and suggest that subsequent studies with larger sample sizes over longer periods would be beneficial. Although these individuals were already using technology in their daily work environment, some clearly lacked an understanding of the system software they were using and, while comfortable with familiar programs, were somewhat intimidated by new applications. It may be beneficial for students to have time to understand the particular operating system they are using. Students who are not as adept at using digital devices should receive instruction on how to use them.

After the workshops, students did not perform as well on the post-assessment questions dealing with advanced database searching as expected. There was no significant improvement on the results measuring students' ability to find library resources and utilize advanced search techniques when conducting research. Therefore, the authors recommend that doctoral students be provided with more in-depth research workshops in the future.

Even with the Zotero instruction and hands-on activities, some students did not fully understand Zotero's functionality. One student posed the question, "so what is Zotero good for then?" after being unable to retrieve an imported PDF article. The individual seemed to think of Zotero as a full-text cloud storage program similar to Dropbox, rather than a program that manages and stores citation data. The authors suggest offering a metadata or programming instructional session prior to citation management so students will have a better grasp of the digital technology they are us-

ing. Students who are just beginning dissertation research need more time to understand meta-data programming concepts in order to develop more efficient information retrieval skills.

A significant amount of time was spent answering questions related to different software programs and systems. Students attempted to download Zotero on their personal computers prior to the class, which resulted in some operating system and download confusion. The authors suggest that students download the software in class for citation management instruction.

During the follow-up workshop, the majority of the beginner group stated that, in general, they were using only the basic features of Zotero, including the in-text citation feature. Two individuals were using a proprietary citation management system because they found it more intuitive than Zotero. In contrast, most, if not all, of the advanced group were enthusiastic Zotero users. The authors suggest that the beginner group be offered additional time so they can become more comfortable with the digital technology being introduced. Students also voiced that the Zotero workshops would have been helpful earlier in their academic career. Students needed continued support for Zotero throughout the doctoral program, and not just for one session.

Suggestions for Future Research

A similar study over a longer period, with a larger sample size, and across multiple disciplines would be beneficial. Basic programming instruction as it relates to citation management systems is another area where the research is lacking.

Conclusion

Co-teaching offered significant benefits over the traditional one-hour library orientation session. The librarian, library intern, and professor team were able to focus on skills relevant to the doctoral students' advanced research needs. Students were able to familiarize themselves with new developments in academic databases. In particular, students learned how to use citation management software Zotero. The majority of students chose to use the program regularly, while some opted to use another citation management program. Since the goal was to teach students how to use citation management software for digital information management, this session was a success even if the students opted for a program other than Zotero.

The students who self-evaluated as less technologically competent were generally those that experienced the most frustration with Zotero and other digital literacy skills. These students would benefit significantly by an expanded workshop designed to increase their ability and confidence in using the digital literacy skills related to academic research. At a minimum, the students have an opportunity to develop a relationship with a librarian and can be encouraged to continue using that resource throughout their doctoral program.

For doctoral students to be successful, they need the digital literacy skills related to advanced research. Professors and librarians collaborating to co-teach digital literacy skills and tools give doctoral students a significant advantage in completing their studies with a minimum of frustration and wasted time.

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Biographies



Paige M. Alfonzo, B.A., M.S. is Reference & Instruction Librarian, Assistant Professor at the University of Mary Hardin-Baylor in Belton, Texas. She provides research instruction to doctoral students and faculty, among others, utilizing a range of advanced Web applications. Her scholarship emphasizes strategies to promote advanced digital literacy skills among students and faculty. She can be reached at palfonzo@umhb.edu



Jennifer G. Batson, B.S., M.H., M.L.S. is Cataloging Manager at the University of Mary Hardin-Baylor, Texas. She uses her background in science education, humanities, and library science to enhance information access and promote digital literacy skills. She can be reached at jbatson@umhb.edu