Journal of Information Literacy

ISSN 1750-5968

Volume 7 Issue 1

June 2013

Article

Kumar, S. and Edwards, M. 2013. Information literacy skills and embedded librarianship in an online graduate programme. *Journal of Information Literacy*, 7(1), pp. 3-17.

http://dx.doi.org/10.11645/7.1.1722

Information literacy skills and embedded librarianship in an online graduate programme

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Abstract

This paper reports on an embedded librarian project aimed at providing incoming online graduate students with essential information literacy skills to succeed in an online programme. It describes the design and implementation of the project, the results of a pre- and post-survey of students' information literacy skills and students' perceived ability, confidence and anxiety when accessing information using library resources. The assessment of the embedded librarian project is discussed in the context of the methods used and the needs of online students.

Keywords

embedded librarian; information literacy; online student support; assessment

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1. Introduction

The number of students taking online courses at US institutions of higher education has steadily increased in recent years. Thirty-one percent of students in institutions of higher education in the US take a course online, and the number of students who took an online course increased from 5.6 million to 6.1 million from 2009 to 2010 (Allen and Seaman 2010; Allen and Seaman 2011). Acknowledging the information literacy (IL) support needed by online students who live in remote locations, the Association of College and Research Libraries (2006) has created Distance Learning Standards and emphasised that online students should be provided with as much IL instruction and support as on-campus students. Academic librarians have also been actively engaged in IL instruction for online students using different formats at the institutional, programme and course level in the last decade. They have used synchronous and asynchronous technologies for instruction and communication based on the infrastructure that was available (Ferguson and Ferguson 2005; Kontos and Henkel 2008; Lindsay et al. 2006; Markgraf 2004; Ramsay and Kinnie 2006).

Notwithstanding the value of several of the non-integrated or 'stand-alone' methods used, course-integrated instruction that addresses course assignments and provides students with opportunities to transfer learning from IL instruction to real-world settings or course activities has been found to be most effective (Adams 1988; Allegri 1985; Beile 2003; Bordonaro and Richardson 2004; Dugan 2008; Hall 2008; Kohl and Wilson 1986; Stein and Lamb 1998). One way in which librarians have integrated into online courses is by embedding themselves and making themselves available within online courses.

Embedded librarians in online courses have proved effective in supporting online students, fostering connectedness to an institution and helping students apply IL instruction to course activities (Kesselman and Watstein 2009; Love and Norwood 2007). Prior research on embedded librarianship has focused mainly on the perceived benefits of embedded librarians and on describing how they were embedded in online courses (Hoffman 2011; Hoffman and Ramin 2010; Konieczny 2010). Few articles were found that also provided a robust assessment of students' IL skills after an embedded librarian experience (Edwards et al. 2010). In this paper, we present the results of an embedded

librarian project with incoming students in an online doctoral program. The embedded librarian used asynchronous and synchronous instruction and a discussion forum to communicate with the doctoral students. Pre- and post-module surveys were used to answer two research questions: How can an embedded librarian experience a) increase students' familiarity with and use of library resources, and b) increase students' confidence and decrease anxiety. The findings and following discussion could be useful to academic librarians and faculty engaged in designing embedded librarian projects and in providing instructional support to online students.

2. Embedded librarians in online education

Embedded library support of distance and online education is a significant aspect of both the distance learning library support literature and the embedded librarianship literature. In their literature review on embedded librarianship, McMillen and Fabbi (2010) found that half of the articles they identified focused on distance and online courses. In fact, some definitions of embedded librarianship specifically refer to the integration of a librarian into online courses as the defining characteristic of embedded librarianship (Owens 2008; York and Vance 2009). In addition to being embedded in online courses, librarians can also be embedded into different contexts including colleges, departments and face-to-face courses (Dewey 2004; Drewes and Hoffman 2010; Dugan 2008; Freiburger and Kramer 2009; Kesselman and Watstein 2009; Love and Norwood 2007; Matthew and Schroeder 2006; McMillen and Fabbi 2010; Shumaker and Talley 2009).

Many libraries are utilising a 'liaison' approach to service provision that allows librarians to specialise in specific subject areas and provide targeted services to faculty, staff and students in those areas (Ferree et al. 2009; Tennant et al. 2001; Tennant and Miyamoto 2002, Tennant et al. 2006). Libraries utilising this approach heavily promote the liaison librarian to their users, including their graduate and doctoral students. Providing services to online graduate students, specifically doctoral level students, presents unique challenges non-existent in service provision to other user groups (Green and Bowser 2003; Tuñón and Ramirez 2010). Macauley and Cavanagh (2001) suggest the use of a liaison librarian (or primary contact) for doctoral students studying at a distance. This primary contact would act similarly to a dissertation advisor, but specialise in supporting these students as they navigate the information sources and services required for degree completion (Macauley and Cavanagh 2001). An online embedded librarian who is also a liaison to a programme can fulfill the role of library contact for supporting the intensive literature searching needs of doctoral students, as is the case in the programme discussed in this paper.

While it is apparent from a search of the published literature that librarians are extending their reach by embedding in a variety of contexts, assessment of these efforts is still limited in amount and scope. The literature that does address assessment primarily reports on users' satisfaction with the services rather than assessing their impact on learning (Edwards et al. 2010). While assessing satisfaction using the 'happy sheet' approach can potentially provide interesting and useful feedback, in-depth evaluations and studies designed to measure learning outcomes and impact on students are essential to providing effective services (Barton et al. 2004; Bowler and Street 2008; McKee 2010; Weaver and Pier 2010). There are a few studies in the literature that assess the impact of librarians embedding in face-to-face undergraduate courses, but these assessment efforts need to be applied to online embedded librarian instruction (Bowler and Street 2008; McMillen and Fabbi 2010) as well.

In order to investigate the efficacy of various levels of course level embedding, Bowler and Street (2008) designed several experimental face-to-face embedded librarian instances with differing levels of integration. The researchers found that a higher level of librarian integration with more student interaction with the librarian resulted in a significant improvement in student scores on a standardised IL rubric. McMillen and Fabbi (2010) embedded in a face-to-face undergraduate education course and used an interesting approach to assess their online embedded librarian implementation. Rather than creating a stand-alone library assessment to gauge library skills, the authors collaborated with the instructors to create several library-based assignments designed to gauge how well the learners were able to apply the integrated library content. Results from their assessment efforts demonstrate positive trends in student learning and have resulted in increased collaboration with faculty in the

College of Education and other units on campus (McMillen and Fabbi 2010). In an attempt to assess the impact of the online embedded librarian in a graduate course in educational technology, Edwards, Kumar and Ochoa (2010) used a mixed methods design to conclude that while the presence of an online embedded librarian was beneficial for both students and faculty, more detailed and rigorous assessment methods are required

Assessment in IL instruction in general was also reviewed in an attempt to identify how it could be applied to online embedded librarianship. The library and information science literature presents a wealth of articles, of varying degrees of quality, assessing IL and/or instruction. Walsh (2009) presents a selected overview of literature assessing IL instruction and reports the results by assessment type. According to Walsh, the most frequently used assessment methods are multiple choice questionnaires followed by analysis of bibliographies. Additional assessment methods include quizzes and tests, self-assessments, portfolios, essays (and other written documents), observation, analysis of final grades and some use of simulation. An important consideration noted by Walsh is the need for IL assessment efforts to address the validity and reliability of assessment methods and instruments. Some recent, well conducted evaluations include the comparison between face-to-face, online and blended instruction by Anderson and May (2010) as well as Walton and Hepworth's (2012) analysis of a blended approach to IL instruction. These precedents of IL evaluation research can inform evaluation in embedded librarianship and should be extended to embedded librarian implementations.

While much has been published about IL in terms of instruction, relatively few studies have also explored the psychosocial, social and cognitive aspects of IL (Boote and Beile 2005; Fletcher 2005; Kurbanoglu 2003; Kurbanoglu et al. 2006; Monoi et al. 2005; Ren 2000; Walton and Hepworth 2011). In one of the more recent and significant studies, Walton and Hepworth (2011) utilised three interventions to investigate cognitive factors associated with critical evaluation, an essential component of IL. The researchers found that students exhibited changes in cognitive states and behavior as well as affective aspects after participating in instruction that focused on the evaluation domain of IL. Specifically, the undergraduate students who participated in the study demonstrated a change from a high degree of uncertainty to a lower degree of uncertainty. This change in affective state relates to other psychosocial aspects of learning including self-efficacy.

Self-efficacy is an important factor that influences IL and library skills (Kurbanoglu 2003). Self-efficacy describes an individual's confidence in their ability to perform specific tasks (Bandura 1977). Self-efficacy was initially described by Bandura (1977) as a component of his social cognitive learning theory, and according to Pajares (1996), Bandura remains the most prominent researcher studying the concept. Two significant characteristics of self-efficacy relate to IL in general and specifically this embedded librarian project. Firstly, self-efficacy is context specific and can vary in specific domains. Individuals can have differing levels of self-efficacy with different tasks, both broadly and within specific domains including IL. For example, a learner may exhibit high self-efficacy with searching a particular database, but lower self-efficacy in searching other databases. Secondly, self-efficacy is positively linked to performance (Bandura 1986). Learners with higher levels of self-efficacy may perform better than those with lower self-efficacy. These two aspects of the concept of self-efficacy relate to self-efficacy with library skills and IL and are important considerations when conducting assessments of IL instruction.

3. Institutional context

The project presented in this paper was situated within an online graduate programme in the College of Education at the University of Florida. The Education Library has made several efforts in recent years to serve the growing number of online students in online Master's and doctoral programs. The Library website describes services for remote users and provides tutorials (e.g. about accessing the library from off-campus). Opportunities for asynchronous and synchronous communication with librarians (e.g. an online helpdesk, a chat feature) are also available. Nevertheless, course-integrated or programme-integrated instruction is not the norm. Feedback from the first group of students in a new online doctoral programme at the College of Education reflected several challenges faced by

incoming online students. In open-ended responses to a first year evaluation survey, 33% of students (n=16) described not knowing how to access library resources from off-campus during initial courses in the programme. Students reported that they were not confident searching library databases or using library resources to complete their assignments at the end of the first year, and 50% suggested that IL instruction be provided to future students at the beginning of the online programme (Kumar et al. 2011).

The programme coordinator therefore collaborated with the education librarian in an attempt to provide the second group of incoming students with IL skills and continuous support to succeed in the online doctoral programme. Online students in educational technology come from various disciplines and are employed full time in diverse environments (e.g. K–12, military, corporate education). They often have advanced technical skills, but several do not have recent experience with academic databases or familiarity with digital resources and scholarship in the field of educational technology. Their ability to access, find, evaluate and synthesise prior research can greatly influence their progress and success in doctoral studies. IL instruction is therefore imperative to their successful completion of programme activities.

An embedded librarian project had previously been conducted in an online Master's course in the educational technology programme. Two librarians had collaborated to design asynchronous instruction in the form of online modules, included a help forum, and taught a synchronous online session for students in the online graduate course. They also conducted pre- and post-instruction assessments and an instructor interview that indicated the project was successful in increasing online students' comfort level and confidence with library resources (Edwards et al. 2010). Furthermore, an analysis of students' access of resources, use of resources and participation in discussions from the Learning Management System (Moodle) used for the online course indicated that students were more likely to access and use library resources that assisted them with specific course assignments (Kumar et al. 2010).

Based on the success of the embedded librarians in the online educational technology course, it was decided that the education librarian would be embedded in a required course that served as an orientation to doctoral study in the online programme. The course was typical of all courses and non-course activities in the programme that were intentionally designed to build a community of inquiry for practitioners (Kumar et al. 2011). The course was hosted in the learning management system, Moodle, and was structured not only to host a repository of resources but also to provide several opportunities for sharing, peer feedback and interactions with external experts. Students shared their ideas, resources, artifacts or research and professional goals with their peers and instructor, received and provided feedback, reflected on both the receipt and provision of feedback and documented their learning. Discussion forums, the chat widget, a shared social bookmarking page and monthly real-time sessions in a virtual classroom contributed to students' collaborative construction of knowledge of the field. The embedded librarian would thus serve as a content expert for IL in the course.

4. Design and implementation

As a first step in the instructional design process that is important to the design of IL instruction, incoming students' existing skills were identified before they began the online programme (Dewald et al. 2000; Higgins 2010; Koneru 2010). Anxiety and self-efficacy with respect to finding, evaluating and citing resources were thus also included in the pre-instruction survey that assessed the students' perceived ability to use resources, find appropriate literature and cite and evaluate resources.

Target skills were identified by reviewing essential IL skills (e.g. off-campus access to databases, finding books/articles) and skills needed to facilitated students' success in the doctoral programme (e.g. writing an annotated bibliography, using APA citations). Specifically, skills that pertained to activities in the orientation course that would serve as the setting for the embedded librarian project were reviewed. Before the course began, the librarian created QuickTime video tutorials and PDFs that contained transcriptions or step-by-step instructions for various topics that did not already exist in the library; these were placed in an online repository. Topics for the online tutorials included an

introduction to the library and off-campus access; library catalogue searches; database searches and tutorials on specific databases such as Wilson Web or ERIC; dissertation searches and using APA. The online repository was linked within the online course. The instructor directed students' attention to specific objects in the repository that could be useful to them for specific assignments.

A library help forum was included in the eight-week online course. It was monitored and supported by the librarian. The instructor emailed the students, introducing the librarian and suggesting that students view the tutorials and use the library help forum provided to ask any questions of the librarian. The librarian also introduced herself in the first discussion forum provided for online introductions. The date and time for an IL synchronous session using the virtual classroom was announced at the beginning of the course, and the instructor requested students to attend. The content for the synchronous session was determined based on both student questions in the help forum and those addressed to the instructor. Although students were able to access library databases following the tutorials, they were not always sure how to determine whether a resource was peer reviewed. Shortly before an assignment where they had to find five peer-reviewed articles pertaining to their area of specialisation, the librarian taught a 45-minute synchronous session on finding and identifying peer-reviewed resources and then answered students' questions in real time.

5. Methodology

Pre- and post-instruction surveys were used to measure students' perceived IL skills before and after the embedded librarian project. The pre-instruction survey was hosted online and sent to students before they began the programme. It assessed students' prior experiences with accessing resources in the college and with prior IL instruction in general and their perceived ability, confidence and anxiety when accessing information using library databases; it also looked at evaluating, managing and using library resources in their writing and citing appropriately. Confidence with library research was defined as students' level of confidence that they are correctly performing library research to find adequate results, and was considered important as a function of self-efficacy (Kurbanoglu 2003). For example, students were asked, 'How confident are you using library resources including the library catalog and article databases?' Mellon's (1986) grounded theory work defines library anxiety as the fear students may have in conducting library research and the feelings associated with that fear, including inadequacy and shame. Students in this study were asked to explicitly self report their anxiety in the item, 'How do you rate your anxiety with the literature search process?' The post-instruction survey was also hosted online and sent to students at the end of the first semester. It focused on students' experiences with the embedded librarian project and reassessed their perceived ability, confidence and anxiety when accessing information using library databases, evaluating, managing and using library resources in their writing and citing appropriately. The analysis of responses to the pre-instruction survey contributed to the design of instruction for the embedded librarian project. Responses to the pre- and post-instruction surveys were compared using descriptive analysis.

Three optional open-ended questions were added to the post-instruction survey pertaining to students' use of resources provided by the embedded librarian. Students were asked how the instruction impacted their approach to using education databases, how they had used the information presented during the synchronous sessions and what additional information or instruction could improve the research process for them. The percentage of students who responded to the questions above was 45%, 68% and 37% respectively. The open-ended responses were open coded first, where each response was a unit of analysis and assigned a descriptive category (Strauss and Corbin 1990). The categories were then collapsed to themes that were used to complement the quantitative results.

6. Findings

Twenty-one of twenty-three students (91%) responded to the pre-instruction survey, and nineteen of twenty-one students to the post-instruction survey (90%). All participants were employed full time in educational institutions and did not study on campus. Thirty-eight percent of participants had

previously attended the university, and 35% of those participants had previously taken online courses. The survey findings are presented here according to constructs in the survey: awareness and use of library resources before and after the embedded librarian project; satisfaction and application of IL instruction; and perceived ability and confidence accessing and using library resources.

6.1 Awareness and use of library resources

Students' ability to access library resources from off campus and their use of library databases for finding literature were important to their success in their orientation course as well as doctoral studies in general; therefore items in these areas were included in the surveys. Compared to only seven students with prior experience at the university who had previously accessed the library remotely, all 17 students who responded to the question after the project had accessed university library resources remotely (Table 1).

Table 1: Have you accessed UF library resources from off campus?

	Pre % (n=21)	Post % (n=17)
Yes	33.3%	100.0%
No	66.7%	0.0%

Instead of using only search engines in the public domain or in other disciplines, it was considered important for students to access and use education databases that contain valuable peer-reviewed resources in educational technology. Students' awareness and use of all databases important to education students increased after the embedded librarian project, except for PsycInfo (Tables 2 and 3). Students' decreased use of Google as a search engine in the public domain and their increased awareness and use of Google Scholar is an indication of their awareness that the general search engine Google might not be the best resource for peer-reviewed scholarship in their new discipline. Likewise, students' awareness and use of the library catalogue as a resource was lower in the post-instruction survey.

Table 2: Of which of these databases are you aware? (check all that apply)

	Pre % (n=19)	Post % (n=19)
ERIC	85.7%	100.0%
Education Full Text	47.6%	100.0%
Education Index Retro	0.0%	10.5%
Library catalogue	71.4%	47.4%
Social Science Citation Index	28.6%	31.6%
Academic Search Premier	38.1%	52.6%
Dissertations and theses	28.6%	89.5%
JSTOR	28.6%	63.2%
PsycInfo	19.0%	10.5%
Web of Science	4.8%	15.8%
WorldCat	38.1%	68.4%
Google	90.5%	73.7%
GoogleScholar	61.9%	100.0%
Other (please specify)	4.8%	5.3%

Table 3: What databases do you use most frequently? (check all that apply)

	Pre % (n=19)	Post % (n=19)
ERIC	60.0%	63.2%
Education Full Text	40.0%	78.9%
Education Index Retro	0.0%	5.3%
Library catalogue	25.0%	15.8%
Social Science Citation Index	10.0%	5.3%
Academic Search Premier	40.0%	31.6%
Dissertations and theses	0.0%	36.8%
JSTOR	10.0%	31.6%
PsycInfo	10.0%	5.3%
Web of Science	0.0%	0.0%
WorldCat	10.0%	15.8%
Google	45.0%	5.3%
GoogleScholar	30.0%	57.9%
Other (please specify)	10.0%	5.3%

Forty-five percent of students responded to the open-ended question: 'In what ways did the library instruction provided to you impact your approach to using the above databases?' They stated that they had learned about new resources, how to search for dissertations, how to determine if a journal was peer reviewed (for example using *Ulrich's*) and how to get an interlibrary loan. One student stated, '*I could not have used it otherwise. I needed help with the VPN and finding peer-reviewed research*.' Another explained, '*I learned through the instruction that I could first sign in to the VPN and then search GoogleScholar, and the articles I found would show a *Find it at UX* icon if they were available there. This was quite helpful.'*

One student also wrote that increased understanding had led to increased confidence and better results during searches.

Table 4: Please rate your satisfaction with the formalised guidance you received for conducting research at UF (1=not satisfied, 2=satisfied, 3=very satisfied)

n=13	Mean	SD
On-campus library orientation	2.74	0.87
Online tutorials	3.00	0.82
Synchronous session	2.95	0.52

6.2 Satisfaction and application of instruction

Sixty-eight percent reported accessing the online tutorials in the course. Students were very satisfied with the online tutorials (M=3.0) and the synchronous session (M=2.95) provided by the embedded librarian in the course (Table 4). Students were required to find and read two dissertations in their area of interest in the fifth week and used the tutorial pertaining to dissertation searches before the assignment. Likewise, they were required to share 3–5 peer-reviewed articles in their specialisation area later in the course. The synchronous session was offered the week prior and dealt with how to use library databases to find peer-reviewed articles, as well as how to distinguish between peer-reviewed and non-peer-reviewed articles.

Ninety-four percent of students reported that they had applied the information communicated during the synchronous session in their coursework. When asked to provide an example of how they used the information from the synchronous session, 68% of the students responded with examples of eleven different databases, how they used them and search strategies. One student wrote, '*I worked*

to use many of the new databases and understood many more of the features used,' while another student explained, '*I did several literature searches using databases such as ERIC and also the Find at UF through GoogleScholar. I also requested and received several articles through the library website*.' The main theme that emerged was the ability to identify peer-reviewed resources; this was mentioned by nine students, four of whom specified their use of *Ulrich's Periodicals* as a result of the sessions: '*I was introduced to* Ulrich's *during the session, and I used it frequently to check that sources were scholarly*,' and, '*I was able to easily access* Ulrich's *for verifying the scholarly and peer-reviewed journals*'' The other five students did not specify a database but made statements such as '*I used Ms W's tips on how to locate peer-reviewed publications.'*

The two main topics in students' responses (37%) to the question 'What additional information or instruction could improve the research process for you?' were the use of bibliographic tools such as RefWorks and the appropriate use of APA style citations. These were included as topics for the embedded librarian instruction in the following semester.

6.3 Confidence, anxiety and self-efficacy

The ability to find, use and evaluate relevant literature in writing assignments in graduate online courses is an important skill in a doctoral programme and was reflected in the five items in the survey. An analysis of the pre- and post-instruction surveys showed an increase in student ratings of their confidence using library resources, including the library catalogue and article databases (Table 5). The standard deviation further indicates that there was less distribution in the level of confidence of students. Students' anxiety regarding the literature search process had increased, while their perceived ability to evaluate and cite resources appropriately had increased marginally.

Table 5: Confidence, anxiety and self-efficacy using library resources

	Pre (n=21)		Post (n=19)	
	Mean	SD	Mean	SD
How confident are you using library resources including the library catalogue and article databases? (scale)	3.00	1.41	3.32	0.71
How do you rate your anxiety regarding the literature search process? (scale)	2.14	0.71	2.47	0.71
How do you rate your success with finding literature that is relevant? (scale)	3.05	0.00	2.79	0.71
How do you rate your ability to evaluate the quality of resources discovered?	3.10	0.00	3.16	0.71
How do you rate your ability to cite your resources appropriately?	3.24	0.00	3.26	0.71

7. Discussion

This research is based on self reports of IL experiences and skills by online education doctoral students who are full-time professionals; therefore, the findings cannot be generalised to online graduate students in all disciplines. Nevertheless, the implementation and assessment of the embedded librarian project in this research could be useful to others interested in supporting students in online graduate programmes. The results of this research are discussed here with respect to a) students' improved IL skills, b) challenges with self reports of students' IL skills and c) the importance of long-term IL support in an online graduate programme.

7.1 Students' improved IL skills

The goal of this embedded librarian project was to provide IL instruction to incoming online doctoral students during their first semester in a doctoral programme. The results of the pre- and post-instruction survey indicate that the embedded librarian project was successful in improving students'

IL skills. For instance, according to the post-instruction survey, 100% of respondents knew how to access resources from off campus compared to 33% at the beginning (Table 1); students used the general search engine Google less but used Google Scholar and other education databases more compared to when they began the program; 89.5% were aware of dissertation databases compared to 28.6% at the beginning; and students were more familiar with education databases identified as important to their doctoral studies (Tables 2 and 3). The embedded librarian interacted with the students in multiple ways: by creating online tutorials before the course, conducting a synchronous session based on a need and being available during a help forum to answer questions. Such multimodal contact with students is recommended as a best practice of embedded librarianship (Hoffman and Ramin 2010; York and Vance 2009).

In addition to the various formats of asynchronous and synchronous online interaction and instruction included in the study, two other factors most likely played a role in its success: the embedded librarian project was designed and structured by a faculty member whose teaching and research focus is e-learning and supported by a librarian who has prior experience with online course support. Furthermore, the programme of study modeled expert e-learning practices grounded in e-learning scholarship, and students were used to various forms of online social constructivist pedagogy in the programme and also applied such teaching in their own practice. The IL instruction was integrated within this social constructivist online environment. A further area for research in this environment might be to identify which types of interactions with the librarian are considered most valuable by doctoral students. For example, a recent article by Francis (2012) explores the social role of the librarian in online courses where one of the librarian's roles is to participate as a member of the online community of learners. In addition to exploring valid and reliable assessment methods (Walsh 2009), it would also be important to analyse in what ways activities or assignments are enhanced or how knowledge is socially constructed due to specific types of student-librarian interactions.

7.2 Challenges with measuring students' IL skills

The context-specific nature of self-efficacy (Pajares 1996) was apparent in our results. Students were comfortable using certain databases over others at the beginning of the study, for example in their areas of expertise such as medicine or information technology but not in education. Students' increased confidence was apparent in their open-ended comments and in the higher ratings for familiarity and use of several databases in the post-instruction survey, indicating better performance (Bandura 1986). From an affective standpoint, students' anxiety searching and evaluating literature in our study can be likened to the uncertainty described by Walton and Hepworth (2011) in their study, in which students' degree of uncertainty decreased after IL instruction. We concur with Walton and Hepworth (2011) that the affective state cannot be isolated from the cognitive state and that it is important to study both together, as we have attempted to do so in our study. Having students reflect on their learning and facilitating metacognition could further contribute to lessening anxiety (Walton and Hepworth 2011) an area not explored in our research.

When measuring IL using student self reports, there is the danger of a disconnect between students' perceived self-efficacy with IL concepts and library skills and their actual performance (Kurbanoglu 2003; Neely 2000). We acknowledge this limitation of using a survey for a pre- and post-instruction test to measure students' IL skills. Moreover, we defined confidence and anxiety for our research plan but relied on a common-sense definition of confidence and anxiety in the survey instead of providing a definition in the survey itself. Each participant might thus have interpreted the questions 'How confident are you?' or 'How do you rate your anxiety?' differently. The results of our survey thus reflect students' perceptions of confidence and anxiety, and their self reports of confidence and anxiety. A further challenge in our survey was students' understanding of the IL terminology used in the survey itself. When asked questions such as 'How do you rate your ability to evaluate the quality of resources discovered?' and 'How do you rate your success with finding literature that is relevant?', it is possible that students who are used to searching and retrieving resources using the Google search engine rated their abilities higher. This was revealed in students' request to learn how to distinguish between peer-reviewed and non-peer-reviewed articles during the synchronous session with the librarian, and in students' survey comments in the post-instruction survey, where students

acknowledged their ignorance of education databases and the search process before they participated in this project.

Conducting a needs analysis or pre-testing is essential to identifying what students might need to learn and to the design of IL instruction. However, librarians should consider the fact that students who are completing a survey might not know enough about their own abilities and might also confuse the phrase 'literature search' with a general search in a search engine such as Google. In this research, student anxiety with finding relevant resources increased because students understood what was involved in the process or meant by the phrase 'literature search' or 'evaluation of resources' *after* the embedded librarian project, but not before. Piloting the survey with a small group of students or conducting 'think aloud' protocols, where students read the items and provide feedback, are changes that will be made in our continuing research in this area.

In addition to using surveys where students self report their skills or use of resources, it is useful to triangulate the data with data from the learning management system or LibGuide where the resources are embedded, and to analyse student assignments as an outcome of IL instruction. In this case, technical problems occurred due to which only partial data from students' use of the resources was available in the learning management system. As this data would not convey a complete picture of how students used the resources provided by the embedded librarian, the data is not included here. A citation analysis of literature reviews submitted by students during a later semester is currently being conducted.

7.3 Long-term instruction and support are required

This paper describes the embedded librarian support for doctoral students in the first semester of an online programme. IL support for this group of students continued through their first year, and efforts have been made to consistently embed such support throughout the programme (Kumar and Ochoa 2012). Regular refreshers and interaction with librarians can help students stay up to date with the latest databases and online resources and find help with IL when they need it. The necessity of refreshing IL skills regularly became apparent when the work of students participating in this project was reviewed a few months later by practising librarians who conducted a literature review analysis. Students had not used certain databases or had forgotten how to identify peer-reviewed resources. Doctoral students studying at a distance experience difficulties with initial IL (Tunon 2010) but also need regular instruction and updates to help them. The long-term focus should not just be on behavioural processes, but on higher-level cognitive processes and critical thinking (Walton and Hepworth 2011) that will help the students throughout their careers as scholars.

8. Implications

This article describes one approach to embedded librarianship based on a pre-instruction test that served as an analysis of students' IL skills and needs. Online students' interactions with the embedded librarian were designed based on the students' context, the goals of the programme and students' existing skills and preferences. This approach might not work in every context, but it is important that interactions of different types (asynchronous and synchronous) and at different levels are considered and implemented based on the online education context and needs at an institution. The number of librarians available and the number of courses that they are expected to support might also contribute to such decisions. In the case of the online programme described in our study, one librarian interacted with the incoming doctoral students throughout their first year and served as their contact in the library. This might be time intensive and challenging if an institution has only a small number of librarians available to a large number of online students, in which case other options might need to be explored. In any case, IL instruction and support improves students' skills and use of digital resources not only in their graduate programme, but also in any environment related to their academic or professional endeavours. Interaction with librarians and experts in IL, whether in the form of embedded librarianship or otherwise, should be explored to assist graduate students who might be adept at googling information, but might need to learn how to find, evaluate and

appropriately use academic resources. Such support for students could lead to higher student satisfaction and retention due to increased feelings of connectedness.

This embedded librarian project was initiated by a faculty member who is the programme coordinator of the online programme. The librarian-faculty collaboration that followed was crucial to the planning, implementation and research described in this article. We posit that such collaborations are essential for successful programmes because each stakeholder brings knowledge and perspectives that cannot be successful without the other. The faculty members in online programmes often have a deep understanding of the skills and products expected of students in a programme, but they need the librarians to provide those skills and guide students to create those products. Likewise, librarians have an expert understanding of the IL skills that graduate students need and of how those can be taught, but might not be aware of the assignments or activities in an online programme within which such instruction can be integrated. Strong relationships between online programmes and their library faculty can lead to successful online programmes and online students who feel supported in their research endeavours.

9. Conclusion

This study described the embedding of a librarian who provided IL support to doctoral students studying at a distance. Consistent and frequent interactions in different formats with the embedded librarian improved online doctoral students' research skills and increased their confidence in finding and using online research. As an increasing number of non-traditional students choose online education options to pursue higher studies; providing them with increased opportunities to access and critically use library resources is essential for them to feel connected to institutions of higher education and to develop critical IL skills. At the same time, using best practices and instructional design principles to integrate IL teaching into traditional instruction ensures that IL teaching is relevant and discipline-specific, not separate from academic coursework. This study provides one successful example of the design and evaluation of IL instruction that is embedded and integral to an online programme. Collaboration and communication between administrators, instructors and librarians could ensure systematic integration of IL instruction across courses in individual programmes or across programmes, ultimately helping students to acquire skills that they will be able to use not just in their academic pursuits, but also in their future workplace.

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