A Two-Phase Study Examining Graduate Library Student Knowledge Gains and Perceptions of Information Literacy Modules

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A Two-Phase Study Examining Graduate Library Student Knowledge Gains and Perceptions of Information Literacy Modules

Holly S. Hebert,1 Karen V. Nourse,2 and Kevin S. Krahenbuhl3

ABSTRACT

This paper reports the results of a two-phase study examining the effectiveness of a set of five online learning modules in increasing student understanding of information literacy topics. The modules were deployed within the foundational class of an online Master of Library Science program. Using Qualtrics-based surveys, Phase 1 assessed 15 students for their possible knowledge gains as well as their perceptions of their experiences with the instructional content. Through a combination of statistical and qualitative analysis, the researchers found modest knowledge gains as well as positive student perceptions of their instruction. Based upon the moderate success of Phase 1, the online learning modules were retained in subsequent offerings of the course. Three years after the Phase 1 study, a Phase 2 study was conducted with 30 students over two semesters to examine student knowledge and perception changes possibly occurring after utilization of the modules. Through the analysis of student reflection writings, the researchers found that all students presented with a minimum desired level of competency postinstruction. Furthermore, the researchers found that knowledge gains were reported primarily within the area of information search strategies. Findings suggest that online learning modules on information literacy topics can be a welcome addition to the first course in a Master of Library Science program sequence and can help instill confidence in new students who are studying to become library science professionals.

Keywords: information literacy, graduate students, library science, scholarship of teaching and learning, reflective practice

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A TWO-PHASE STUDY EXAMINING GRADUATE LIBRARY STUDENT KNOWLEDGE GAINS AND PERCEPTIONS OF INFORMATION LITERACY MODULES

Today’s information professional should be proficient in information literacy (IL) concepts, both for their own needs and for those of their users. Beginning library science graduate students need to learn IL skills as they don’t necessarily enter graduate school with a solid base of knowledge and skills in IL (Hebert, 2018). They must become information literate, as librarians employed in all types of libraries teach IL in one form or another (Becker, 2022). Especially in this time of overwhelming access to information, Master of Library Science (MLS) programs should produce graduates who are able to assist communities that “require sophisticated information literacy skills, and foremost leadership from information professionals” (Fisher & Fulton, 2022, p. 45). The concepts and skills categorized in the Framework for Information Literacy for Higher Education are therefore integral to the coursework of MLS programs. However, there is the age-old problem of how best to situate IL instruction within the coursework of a graduate program. This study looks at IL instruction from students’ perspectives as they reflect on IL modules inserted into a core course at the beginning of their graduate studies.

BACKGROUND

Introduced in 2015, the Framework for Information Literacy for Higher Education was developed by the Association of College and Research Libraries (ACRL) as a tool to inform university-level instruction to students regarding the location, evaluation, and use of information. The Framework defines information literacy as “the set of integrated abilities encompassing the reflective discovery of information, the understanding of how information is produced and valued, and the use of information in creating new knowledge and participating ethically in communities of learning” (ACRL, 2016). IL instruction has long been a focus for academic librarians and content faculty alike (ACRL, 2016; Blummer, 2009; Nichols Hess, 2020). Content faculty at all academic levels regularly assign course deliverables such as research papers, annotated bibliographies, and class presentations as practical applications by which students can demonstrate knowledge of IL concepts (McGowan et al., 2016). Students cannot be expected to have prior knowledge of these concepts, however (Lamb, 2017; Smith, 2012), and therefore explicit instruction of the IL concepts by librarians must occur through such delivery mediums as direct instruction, online learning (Feekery et al., 2021; Mune et al., 2015), and non-credit-bearing courses (Walsh, 2010).
There is much discussion regarding the differences in IL instruction at the undergraduate level versus the graduate level. One area of concern is determining which specific skills should be taught at each level. Monroe-Gulick and Petr (2012) concluded that undergraduates have simpler needs in that they only require a functional level of IL skills, whereas graduate students need to go further in their IL skills to attain an understanding of the research process itself. Other researchers (Hebert, 2018; Hebert & Duet, 2017; Lamb, 2017; Saunders et al., 2015) disagree with this approach, noting the fallacy of assuming that undergraduate IL skills will be retained long-term such that students can successfully recall and build upon these skills in graduate school. Furthermore, these dissenting researchers have documented the lack of standardization of undergraduate IL training; it is essentially impossible to adequately discern the minimum IL skills present among incoming MLS students. Several studies of incoming graduate students in library science programs have indicated that students enter these programs unprepared in IL concepts. Lamb (2017) wrote that incoming graduate library science students demonstrated a wide variety in their skill levels, with some students having only small gaps in their knowledge and others requiring extensive instruction prior to the onset of their coursework. Hebert (2018) had a similar conclusion, noting that “the varied academic and professional backgrounds of [library and information science] graduate students make it hard to predict what IL skills incoming students may possess” (p. 33). Both Hebert and Lamb found that even graduate students on the path to becoming information professionals can benefit from IL instruction.

In addition to the concern of how to differentiate IL instruction to graduate students, another issue is that of the best instructional medium. This is one area in which student preferences may have changed over time. A 2012 study of IL instruction to online graduate students found that students preferred synchronous online lessons and face-to-face instruction over asynchronous learning modules; however, the authors attributed this to perceived low quality of the learning modules (Kumar & Ochoa, 2012). Online learning modules have seen quality improvements and greater success in recent years: a study by Lamb (2017) found that incoming graduate students in library science felt much more confident in their IL skills after instruction via online tutorials. Furthermore, Lamb found an additional benefit of the online tutorials in that students could identify early the instruction they needed through pretesting. Online modules can be purchased through proprietary software development companies and customized by librarians (Holda & Hayes, 2021) or developed in-house by faculty members and/or librarians (Lamb, 2017; Mune et al., 2015).

In our work as university faculty, we have seen how students’ access to information has changed greatly over the years and continues to do so, making aspects of information gathering a continual learning curve. To build upon the evidence base indicating a need for IL
skills training at the graduate education level, we embarked upon a course redesign and subsequent two-phase study.

COURSE REDESIGN

LIBS 6000 is an introductory course in the MLS program at Middle Tennessee State University. Although the class had been successfully conducted for many semesters, a grant offered in Spring 2018 by the university library provided a welcome opportunity for a course redesign. The redesign was prompted by the lead instructor’s observation that her students were entering the program with a wide range of IL skill levels. She wished to bring all of her students to a minimum desired level of proficiency and therefore decided to emphasize IL concepts in her redesigned course curriculum. The challenge was to decide how to incorporate new material into an already packed semester. Her solution was to develop online learning modules that students could complete for extra credit. The online learning modules were created during Summer 2018 and covered the five following topics:

- **Module 1:** How to begin your research
- **Module 2:** Types of information sources
- **Module 3:** Finding sources
- **Module 4:** Evaluating sources
- **Module 5:** Citing sources, plagiarism, and ethics

Each module included a short video by the instructor and several articles to read on that topic. The modules were deployed across multiple semesters of the core librarianship course, beginning with the Fall 2018 semester.

OVERVIEW OF TWO-PHASE STUDY

Although we were very interested in learning about possible student knowledge gains as a result of the instruction, just as important were student perceptions regarding their learning. We wanted to see if students valued the instruction they were receiving, and we also wanted to understand student self-efficacy regarding their IL skills. In our Phase 1 study (Hebert & Reed, 2019), conducted in Fall 2018, 15 students were assessed pre- and post-instruction through a multiple-choice survey instrument to understand any possible gains in knowledge. These students were also assessed post-instruction through a survey instrument to understand student perceptions of their interactions with the instructional content. This survey included open-ended and Likert-based questions. In Phase 2 of our study (Hebert
et al., 2022), 30 students in the course were assessed through a qualitative data collection strategy across two semesters (Summer 2021 and Fall 2021). Student reflection data was analyzed to understand student perceptions of the information they encountered in the modules, as well as to identify possible knowledge gains and competencies reinforced by the content. Through both phases of this study, the instructor ultimately hoped to learn whether the online modules were a good solution for ensuring a minimum desired knowledge of IL topics for students in the MLS program, and whether any improvements to the modules needed to be made.

Copies of all survey instruments as well as additional materials pertaining to both phases of the study (such as data files and a codebook) can be viewed at the researchers’ online repository (Nourse & Hebert, 2023).

**PHASE 1 STUDY: MIXED METHODS STUDY OF STUDENT KNOWLEDGE GAINS AND PERCEPTIONS**

**Research Questions for Phase 1 Study**

The research questions for Phase 1 were as follows:

- **RQ1.1:** Is there a statistically significant difference in participant knowledge of IL skills as a result of the instructional intervention?
- **RQ1.2:** What are participant perceptions regarding their proficiency with IL skills after the instructional intervention?
- **RQ1.3:** What are participant perceptions regarding the overall value of IL skills after the instructional intervention?

**Participants**

This study utilized a convenience sample of 15 students enrolled in the Fall 2018 offering of the course. Institutional review board approval was granted by the researchers’ institution, and informed consent was obtained from all participants prior to their participation in the study. Participants ranged in age from 23 to 56 years old, and their number of years postbaccalaureate ranged from 0 to 22 years. Although the course is intended to be the first class taken in the MLS program, two students had completed at least one other class in the program prior to Fall 2018.
Methodology

The Phase 1 study utilized a convergent mixed methods design through which several instruments assessed students pre- and postinstruction. The goal was to assess student knowledge gains (Knowledge construct), as measured through pre- and posttesting; the researchers also wanted to assess student perceptions of the modules and their learning experience (Perceptions construct) postinstruction. All survey instruments were administered online through Qualtrics.

To measure the Knowledge construct, a 30-question multiple-choice assessment (Knowledge Survey) was developed using the “Learning Assessment Questions Version 2018-05-16” of the Information Literacy Assessment & Advocacy Project (ILAAP) (Goebel et al., 2013). The 30 questions were taken directly from this source, with seven of the questions modified by the instructor to better address course needs. Each question addressed a specific area (or frame) of the 2016 ACRL Framework for Information Literacy for Higher Education standards. Table 1 provides a summary of how items on the Knowledge Survey were categorized within each of these frames.

Students were administered the Knowledge Survey prior to beginning the instructional modules, and again at the conclusion of instruction. The data collected through the pre- and postassessments for the Knowledge construct were compared through a Wilcoxon signed-rank test in SPSS. This test is “the non-parametric equivalent of the paired-samples t-test” (Field, 2013, p. 228), and is recommended for use with small sample sizes when one must compare two sets of scores from the same participants. Aggregate scores pre- and

Table 1
Knowledge Survey Questions’ Alignment With ACRL Frames

<table>
<thead>
<tr>
<th>Specific ACRL frame</th>
<th>Total number of questions addressing frame</th>
<th>Individual questions addressing frame</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research as Inquiry</td>
<td>4</td>
<td>1, 13, 15, 23</td>
</tr>
<tr>
<td>Searching as Strategic Exploration</td>
<td>8</td>
<td>1, 5, 6, 8, 9, 14, 18, 30</td>
</tr>
<tr>
<td>Scholarship as Conversation</td>
<td>10</td>
<td>2, 3, 7, 10, 13, 16, 19, 26, 27, 28</td>
</tr>
<tr>
<td>Authority Is Constructed and Contextual</td>
<td>7</td>
<td>2, 4, 11, 12, 17, 21, 29</td>
</tr>
<tr>
<td>Information Creation as a Process</td>
<td>5</td>
<td>3, 4, 7, 16, 23</td>
</tr>
<tr>
<td>Information Has Value</td>
<td>6</td>
<td>20, 22, 24, 25, 26, 28</td>
</tr>
</tbody>
</table>
postinstruction were compared, as well as individual comparisons for each of the six ACRL frames pre- and postinstruction.

In addition to the possible student knowledge gains, the researchers were also interested in understanding student perceptions (Perceptions construct) of their experience with the online learning modules. A short survey (Perceptions Survey) that included the following was deployed postinstruction: three demographic questions, five Likert-based questions, and three open-ended questions to gauge student confidence in their understanding of the material as well as their perceptions of the importance of the content.

Results of the Phase 1 Study

RQ1.1: Is There a Statistically Significant Difference in Participant Knowledge of IL Skills as a Result of the Instructional Intervention?

We found statistically significant differences at the aggregate level as well as for one of the six tested ACRL frames. On an aggregate basis, student scores on the Knowledge Survey were significantly higher postinstruction \((Mdn = 26.00)\) than preinstruction \((Mdn = 25.00)\), \(z = 2.30, p = .022, r = .41\). For the ACRL frame “Information Creation as a Process,” student scores on the Knowledge Survey were significantly higher postinstruction \((Mdn = 5.00)\) than preinstruction \((Mdn = 4.00)\), \(z = 2.52, p = .012, r = .46\). A summary of our results can be found in Table 2.

Table 2

Results of Knowledge Construct Analysis, Pre- to Postinstruction

<table>
<thead>
<tr>
<th>Specific ACRL frame</th>
<th>Pretest Mdn</th>
<th>Posttest Mdn</th>
<th>T</th>
<th>SE</th>
<th>z</th>
<th>p</th>
<th>r</th>
</tr>
</thead>
<tbody>
<tr>
<td>(Aggregate scores)</td>
<td>25.00</td>
<td>26.00</td>
<td>68</td>
<td>12.62</td>
<td>2.30</td>
<td>.022</td>
<td>.41</td>
</tr>
<tr>
<td>Research as Inquiry</td>
<td>3.00</td>
<td>4.00</td>
<td>24</td>
<td>5.29</td>
<td>1.89</td>
<td>.059</td>
<td></td>
</tr>
<tr>
<td>Searching as Strategic Exploration</td>
<td>7.00</td>
<td>7.00</td>
<td>69</td>
<td>13.57</td>
<td>1.73</td>
<td>.083</td>
<td></td>
</tr>
<tr>
<td>Scholarship as Conversation</td>
<td>8.00</td>
<td>8.00</td>
<td>67.5</td>
<td>13.92</td>
<td>1.58</td>
<td>.114</td>
<td></td>
</tr>
<tr>
<td>Authority Is Constructed and Contextual</td>
<td>6.00</td>
<td>6.00</td>
<td>46.5</td>
<td>10.94</td>
<td>1.23</td>
<td>.217</td>
<td></td>
</tr>
<tr>
<td>Information Creation as a Process</td>
<td>4.00</td>
<td>5.00</td>
<td>51.5</td>
<td>9.52</td>
<td>2.52</td>
<td>.012</td>
<td>.46</td>
</tr>
<tr>
<td>Information Has Value</td>
<td>5.00</td>
<td>5.00</td>
<td>20</td>
<td>6.63</td>
<td>.302</td>
<td></td>
<td>.76</td>
</tr>
</tbody>
</table>
RQ1.2: What Are Participant Perceptions Regarding Their Proficiency With IL Skills After the Instructional Intervention?

Regarding the Perceptions construct, the five Likert-based questions used a 10-point scale to measure student familiarity with IL, as well as student confidence in citing sources, evaluating online sources, and finding sources on the library website. Students completed the course with a self-reported moderate confidence level regarding their familiarity with the concepts of IL ($M = 6.9$), ability to cite sources ($M = 6.73$), find scholarly sources on the library website ($M = 7.53$), and evaluate online sources ($M = 7.8$). The vast majority of students believed that IL skills were important for librarians to have ($M = 9.6$).

RQ1.3: What Are Participant Perceptions Regarding the Overall Value of IL Skills After the Instructional Intervention?

The data suggested that students were overall appreciative of the content. In response to the open-ended question, “Was the information literacy instruction included in this course helpful to you?” all 15 students responded in the affirmative. Responses ranged from a sentiment capturing the modules’ originality (“Yes, I gained a lot of new knowledge about different databases and resources for information”) to the idea that this was a helpful refresher (“Much of it I was already familiar with, but it was extremely helpful to review”). When asked, “Did the information literacy instruction in this course help you feel more confident about doing research in graduate school?” 13 students responded in the affirmative. One student felt that they needed “more practice,” and another student expressed indifference. The third question, which asked students, “What should be added to the information literacy instruction [modules]?” did not yield a great deal of feedback, as 12 of the students either did not respond or indicated that they were satisfied with the content. Of the recorded responses, “public relations topics,” “information about types of private libraries,” “study skills,” and “additional lecture materials” were all listed.

Takeaways From the Phase 1 Study

Although Phase 1 produced only modest knowledge gains, the instructor was satisfied that a minimum desired level of IL skills had been attained by all of her students such that they would be better prepared for the rigor of the program’s subsequent coursework. The researchers were therefore encouraged by the potential of the modules to develop IL skills in MLS students. Furthermore, responses to the Perceptions Survey indicated that MLS students saw value in the modules and recognized the importance of these skills to their
future profession. Based upon these findings, the instructor decided to retain the modules in subsequent offerings of the course.

Other than the usual maintenance of updating links and finding alternative sources for a topic when one becomes defunct, the modules were not changed after the Phase 1 study. Two years after the Phase 1 study (in Fall 2020), the modules became compulsory for the course so that more students would complete them. In Fall 2021, the timing of the modules changed from “at your own pace” to being interspersed with the class content during the first five weeks of the semester. In this way, students could benefit from the modules before writing one of their main research papers for the semester.

**PHASE 2 STUDY: CASE STUDY OF STUDENT KNOWLEDGE GAINS AND PERCEPTIONS**

After several years of implementing the online modules through the course, Phase 2 was developed in response to the instructor’s interest in revisiting student knowledge gains and perceptions of the instructional content. For this phase, students were asked to follow a prompt and write reflections after the completion of each of the five online instructional modules. Student reflections were gathered for the Summer 2021 and Fall 2021 semesters and were analyzed through a qualitative design methodology. The Phase 2 study proceeded upon obtaining the human participant research protocol approval from the institutional review board of the researchers’ university.

**Research Questions for the Phase 2 Study**

The research questions for Phase 2 were as follows:

- **RQ2.1:** What were student perceptions of the information they encountered in the modules?
- **RQ2.2:** What knowledge gains and competencies did students demonstrate from the modules?
- **RQ2.3:** What are the implications for the instructor?

**Participants**

This study utilized a convenience sample of 30 total students enrolled in the course. Twelve of these students were enrolled in the Summer 2021 offering of the class, and 18 students
were enrolled in the Fall 2021 offering. Classes were drawn from two semesters to increase the amount of data while maintaining consistency in terms of program, course, and approximate sequence within the program. However, one change was made by the instructor to the reflective task for the fourth module, so the research team excluded that information for the purposes of this study. As a result, the second semester of this Phase 2 study focused only on reflections from modules 1, 2, 3, and 5.

**Methodology**

To understand how these modules impacted students, an explanatory sequential case study design was utilized (Creswell & Creswell, 2018). In this design, the first phase of research collects quantitative data that is used to assess preliminary questions and to identify results to be followed up on in subsequent research. The results of our Phase 1 study demonstrated modest knowledge gains overall but did not provide the detailed information needed by the instructor, such as which specific topics were new information for students. While the Phase 1 results demonstrated greater student confidence with certain topics postinstruction, the instructor desired additional information regarding student perceptions. These concerns led to this second phase of the study, in which qualitative data was collected related to the modules. The goal of Phase 2 was to explain the findings of Phase 1 in context and with expanded detail.

During Phase 2, the instructor compiled all student responses to prompts in discussion forums, providing pseudonyms for all students. The responses were then organized into a shared document, which the research team (consisting of the instructor, the embedded librarian, and a faculty member from another program) independently coded, initially employing a descriptive coding scheme (Saldana, 2013). The team then met and explored distinctions in the individual coding and helped clarify emerging categories. Subsequent rounds of coding followed traditional processes of constant comparison, and the researchers continued to update the shared codebook. During these secondary cycles of coding, the research team employed a pattern coding scheme (Saldana, 2013) to help organize the data around central categories, which were then utilized to construct themes depicting general trends and patterns across all the data. While clarifying central categories and themes, the researchers organized patterns explicitly around the research questions and explored data that diverged from those patterns so as to note distinctions for follow-up. Table 3 provides a visual depiction for the flow of this study.

**Theoretical Framework**
Table 3
*Methodological Flow of Phases 1 and 2 of the Study*

<table>
<thead>
<tr>
<th>Phase 1</th>
<th>Data collection</th>
<th>Type of data analysis</th>
<th>Data analysis technique</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge construct</td>
<td>Data collection</td>
<td>Type of data analysis</td>
<td>Data analysis technique</td>
<td>Results</td>
</tr>
<tr>
<td>(pre- &amp; postinstruction through multiple-choice survey questions)</td>
<td>Quantitative</td>
<td>Paired samples t test</td>
<td>Moderate increase in knowledge</td>
<td></td>
</tr>
<tr>
<td>Perceptions construct</td>
<td>Quantitative</td>
<td>Descriptive statistics</td>
<td>Students appreciated modules</td>
<td></td>
</tr>
<tr>
<td>(postinstruction through Likert-scaled survey questions)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceptions construct</td>
<td>Qualitative</td>
<td>Open coding</td>
<td>Students saw value of modules</td>
<td></td>
</tr>
<tr>
<td>(postinstruction through open-ended survey questions)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Phase 2</th>
<th>Data collection</th>
<th>Type of data analysis</th>
<th>Data analysis technique</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge gains and competencies</td>
<td>Qualitative</td>
<td>Open coding</td>
<td>All students demonstrated a level of understanding</td>
<td></td>
</tr>
<tr>
<td>(collected through student writings)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Perceptions of the content</td>
<td>Qualitative</td>
<td>Open coding</td>
<td>Students identified their areas of learning</td>
<td></td>
</tr>
<tr>
<td>(collected through student writings)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

The theoretical framework for the Phase 2 study wove together several interacting and relevant components. The first element of this framework is drawn from the nature of the participants in this study, all of whom were adult learners. Consequently, we drew heavily upon andragogy theory and especially the principles outlined by Knowles (1984), which emphasize the self-directed and task-oriented nature of adult instruction. The second element of this theoretical framework was chosen for its alignment to the actual tasks that students were charged with completing in the modules. Each of these tasks was reflective in nature, and so we drew from Bain et al. (2002) and their 5R framework, as this has been used as a model for assessing reflective writing. The components of the 5R framework are reporting/recounting, responding, relating, reasoning, and reconstructing. Each of these components was incorporated into our coding system for the student writings.

Table 4 illustrates the process employed by the researchers to trace back general themes from the study. For each codebook category, specific NVivo codes are included to show the alignment.
Table 4
Sample Code and Category Alignment

<table>
<thead>
<tr>
<th>Category</th>
<th>Sample NVivo Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Research anxiety</td>
<td>“Plagiarism has always scared me.”</td>
</tr>
<tr>
<td>Gap in schooling</td>
<td>“It has been ten years since I have even had to think about writing a paper.”</td>
</tr>
<tr>
<td>Increased confidence</td>
<td>“I feel more confident in my ability to cite sources, and not plagiarize, even accidentally.”</td>
</tr>
<tr>
<td>Struggle</td>
<td>“I fear that I am not citing enough or that I am citing more than necessary. Trying to find that balance between my own words and the words of others is sometimes tricky.”</td>
</tr>
</tbody>
</table>

Results of the Phase 2 Study

RQ2.1: What Were Student Perceptions of the Information They Encountered in the Modules?

Overall, the reflections showed that students responded positively to the inclusion of the IL modules in the course. Students conveyed that the modules were helpful to them either as a refresher or as new information, and often the information presented in the modules was a combination of new and previously known information. Comments such as “I didn’t know I needed it, but I’m glad we’re starting with this topic,” “I enjoyed having a refresher,” and “I’m grateful that these modules have been included in this course” were made. While several students used the term “refresher” to indicate previous knowledge, a few also expressed sentiments such as “feeling a little rusty”; “Although most of the information in this article was familiar to me, it was an important review and reminder”; and “I am looking forward to continuing these lessons as a way to refresh, relearn, and possibly learn for the first time (or what seems like the first time).” In addition, many expressed increased confidence in their knowledge of research skills after working through the modules.

Students responded the most strongly to Module 1 (beginning the research process, choosing a topic, and writing a research question) and to Module 5 (how to cite in APA style, plagiarism, and weaving sources into the narrative). Several other themes quickly emerged, such as research anxiety, concern over time, gaps in schooling, struggles with citing, how to integrate sources into papers, time management, information overload, fears of plagiarizing, choosing a topic, and writing a research question. The graduate students in this study were acutely aware that even a small gap in their schooling meant that their previous skills might have become outdated or forgotten. The gap between their last college experience
and current enrollment in the graduate program spanned from a couple of months to decades.

Students expressed both strengths and weaknesses, or “good habits” and “bad habits,” in response to reflection prompts. These strengths and weaknesses varied by student. Where one student would express mastery of a skill such as finding appropriate sources, another would express that they quickly became overwhelmed in the sea of information available. While still different for each student, reported weaknesses seemed to be more prevalent surrounding certain topics such as formatting citations in APA, using in-text citations, knowing how and when to introduce other viewpoints, and how and when to integrate their voice with the voice from sources. Students also mentioned having the “bad habit” of adding sources and citations to their paper at the end and having trouble locating the sources again.

One surprising response from the students was their seeming quickness to look for easy solutions to some of their concerns before the intended topic was even introduced. For instance, in Module 1, students fixated on a link to the CARS (Credibility, Accuracy, Reasonableness, Support) checklist for evaluating sources (Harris, 2020), which the instructor didn’t realize was there, and the instructor did not intend for the students to consider evaluating sources at that point. Students focused on other tools as well, such as the CRAAP (Currency, Relevance, Authority, Accuracy, and Purpose) test (Blakeslee, 2004), the media bias chart, and creating a “cheat sheet” for citing common sources. Several students expressed relief at not having to memorize all of the content, instead being able to rely on the sources at a later date.

**RQ2.2: What Knowledge Gains and Competencies Did Students Demonstrate From the Modules?**

During the initial rounds of coding, it became clear to the researchers that it would be difficult to determine precise student learning gains from their writings. A few students discussed the classroom content in terms that appeared to be simply repeating the facts back to the instructor; it was therefore not clear from the writings whether these students had learned something new or if they were simply reciting back the instructional content. In recognition of this problem, a distinction was made in the coding of participant writings such that simple recitation of facts was coded as a “recounting,” whereas a discussion of instructional content that noted student use of the content (such as a demonstration that the student knew how to make a practical application of the content) was coded as a “competency.”
As an example of this distinction in coding, consider the following student quote. After completing the Module 2 content, a student we’ll call Student 1 wrote, “The Johns Hopkins Sheridan Libraries website lists six elements to consider when evaluating a resource. These elements include authorship, accuracy, currency, the publishing body, point of view or bias, and knowledge of the literature.” Here Student 1 seems to be simply recounting the information they were presented in the module; there is no synthesis of the material or discussion of what this information means to the student. We cannot determine if this is new information for Student 1 (for which they have made a gain in knowledge), or previously encountered material. Therefore, this segment was coded as “recounting.”

In contrast, Student 2 described some of the factors involved in writing an effective research paper before commenting, “Doing preliminary searches to make sure I’m on the right track is a great practice.” Without this self-reflective statement, the text segment likely would have been coded with a simple “recounting” code, acknowledging Student 2’s understanding of the instructional module’s topic. But with this practical application of the instructional content to the student’s life (in this instance, writing effective research papers), the researchers saw evidence of student competency of the material. That is, Student 2 had shown that they knew how to apply the instructional content at hand. The segment was therefore elevated to a “competency” coding.

The next problem in coding was determining what had been learned as a result of the instructional module, and what had already been known by the student. In the previous example, it is impossible to discern whether Student 2’s statement was made as a result of their prior knowledge, or if their comment was an epiphany in reaction to the instructional module. The researchers now had to make another distinction in their coding: student writings that clearly articulated that they experienced new knowledge were coded with “knowledge gains.” To illustrate this coding nuance using a different student’s writing, consider Student 3, who reacted to the module on writing effective research papers saying, “I have never actually had to both decide on and answer my own research question. I will now have a solid starting point to begin my research journey.” This indicates that the instructional content was new to the student, and they made a learning gain; the segment was therefore coded as “knowledge gain.” Another example of a statement coded as a “knowledge gain” came from Student 4, who wrote about the module on search strategies: “I was pleased to discover a couple of new strategies to improve how I use this search engine for research. For example, I had no idea that you could use quotations to designate a phrase.”

Under this method of coding, it was possible to extrapolate some student knowledge gains and competencies. The researchers found by far the greatest number of knowledge gains in the topic of advanced search strategies, including Boolean operators and advanced Google
search options. Following this topic, the other areas of greatest knowledge gains appeared to be how the scholarly publishing process works; how to formulate a research question/topic; and the nuances of the APA citation format. Although the students demonstrated competencies for each of the modules, this information simply told the researchers that the modules were serving their intended purpose of attaining a minimum desired level of understanding on the topics. Whether students knew the instructional content prior to the modules could not be determined except in cases where students explicitly expressed this. However, it was clear that all students demonstrated a level of understanding with the content postinstruction.

**RQ2.3: What Are the Implications for the Instructor?**

Since the modules were well received either as providing new information, as a reminder of useful knowledge, or as a way to connect knowledge to practice, the instructor felt that they were an important part of the MLS program and were situated well in the foundational course, allowing students to apply any knowledge gains early in the program to help ensure their success.

Based on the quality of the reflections, which showed evidence of all levels the 5R framework as a means for reflecting on the learning experience (Bain et al., 2002), the instructor was satisfied with the current prompts for the reflections and left them in place for future use. The researchers found that students repeatedly used all five levels of reflection, showing not only absorption of information but also connections to previous learning, current applications, and in several instances future plans for using this knowledge. Only two students out of 30 seemed to be stuck in reporting or recounting without any further examination of the information presented in the modules.

Module 1 included information on the steps of research, choosing a topic, and how to write a good research question. Students responded to these topics well and the instructor will keep them as they are. As mentioned in RQ2.1, one surprising comment found repeatedly in the reflections on Module 1 was the mention of the CARS checklist. The instructor was surprised at the number of students mentioning the checklist because it was embedded in an article on the steps of research and the instructor didn’t expect the students to delve that far into it. (Evaluating sources is not covered until Module 4.) So, while the link cannot be removed from the source, in the future the instructor plans to acknowledge it and inform students that more information on evaluating sources will be covered in a later module. This finding also led the instructor to think about what other “erroneous” or unnecessary information might be in each module. The instructor plans to make sure that
each module is tightened up and, to the extent possible, only contains clear and relevant sources for each topic.

Module 2 covered types of information sources, peer review, bias, and the concept of authority. Again, many students expressed prior understanding of information sources, such as primary and secondary sources, but others found that to be new information. Some of the student reflections seemed to characterize sources as “good” or “bad,” so the instructor plans to add material explaining the uses for different types of sources depending on one’s assigned writing task.

Module 3 covered search strategies and using library databases. Reflections for this module were again mixed, with some students feeling comfortable using library resources and others seemingly unable to transfer any previous knowledge of library databases, catalogs, and websites to their current situation as graduate students. Some students noted prior knowledge of Boolean searching, but several noted that they didn't know about using “NOT” as a parameter to filter sources. Students also expressed initial confidence when searching Google; however, upon being shown advanced search methods in Google and techniques such as phrasing and limiting by domain, the majority of students commented that they never knew that those strategies existed. The instructor felt that this module was important and useful in its present state.

Module 4 covered evaluating sources. As noted above, data from this module was not used in this study because the instructor changed the assignment from a reflection in Summer 2021 to an application assignment in Fall 2021. Given the response to the CARS checklist in Module 1, it seemed apparent that students are looking for tools to help them evaluate sources.

Module 5 covered citing sources, using in-text citations, and plagiarism. It did not surprise the research team that students responded positively to this module, stating that it was very helpful for them, particularly since our students come from a variety of backgrounds, have been away from school for varying amounts of time, and may not have used the APA citation style before. Since APA is the style used throughout the program, becoming proficient at it is advantageous. As noted in Table 4, anxiety surrounding plagiarism still persists in graduate library science students. The instructor saw no need to change this module.

In the instructor’s view, the reflections gave valuable insights into each student’s response to the modules. It is clear that all of the current modules were effective and needed, and they will be tweaked as outlined above. Because of the nature of online sources and the swiftness with which ways of accessing information change, each module will continue to
be checked for broken links, and updated information will be added as older information is replaced. The initial instructor videos are now several years old, so they will be redone to reflect any changes in current practice.

**Takeaways From the Phase 2 Study**

The qualitative design of the Phase 2 study provided much-needed student input regarding their learning experience with the online learning modules. Students clearly articulated the need for the content contained in the modules. Of note, students who had been away from formal learning institutions for longer periods of time expressed gratitude for the inclusion of the modules in the foundational course. Although this phase of the study was not intended to measure learning gains in a quantitative manner, the instructor was satisfied that all students had demonstrated a desired minimum of competency with the material, as evidenced by the coding scheme. By carefully analyzing each student’s written reflections, the instructor found that, for each module, the students either recounted facts from the reading, demonstrated a competency with the reading’s concepts, or (in the best case) expressed a gain in their understanding of the material. Furthermore, the Phase 2 study provided valuable feedback to the instructor regarding areas of improvement regarding the modules.

**DISCUSSION**

This two-phase study confirmed the findings of prior research that incoming graduate students, even MLS students, can benefit from IL instruction (Hebert, 2018; Hebert & Duet, 2017; Lamb, 2017; Saunders et al., 2015). Our main finding was that our graduate library science students are not that different from other incoming graduate students in that they still struggle to gain competency in IL skills. Between the modest gains shown from Phases 1 and 2, and the positive responses to the Perceptions Survey and the IL modules, it appears that embedding IL content into a course can be beneficial. From the instructor’s standpoint, introducing IL concepts as soon as possible to new students in the program helps to level the playing field and get everyone on the same page, enabling both the students and the instructor to focus more on the course content as they go forward.

**Limitations**

This two-phase study examined a beginning core course in an online library science graduate program; its implications cannot be generalized to all MLS programs. Both Phases 1 and 2 were limited by their relatively small sample sizes. In Phase 1, the same Knowledge
Survey questions were given during the pre- and posttest, which could possibly have led to some of the increase in scores. In Phase 1, students were given credit for completing the Knowledge and Perceptions Surveys, and the IL modules themselves were counted as extra credit if completed. In Phase 2, reflections were class assignments, and students were given points for completion. The fact that these items were completed as part of a course could have affected the students’ answers in some cases; for example, their answers to reflection questions may not have been candid. Although both the Perceptions Survey in Phase 1 and the reflections in Phase 2 were anonymized, students may have been concerned that their remarks would have been distinctive and easily personally identifying. Another possible limitation was bias in the coding of qualitative data; however, this limitation was minimized by the instructor collaborating with two other researchers (the embedded librarian and an additional faculty member outside of the MLS program) during the entire data analysis process.

Further Possible Research

This study brought up several avenues for future research. First, there could be more research into the effectiveness of IL modules for beginning graduate students. Second, themes that emerged from the qualitative data, such as the gap in schooling that graduate students often have, could be explored further.

CONCLUSION

Competency in IL skills is necessary for our students to master, yet cannot be presumed among incoming MLS students. Although many researchers have noted the need for an introductory skills course in IL, faculty often struggle with the inclusion of this additional material in an already compacted course. Online learning modules were an effective answer to this problem for our program. Our two-phase study allowed us to continually refine our process and adjust to the needs of our students. Our data clearly indicated a need for this content among our students, as well as their willingness to participate in this manner of learning.

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