Pilot Study Examining Student Learning Gains Using Online Information Literacy Modules

Corinne Bishop, Francisca Yonekura, and Patsy Moskal

Introduction

Since the release of the Information Literacy Competency Standards for Higher Education,[1] academic libraries have implemented a wide range of initiatives and programs. Formats range from traditional library instruction that integrates information literacy concepts in "one shot" sessions to credit-bearing courses that are librarian led and offer course or discipline-specific instruction. Delivery modes also range from face-to-face to online instruction. Increasingly, student assessment and indicators related to program impact have become the focus of ongoing discussions. Guidelines such as the Association of College and Research Libraries (ACRL) Standards for Libraries in Higher Education,[2] Guidelines for Instruction Programs in Academic Libraries[3] and The Value of Academic Libraries: A Comprehensive Research Review and Report[4] offer direction related to student assessment and defining program impacts. These documents also reflect a recognition that information literacy and library instruction programs are varied in response to institutional needs.

Information Literacy at the University of Central Florida

The University of Central Florida (UCF) is the nation's second largest university in student enrollment and is ranked in the top tier of research universities by the Carnegie Foundation for the Advancement of Teaching.[5] UCF's main campus is located in Orlando, Florida and the University's geographic service area encompasses eleven counties and ten regional and joint-use campuses in the Central Florida area. Enrollment in fall 2012 included 59,767 students with 28,219 in fully online and blended courses.[6] Serving such a large student population, with approximately a third of UCF's student credit hours being accounted for by web courses, makes the provision of information literacy instruction a priority for all students. In fact, as evidence of UCF's commitment toward this end, the University funded the Office of Information Fluency in 2005 as part of the Southern Association of Colleges and Schools (SACS) reaffirmation process to ensure "that UCF graduates are information fluent upon graduation."[7]

The Office of Information Fluency provides funding for the Information Literacy Modules project, which is a collaborative initiative developed by teams at the UCF libraries and the Center for Distributed Learning (CDL). In May 2006, a new Information Literacy and Outreach (ILO) department was formed at the John C. Hitt Library, located on the main campus. In 2007, development began with the design of a prototype module and participation by faculty, librarians and students in focus groups and usability testing. To date, fourteen online information literacy modules have been created and are available to faculty and students for use in courses across the curriculum. The modules serve as course resources and are an extension of the existing library instruction program. Module objectives are aligned with ACRL Information Literacy Competency Standards.[8] Topics cover a range of information literacy concepts and are designed to be non-discipline specific. Modules may be assigned in face-to-face and online

Corinne Bishop (Corinne.Bishop@ucf.edu), Francisca Yonekura (francisca@ucf.edu), and Patsy Moskal (Patsy.Moskal@ucf.edu) are all at the University of Central Florida

courses and in both undergraduate and graduate-level courses. Each module includes four sections: a learning objective, content, practice questions with feedback, and assessment questions. Content sections typically include ten to twelve screens and use a combination of text with graphics, video or animations. Practice and assessment sections include multiple-choice and true/false questions. Item-writing procedures for multiple-choice questions follow best practices guidelines.[9] Modules are developed using a combination of learning object design principles as described by Thompson and Yonekura[10] and "backward design" practices as described by Wiggins and McTighe.[11] Combining design strategies produces reusable instructional materials that include consistent alignment of objectives, content and assessment. Course instructors may assign modules as stand-alone resources or choose to offer them for credit, as extra/participation credit or as non-credit content. Often, librarians also assign modules in combination with scheduled library instruction sessions. Since modules are available online, they can be assigned as outside coursework, which means they do not add to in-class time for students, faculty or librarians. Online modules also offer the advantage of scalability, which is not possible with face-to-face instruction alone, thereby accommodating the large, distributed student population served by the libraries. Access to the modules is provided by the University's in-house tool called Obojobo.[12] Since their initial release, the modules have been assigned in a wide range of courses and programs. Table 1 shows module usage statistics for the period of June 1, 2008 through December 31, 2012.

TABLE 1
University of Central Florida Information Literacy Modules, June 1, 2008 through December 31, 2012

Unique Counts	
Course Instructors	316
Instances Created (module copies)	3,739
Students	23,074
Assessments Completed	112,295

Purpose of the Pilot Study

The purpose of the current study, which was funded by a UCF Libraries Professional Development Award, was threefold: to identify students' learning gains for the study modules by comparing pretest and posttest scores; to evaluate the effectiveness of the pretest/posttest design as a potential model for future score comparisons; and to gather indicators that could inform future content and assessment planning. Study modules included: *Creating a Search Strategy (CSS)*, *Evaluating Web Sites (EWS)* and *Focusing an Information Search (FIS)* and teach basic and advanced search strategies and web site evaluation. The modules were selected based on the nature of the content, which represents foundational information literacy concepts.

Methods

In summer 2011, the information literacy librarian met with English and History faculty who had expressed an interest in participating in the study. Faculty selected one to three modules to assign in their courses and planned a timeframe for completion of the study components. After receiving IRB approval, the information literacy librarian visited individual classes to explain the study, distribute informed consents and provide instruction sheets to students. Students were instructed to log in, complete a pretest and then complete the corresponding module content, practice with feedback, and module assessment sections (posttest). The timeframe for completion of study components varied depending on individual class schedules and ranged from seven to thirteen days. Modules were assigned prior to students attending scheduled library instruction sessions. When multiple modules were assigned in a course, students were not required to complete all of them on the same day. However, for a given module, they were instructed to complete a pretest and then to complete the corresponding module (with assessment/posttest) in the same session. Upon completion of a module, each student automatically received a confirmation of his or her module assessment score (posttest) via email. Pretest and posttest assessment scores were also downloadable for each course instructor. Table 2 illustrates the number of students participating by module.

TABLE 2
Total Student Participation by Module

Module	Number of Students
Creating a Search Strategy (CSS)	101
Evaluating Web Sites (EWS)	116
Focusing an Information Search (FIS)	108
Total	325

TABLE 3
Pretest and Posttest Means per Module

	n	Mean Pretest	Mean Posttest	t	df	Sig
CSS Module	60	83.83	83.67	0.08	59	.94
EWS Module	49	87.55	89.18	0.83	48	.41
FIS Module	48	69.30	82.02	4.46	43	.00*
*p <.05						

Because the pretest was added specifically for this study, it was a stand-alone test and it was possible for students to complete a module independent of the pretest. While few students did so, those who completed the pretest after the posttest were excluded from analyses. Table 3 illustrates the means for each of the three modules. Students performed significantly better ($p<.05$, $t(47) = 4.46$) on the FIS module posttest, with a mean of 82.02 as compared to the pretest mean of 69.30. However, student performance on the CSS and EWS modules showed no significant difference between pretest and posttest means and the average on the pretest was very high for these modules (83.83 and 87.55, respectively). In addition to examining the mean differences between pretest and posttest, we were interested in how many students achieved the established threshold of 80% or higher on the module assessment. Eighty percent was established as an arbitrary indicator that students had learned the required content to successfully use the concepts in their courses. Table 4 illustrates the percentage of students who achieved a score of 80% on the pretest and posttest assessments for each of the three study modules.

TABLE 4
Pass/Fail Percentages for Pretest and Posttest

	n	Pretest ≥80	Posttest ≥80
CSS Module	60	75%	72%
EWS Module	49	86%	84%
FIS Module	48	37%	65%

As was indicated by the mean scores, both the CSS module and EWS module had a high pass rate on both pretest and posttest. In fact, 75% of the students passed the CSS module on the pretest, with 86% of students passing the EWS module assessment. It is possible that students had some existing knowledge related to the content of these modules and had evaluated web sites or had to develop search strategies as part of their earlier academic experiences. If we assume that a high percentage of students achieving an 80% or higher is indicative of existing, strong skills that our students already possess, then the study modules may be good candidates for use as standard online instruction as opposed to covering this content in face-to-face library instruction sessions.

The FIS module illustrated a much higher percentage of students who mastered the material on the posttest (65%) as compared to the pretest (37%). The low performance on the pretest for this module is an indication that students may have less prior experience with the content covered in this module. The learning objective for the module covers advanced search strategies. Students must identify the correct strategies for searching exact phrases and subject terms, combining subject and keyword terms and using truncation. It makes intuitive sense that these may be skills students have limited experience with prior to college. However, students performed significantly better on the posttest after completing the module than on the pretest.

Key goals for this project were to identify a model that could be used to investigate additional modules and to discover indicators of learning gains to inform future module development. Due to the variability in student performance from pretest to posttest, we decided to examine individual FIS module questions to determine if we could establish a plan for reviewing other modules. Item analysis was used to discover any problems with specific questions and to help identify potential disconnects between the content and questions.

Table 5 presents the percentage of students who selected each question item for students who took both the pretest and posttest (n=48) for the FIS module. Multiple-choice questions had three possible responses (A, B, C) while media formatted questions were either correct or incorrect. Although the content was similar, questions varied for pretest and posttest. Examining the percentage of those students (in bold) who selected the correct item provides us with some valuable information. Several questions had a very high percentage of students who selected the correct item on the pretest. On the pretest, for instance, 88% of students correctly answered question 2, 96% of students correctly answered question 3, and 90% of students correctly answered question 10. Because

TABLE 5
Percent of Students Selecting Items on Pretest and Posttest on FIS Module

	Pre (n=48)				Post (n=48)				
	Media	A	B	C	Media	A	B	C	Gain
1		2	**81**	17		**98**	2		+17
2		10	**88**	2		**92**	4	4	+4
3	**96**					19	10	**71**	-25
4		27	27	**46**		13	**79**	8	+33
5	**28**				**92**				+64
6		60	2	**38**		**79**	15	6	+41
7	**44**				**90**				+46
8		**33**	13	54		8	**63**	29	+30
9	**81**				**83**				+2
10	**90**				**81**				-9
11		25	2	**73**		**60**	38	2	-13
12	**81**				**87**				+6

students performed so well on these items on the pretest, we can assume they were familiar with the content tested in those questions. Similarly, there were students who performed poorly on questions, with 46% correctly answering question 4, 28% correctly answering question 5, and 38% correctly answering question 6. These questions test content we assume the majority of students were unfamiliar with prior to this instruction. Examining item selections in this way provides guidance about how we can potentially maximize instruction for content students do not already know. Using this process may help us identify what students already know and what they need to learn through instruction, which is similar to various types of learner analysis commonly used in many instructional design models.[13]

Examining the percentage of students who answered questions correctly on the posttest in a similar fashion also provides us with valuable information. Ideally, we hope that students will always select the correct answer on the posttest and, thus, the percentage of students who correctly answer the test item would approach 100 percent. So, questions that have a high percentage of students selecting the correct answer illustrate that the content in the module effectively taught that concept. For instance, 98% of students correctly answered question 1 and, thus, mastered that concept. Questions with lower percentages of students answering correctly indicate that either the students did not learn the concept effectively, or an issue exists with the wording of the question in that it is ambiguous or incongruous with the content covered in the module. Question 11 is one such question, where only 60 percent of the students correctly answered the question after working through the instructional content provided in the module.

Finally, examining the difference between the percentage of students who correctly answered pretest and posttest items can illustrate the items for which students gained the most in knowledge and also illuminate any issues that may be present when students perform better on the pretest item than the similar posttest item. Questions with small gains, or even losses, indicate a need to examine both the question and how the content is taught in the module.

Questions 3, 10, and 11 indicate questions for which content should be reviewed.

Conclusions

This study grew out of the Information Literacy Modules initiative at the University of Central Florida. It served to establish a potential model that could be used in the future. The pretest/posttest design used in the study provided a first look at students' prior knowledge related to module content. Scores for two of the three modules examined, CSS and EWS, indicated that the majority of students had experience with these topics. This motivated the investigators to focus on the FIS module, which showed significant student improvement from pretest to posttest. The

study also illustrated the need to examine individual items, as students had difficulty with several posttest questions even after completing the module content, indicating a higher than desired item difficulty. A limitation of the study is the lack of demographic information. Additionally, re-testing the modules to compare item-level scores would serve to support initial indicators and support reliability and validity. Overall, the study provided some valuable indicators related to module design and insights about topics that may benefit most from coverage in face-to-face library instruction sessions versus content presented online. Future research may focus on refining and extending the model to plan for continual program development and refinement, thereby maintaining UCF's focus and helping to ensure that students are information fluent.

Notes

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