

Assessment of Library Instruction to Develop Student Information Literacy Skills

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The radiographic science program at Idaho State University is programmatically accredited by the Joint Review Committee on Education in Radiologic Technology and regionally accredited by the Northwest Commission on Colleges and Universities. The mission of this baccalaureate program is to provide students with both the academic and technical foundations to perform radiologic procedures competently and safely, to prepare qualified imaging technologists who will respond ethically to the needs of patients with technical knowledge and compassion, and to prepare students to assume a vital professional role as a medical team member.¹

Students who graduate from this accredited program are eligible to sit for the national certification examination in radiography administered by the American Registry of Radiologic Technologists. To graduate, students must complete a minimum of 38 general education credits from 9 core objective areas and complete 84 professional and program requirement credits. In addition, students must exhibit all of the learning outcomes for each course and demonstrate competency as defined by the American Registry of Radiologic Technologists.²

Program quality is measured with an assessment plan.³ The first goal of the assessment plan at Idaho State University is to teach students critical-thinking and problem-solving skills. One of the specific outcomes for this goal requires students to write clearly

and accurately in a variety of contexts while checking, editing, and revising their written work for correct information and appropriate emphasis, form, style, and grammar.³ To do this, students must apply information literacy skills to locate, evaluate, and use information effectively. *Information literacy* refers to the set of skills needed to find, retrieve, analyze, and use information.⁴ The Association of College and Research Libraries, in its information literacy competency standards, emphasizes the importance of teaching students information literacy skills and their value in higher education.⁵

Information literacy and the knowledge gained by evaluating reputable health information sources are crucial in delivering good patient care. Because medical imaging is a continually evolving profession with rapidly changing technologies, radiologic technologists must stay up to date with current medical literature to engage in best professional practices. Technologists also must learn how to find and evaluate reputable health information to stay prepared for their occupational pursuits. Underdeveloped information literacy can have a negative effect on professional best practices, which ultimately is detrimental to patient care. It is essential for radiologic science students to learn how to evaluate health information, to build effective search strategies, and to use credible health information effectively.

To ensure radiologic science students develop health information literacy skills, a partnership between health science librarians and academic program faculty is

crucial. For several years, a health science librarian has provided the Idaho State University radiologic science students with library instruction to enhance student information literacy skills. Library instruction assures that information literacy is fully incorporated into the radiologic science curriculum. The purpose of this study was to assess student skills and knowledge of information literacy and their self-reflections before and after the library instruction.

Literature Review

According to the Association of College and Research Libraries, an information literate individual is able to⁵:

- Determine the extent of information needed.
- Access and critically evaluate the needed information effectively and efficiently.
- Incorporate selected information into his or her knowledge base.
- Use information effectively to accomplish a specific purpose.
- Understand the economic, legal, and social issues surrounding the use of information.
- Access and use information ethically and legally.

The Association of College and Research Libraries suggests incorporating information literacy across curricula, in all programs and services, and throughout the students' tenure at the university. To do this requires the collaborative efforts of faculty, librarians, and administrators.

Studies show that health science librarians and health science faculty have established collaborative relationships in teaching information literacy to students majoring in medicine, pharmacy, occupational therapy, physical therapy, and nursing.⁶⁻¹⁰ The results of these studies indicated that library instruction confirmed improved student information literacy skills. However, few publications report on collaborative efforts between health science librarians and radiologic science faculty to improve radiologic science students' information literacy skills and knowledge.

Evidence of student self-perceptions and library learning outcomes can be collected in many ways, including measuring performance, attitudes, and behavior. Schilling and Applegate conducted a literature review to explore the best methods for evaluating educational effectiveness. They compared the efficacy of

traditional measures used to assess library instruction and examined the benefits and drawbacks of assessment measures.¹¹ The results of their review showed that affective surveys are the most frequently used tool for assessing library instruction and measuring respondents' attitudes and perceptions, including what they think, feel, or believe about library research, training experience, and their searching skills.¹¹

Schilling and Applegate also indicated that affective measures are important because user satisfaction and self-confidence affect how people use information and develop information literacy skills. However, questions arise as to whether self-described knowledge and search skills match actual abilities. In addition, some people question the methods used to measure real student learning outcomes.¹¹ Schilling and Applegate suggest that common affective measures such as questionnaires and self-reporting skills surveys are subjective and unreliable measures of skills and knowledge.¹¹ However, others think that practical exercises and tests can be used to demonstrate applied skills and measure the quality of library instruction. For instance, several researchers used pretests and posttests to measure differences in student learning outcomes before and after library instruction.^{6,11-15} Their results showed that testing is an objective way to measure student skills or knowledge before and after library instruction.

Methods

Research Questions

The purpose of this study was to measure the effectiveness of library instruction on student learning outcomes in terms of demonstration of student information literacy skills and self-confidence in using these skills. Based on the literature review and the purpose of the study, 4 research questions were determined:

- Does library instruction increase radiologic science student learning outcomes in information literacy?
- Are there any differences in student knowledge scores of information literacy before and after library instruction?
- Are there any changes in radiologic science student self-reflections after library instruction?
- Do students improve the level of their confidence and comfort as their information literacy knowledge scores increase?

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Study Population and Settings

The target population of this study was senior undergraduate students in the radiologic science program in the Kasiska College of Health Professions at Idaho State University. Seventeen students voluntarily participated in this study, which took place at the Idaho Health Sciences Library at Idaho State University in Pocatello, Idaho. The institutional review board granted approval for this study.

Research Design

A quantitative research method was used in this study to assess the differences in learning outcomes among radiologic science students before and after library instruction. In addition, student self-reflections on confidence and comfort in using library resources and services were assessed. This study consisted of a 120-minute hands-on library instruction and workshop session, which included pretest and posttest methods, culminating in a self-reflection survey.

The pretest, posttest, and self-reflection survey instrument were developed by the health science librarian and radiologic science faculty based on the information literacy standards described by the Association of College and Research Libraries and the radiologic science program core curriculum competencies and student learning outcomes. The pretest and posttest included 10 items that measured student information literacy skills. The self-reflection survey contained 7 items that identified student self-perceptions on the use of library information resources and services for their academic studies in the radiologic sciences. Both instruments were validated by conducting a pilot test among health science students.

Data Collection and Analysis

A baseline of student knowledge and skills in information literacy and self-perceived library research skills and confidence in these skills was obtained via the pretest, posttest, and self-reflection surveys. After students completed the pretest and self-reflection survey, they were given library instruction on planning literature searches, developing search strategies, searching health-related and medical-related databases to locate radiologic science literature, evaluating quality of information, and using EndNote, a software program that allows

users to format references in different citation styles (Thomson Reuters). Instruction was provided to demonstrate methodology in finding peer-reviewed articles in professional journals. During the library instruction, students completed hands-on exercises to practice what they learned. After finishing the exercises, students completed the posttest and self-reflection survey.

All pretests, posttests, and self-reflection surveys were collected, and the data were entered into an Excel spreadsheet (Microsoft), and then exported to IBM SPSS Statistics 21.0. Frequency and descriptive statistical analyses were performed, and a paired sample test was conducted to compare the different means of student pretest and posttest scores.

Results

Of the 17 students who participated in this study, 12 students (70.6%) self-reported that they had not attended library workshops previously; however, 5 students (29.4%) had received previous instruction.

Pretest and Posttest Scores

Ten items tested student knowledge and skills in developing information search strategies, locating journal articles, selecting and searching databases, using citation style, and general library services, including an interlibrary loan service. Following library instruction and hands-on practice, students' posttest correction scores showed a significant increase in database selection (47.1%), database searching (64.7%), and a moderate increase in access to the journal articles (29.4%), search strategies (17.7%), and citation components (17.7%).

In contrast, some scores in the test items, such as characteristics of references and general citation styles, did not show a significant increase because students had this knowledge before attending the library instruction. **Table 1** provides details about the pretest and posttest results.

The statistical results showed that the total average score of student knowledge before library instruction was 66.47%. In contrast, the total average score of student knowledge after library instruction was 91.18%. A statistically significant difference in student learning outcomes before and after the library instruction was evident ($P < .001$) (see **Table 2**).

Table 1

Raw Data from Pretest and Posttest					
Item No.	Item	Pretest Correct	Pretest Incorrect	Posttest Correct	Posttest Incorrect
1	A-Z journal list	70.6%	29.4%	100.0%	0.0%
2	Database search skills (activity)	29.4%	70.6%	94.1%	5.9%
3	Interlibrary loan service	58.8%	41.2%	64.7%	35.3%
4	Search strategies (Boolean)	82.3%	17.7%	100.0%	0.0%
5	Peer-reviewed journals	82.3%	17.7%	88.2%	11.8%
6	Characteristics of references	100.0%	0.0%	100.0%	0.0%
7	Search concepts	94.1%	5.9%	100.0%	0.0%
8	Citation style	100.0%	0.0%	100.0%	0.0%
9	Database selection	17.6%	82.4%	64.7%	35.3%
10	Citation components	64.7%	35.3%	82.4%	17.6%

Self-Reflection Assessment Outcomes

The self-reflection assessment included 7 items that measured student confidence and comfort in information literacy knowledge and skills. Three items showed a statistically significant difference:

- Students were more confident about how to access search databases and obtain research articles in the radiologic sciences ($P < .001$).
- Students felt more knowledgeable about correctly citing references using American Medical Association citation style ($P < .001$).
- Students felt more comfortable with identifying the various parts of a journal citation ($P < .001$).

Overall, a statistically significant difference was seen in student self-reflections before and after the library instruction ($P < .001$). **Table 3** contains detailed results.

Discussion

The health science librarian and radiologic science program faculty members established a cooperative relationship with a goal to increase student learning in information literacy. This collaborative effort answered the first 2 research questions. Information literacy

training does increase student learning and provides skills needed to acquire information literacy. The results of this study were consistent with studies conducted by other researchers using pretests and posttests.¹¹⁻¹⁵

Regarding the other 2 research questions posed in this study, results showed that self-reflection scores increased as information literacy increased.

Schilling and Applegate stated that in a well-rounded evaluation system, both formative and summative assessment are essential, and the longitudinal summative assessment of practical skills is the truest measure of learning.¹² A formative survey is used for measuring student perceptions on their confidence, comfort, and attitudes. A summative survey is used for measuring student knowledge and skills. In this study, both formative and summative assessments were used to measure student learning outcomes at the beginning and the end of library instruction. A significant change in students' perceived knowledge and their overall progress in information literacy skills were identified.

Students usually self-report that they feel more confident in their information literacy following library instruction. However, increase in confidence does not always correlate with actual increase in knowledge. Nonetheless, the findings of this study support the statement that student confidence and comfort increased as their knowledge and skills increased.

Implications for Practice

Some implications of this study were identified by the health science librarians and radiologic science faculty. The collaboration resulted in students becoming more literate in information technology. Collaborative teaching between health science librarians and radiologic science faculty is an effective way of educating radiologic science students in information literacy. Eventually, students applied the skills they learned to write a research paper or case report. (These papers are available online at http://www.isu.edu/radsci/student_research13.shtml.)

Another implication for further research is that both formative and summative assessments are necessary to measure student learning outcomes accurately. Both

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Table 2

Pretest and Posttest Paired Samples Statistics					
Pair	Mean	Standard Deviation	t	df	P Value
Pair 1: Total Pretest–Total Posttest	-24.706	15.858	-6.424	16	.001

Table 3

Self-Reflection Assessment Results ^a				
Item No.	Self-Reflections	Pretest Mean Score	Posttest Mean Score	P Value
1	I am very confident about how to access databases and obtain referred research articles in radiologic sciences.	2.18	3.76	.001
2	I am very knowledgeable about correctly citing references using AMA citation style used in written papers for my classes.	1.82	3.71	.001
3	I am comfortable with identifying the various parts of a journal citation.	2.59	3.82	.001
4	I do not think it is important to obtain knowledge about conducting library searches because I already know how to do it.	1.53	1.76	.305
5	The thought of having to conduct a literature search scares me.	2.59	2.53	.873
6	The thought of having to write a paper and support my opinions based on existing research is very intimidating to me.	2.94	2.59	.145
7	Plagiarism has not occurred as long as I provide a reference cited in my paper.	3	3.59	.296

Abbreviation: AMA, American Medical Association.

^a A 5-point Likert scale was used in the survey, and a Wilcoxon signed rank test was performed.

types of assessments were used in this study to measure the effectiveness of library instruction on student learning: a pretest, posttest, and a self-reflection survey. Combining these assessments allows researchers to measure both student self-perceptions and their actual information literacy skills.

Limitations and Future Study

There are 2 major limitations to this study. First, the sample size was small. Therefore, the results could not be generalizable to all radiologic science students or students of other health professions. Second, library instruction was given to students once, and its effectiveness was measured immediately following the workshop. Long-term efficacy of the library instruction and student retention of knowledge concerning information literacy was not measured.

A follow-up assessment 6 months after the initial library instruction will be conducted to evaluate students' long-term knowledge retention. The resulting study will include an analysis of methods for retaining skills and knowledge required for information literacy.

Conclusion

This study showed that providing library instruction to students increased their skills and knowledge in health information literacy. Outcomes demonstrated a significant increase in database selection skills and searching strategies, with a moderate increase in students' ability to access peer-reviewed journal articles and cite them properly.

The study also demonstrated that the library instruction affected student learning and confirmed that students were more confident about accessing research and felt more knowledgeable about citing in American Medical Association style and identifying the various components of a citation.

In addition, there was a measurable increase in confidence and comfort in students' knowledge regarding

information literacy. The well-written research papers completed by the 17 students also are tangible evidence that students' confidence, comfort, and knowledge of literary skills increased as a result of the instruction.

Finally, this study emphasizes the need for partnerships between health science librarians and radiologic science faculty to educate future leaders and health professionals in the radiologic sciences.

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The authors thank the radiologic science students who participated in this study as well as Loretta Zuber and Thomas J Henrie at Idaho Health Sciences Library for their assistance with data entry.

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