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# Structured Introduction to Information Literacy Using a Scaffold Project in an Introductory Engineering Course

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## Abstract

Faculty from two engineering departments teamed with Florida Gulf Coast University's STEM Librarian to develop an instructional module for delivery in the introductory engineering course in an effort to increase the student's awareness of both the resources available through the library as well as methodology of discriminating amongst multiple references. This paper will detail the information literacy module components, briefly describe the course in which it is placed, summarize the related project assignments, and present an analysis of various student project reference sections to begin to quantify the potential impact of the module on student performance. Assignment modifications over various semesters as well as the future direction of the research will also be included.


## Information Literacy

Studies[1,2] have shown that despite the technological savviness of digital natives, the ability to discriminate between non-quality and quality reference sources as well as to conduct research queries in a rigorous and optimized manner are still not skills mastered by the majority of undergraduate students. And while students can often locate a random piece of pop culture knowledge simply by "asking" their phone or "googling" the question, research has demonstrated that they are unfamiliar with the fact that this same approach is not the one that should be taken in every search engine. If information literacy, "the ability to recognize when information is needed and have the ability to locate, evaluate, and use effectively the needed information[3]," is the goal, then prior research suggests digital natives need both training on effective search methodologies and assignments that value varied and quality references.

Even prior to the 21st century Information Age, the concept of information literacy has received attention and consideration from multiple researchers[4–7]. While the specific definition has evolved over the past decades, and even today has not reached a single consensus, the key elements in all definitions include that of an established skill set with regards to information location, knowledge of resources which contain the desired information, and the ability to analyze and use this information. Indeed, information literacy is a critically important skill for those in the scientific and technical disciplines, due in part to the speed at which information changes in these fields, and the decisions made based on this information may have far reaching effects on public health and welfare. The explosion of publications, research data, and other sources of information available in the digital age poses a challenge for researchers to keep abreast of current developments in their fields. The Association of College and Research

Libraries (ACRL) outlines some of the unique aspects of information literacy as it pertains to STEM in its Information Literacy Standards for Science and Engineering/Technology. Challenges identified include the cost of peer reviewed journals, the plethora of grey literature sources and need to understand who is funding and publishing these works; the often interdisciplinary nature of discoveries; and the need for proficiency in working with a myriad of different formats of information, often requiring knowledge of specialized software and/or laboratory techniques[3]. Five different information literacy standards are identified in the document, each with numerous performance indicators:

- Standard One: The information literate student determines the nature and extent of the information needed.
- Standard Two: The information literate student acquires needed information effectively and efficiently.
- Standard Three: The information literate student critically evaluates the procured information and its sources, and as a result, decides whether or not to modify the initial query and/or seek additional sources and whether to develop a new research process.
- Standard Four: The information literate student understands the economic, ethical, legal, and social issues surrounding the use of information and its technologies and either as an individual or as a member of a group, uses information effectively, ethically, and legally to accomplish a specific purpose.
- Standard Five: The information literate student understands that information literacy is an ongoing process and an important component of lifelong learning and recognizes the need to keep current regarding new developments in his or her field.[8]

Information Literacy is combined with writing and critical thinking to form the focus of the current Quality Enhancement Plan (QEP) at Florida Gulf Coast University (FGCU). The QEP is a component of the Southern Association of Colleges and Schools accreditation designed to identify "key issues emerging from an institutional assessment and focuses on learning outcomes and/or the environment supporting student learning and accomplishing the mission of the institution[9]." These skills are well aligned with "a recognition of the need for and an ability to engage in life-long learning[10]", one of the student outcomes of ABET accreditation. Development of this skill set ensures students will "master content and extend investigations, become more self-directed, and assume greater control over their own learning[7]" and become informed citizens able to contribute in productive and meaningful ways to the betterment of society.

Instilling in students the appreciation that learning is a continual process even beyond degree attainment reinforces a growth mindset. Described by Dweck[11], a growth mindset is the recognition that dedication and commitment to learning results in the further development of knowledge and greater likelihood of goal achievement. This is counter to a fixed mindset touting a predetermined level of natural abilities that can never be surpassed. Additionally a focus on

information literacy is grounded in constructivist theory[12,13] which emphasizes the creation of knowledge built on personal experience from a variety of sources as a critical learning mechanism. This individualized engagement with multiple sources of knowledge initially requires analysis and synthesis and ultimately can result in creation, all higher levels of achievement on Bloom's Taxonomy[14].

**How Students Search**

The mission of the academic librarian is to teach students to "go beyond Google" and develop robust information literacy skills. The FGCU Library offers a full range of standard academic resources and services including scholarly journals, books, databases, interlibrary loan, online research guides, classroom instruction, walk-up service at a reference desk, workshops, and individual research consultations. In addition, FGCU's QEP is now systematically embedding information literacy into the curriculum for the first time in the University's history. However, in today's information age, the tendency of students to rely primarily on Google for their academic research is a constant challenge, even with the most energetic outreach. Anecdotally, librarians encounter a widespread assumption among students that if an article or other piece of information can't be found quickly online, it doesn't exist. Additionally, the problem of library anxiety, in which students are overwhelmed and intimidated by the library's myriad resources, is well-documented[15,16], and can be a "psychological barrier to academic success[17]".

Students often overestimate their own ability to conduct thorough research and identify high-quality sources. In a study of upper-level students enrolled in a health sciences course, Molteni and Chan[18] found that students' confidence in their own research skills was not a reliable predictor of their competence in information literacy. Head and Eisenberg[19] report that while students rate themselves highly in their abilities to find and evaluate information, they struggle with the beginning stages of the research process, particularly defining a research question. Narrowing topics and filtering results are also difficult in light of the vast amount of information available. Only about half of the students they interviewed reported asking a professor for help in evaluating sources; only 11% asked a librarian. Finally, students rated conducting a comprehensive search and enhancing their own knowledge of a topic as less important than completing the assignment and course with a good grade.

Kim and Sin[20] found that although students recognize the importance that quality references play in research projects, when it comes to applying this knowledge to their own assignments, quality references drop off the priority list in favor of accessibility and ease of use. This deficiency is often compounded by the inability of students to identify appropriate peer reviewed journals in their technical subject area, or even how to use recommended library databases for proper searches, as well as their general unwillingness to ask a librarian for assistance. Taken together, it becomes easy to see how the gap grows between what students know should be applied in

information searches and how they actually search for information. Additionally, while faculty may choose to provide open ended research assignments with the belief that allowing students to choose a topic of interest will result in increased engagement with the material, students often select research topics based not on interest, but rather on the availability of information[1].

**The Introductory Engineering Course**

Introduction to the Engineering Profession (EGS 1006L) is a one-credit course offered to students entering the engineering curriculum at FGCU. When this course was first created, it was done so within a brand new school of engineering. As such, "Introduction to the Engineering Profession" was originally developed to provide an overview of the engineering programs at FGCU, and encourage students to consider engineering as a potential career choice. In Fall 2014, the course was revised to provide a more cohesive, meaningful first year experience that tied into the pedagogical philosophy prevalent amongst the engineering faculty and that was consistent with the University's new QEP focusing on writing, critical thinking, and information literacy[21].

The overarching element of the introductory course is a research paper focusing on innovations in engineering, tying in with the National Academy of Engineering Grand Challenges. Students are asked to identify four recent engineering innovations, focusing on topics that are relevant to their chosen major. For those students who enter the class not knowing what their major will be, they are asked to focus on which engineering discipline (Civil, Environmental or Bioengineering) they are currently most interested in, recognizing that this choice will have no bearing on their future courses. Faculty make no stipulation regarding where these innovations were found, only suggesting that they be "recent" (i.e. within the last 3-4 years). Students are then asked to select their favorite innovation from the four they originally found, and research it a bit further, collecting additional citations that further describe / define the innovation. Groups of 4-5 students are then created based on their major, and each student in the group is asked to present their findings from their favorite topic to the rest of the group, such that the group can decide which topic to focus on for the rest of the semester. Additional details describing this process are available from Geiger and Sweeney[22].

After selecting a topic for the semester, additional in-class activities and subsequent deliverables focus on information literacy. As a group, the students are asked to expand upon the reference list initially developed by the individual group member whose topic was chosen for further investigation, followed by reading and summarizing these additional references. At a minimum, groups are expected to have 10 references for their research topic by the end of the 5th week of class, and should have individual summaries of those by the end of week 6-7. This allows for the development of an outline of the final paper, completion of a 50% draft that undergoes peer review, and completion of the final paper during the remainder of the semester. By the end of the semester, groups are expected to turn in a 5-7 page paper on their chosen innovation, with

appropriate references, focusing on its development, current status and potential future implementation (past, present, future).

**Module Development and Student Assignments**

The use of online information literacy modules in first-year engineering classes is a topic that has recently gained attention. Zhang, Goodman and Xie[23] describe a setup for such a class at the University of Western Ontario in which students complete a library module embedded in the course management system in addition to holding in-person library tutorial sessions.
In the case of Introduction to the Engineering Profession at FGCU, the second class of the semester is designated as a Library Introduction lesson. Conducted with a flipped classroom approach, students are not required to attend the specific class time, but instead are encouraged to complete the module discussed below prior to the official class period. Class time is conducted as drop in office hours, with students having the ability to meet the Engineering Librarian and ask questions of the Librarian, the course instructors, or the course TAs. The graded components associated with this lesson include two quizzes and an individual initial references assignment, all discussed in more detail below.

The Library Introduction Lesson begins with several online videos embedded in the module. The majority are YouTube videos created by the FGCU Library's Instructional Technology Librarian. The ease of sharing videos in YouTube makes it an ideal platform for creating video-based learning objects. Some of the videos are freely available via the FGCU Library's YouTube channel, FGCUlibraryservices, and were designed to be used by all of the librarians as needed. Videos can be posted to or embedded in multiple locations such as the Library's Facebook page, LibGuides (online research guides), and in this case, Canvas. Two more videos, covering concepts of scholarly vs. popular publications and the peer review process, were created by the Information Literacy Subcommittee of the Council of State University Libraries. All of the videos are relatively short (with the longest running for 4:35), visually engaging and straightforward, making them an ideal introduction for beginning students. The "playlist" totals about 20 minutes and is designed to present a logical progression of skills and concepts:

1. Tour of the Library Website - This video orients students to the library website as the essential gateway to our services and resources.
2. Popular Periodicals vs. Scholarly Publications - Teaches the critical differences between magazines and scholarly journals, and introduces the latter as the primary means of scholarly communication.
3. The Peer Review Process: What Is Peer Review? - Helps students understand that most articles published in scholarly journals undergo the peer review process
4. Finding Articles at FGCU Library - Demonstrates how to access the Library's subscription databases to find scholarly journal articles.

5. Searching a Database - Shows how to optimize a database search through the thoughtful and intentional use of keywords and search options.
6. Finding Books at FGCU Library - Introduces students to use of the Library Catalog and Library of Congress Classification System by which our books are organized.

A ten question quiz follows the videos. The quiz was created using Canvas, which provides a number of different question types: multiple choice, fill in the blank, matching, essay, etc.. Students can try a question multiple times until they get the right answer; the intent is not just to test but also give them opportunities for practice and reinforcement. While some of the questions are straightforward, testing students' recollection of simple facts (for example, that the library's books are organized using Library of Congress Classification), others walk students through prescribed database searches with specific instructions designed to provide practice with search techniques. For example, in one question students are instructed to use quotes around two words in order to search for an exact phrase. In another, students consider how Boolean operators would affect a search for multiple concepts. Perhaps the most important question in Quiz A introduces students to the engineering-specific databases by directing them to the Engineering subject category of the FGCU Library's Databases page, the portal to the over 400 databases to which the Library subscribes.

Quiz B introduces the concept of citation while continuing to delve into advanced searching techniques. One additional video is presented prior to the quiz, "Avoiding Plagiarism Using Citations," (also created by FGCU's Instructional Technology Librarian), with refresher videos from Quiz A provided as well. In this quiz, students are walked through various ProQuest Engineering Collection searches through the use of screenshots and complete tasks such as searching in different fields (title, abstract and so on), using the peer-reviewed limiter/filter, and using the library's Article Linker service to connect to full text when available. Our STEM librarian finds ProQuest to be an excellent database for use in lower-level classes due to its ease of use, comprehensive subject coverage, and wealth of time-saving features. Students are required to show proficiency in using the database's Cite and Email tools by completing tasks such as copying and pasting the APA citation for an article in one question, and uploading a full text pdf file in another. Finally, a three point essay question directs students to try three different keywords in three different databases: Elsevier's Engineering Village, Ebsco's GreenFile, and IEEE Xplore. These databases focus on engineering, the environment, and technology respectively. The purpose of the question is to demonstrate that different databases have different strengths and provide different types of results. Students choose from the search terms "artificial heart," "soil pollution," and "concrete strength," search in each of the three databases and answer the following questions:

1. Which search term did you choose?
2. Which database had the most results for that term? What was the top journal represented in the results list?

3. What were the similarities in results among the databases?
4. What were the differences?
5. Which database do you feel was most effective for that search term? Why?

The essay question is by far the most in-depth portion of the quiz and represents the culmination of the information literacy module. By now, students should be familiar with the library's services and resources, aware of the scholarly engineering literature, and able to search for, find and identify relevant articles from a variety of databases.

The initial references assignment follows the library introduction module. By this time students have already investigated a number of potential innovations and selected the one they wish to pursue further. This assignment requires them to identify 3 - 5 scholarly articles that are related to their chosen innovation. The goal is to practice skills introduced in the information literacy module and begin to integrate this learning with their semester research project. Once the teams have selected an innovation topic from the choices presented by each team member, a second literature review search is assigned. This second reference search reinforces the skills gained individually in earlier assignments with the expectation of identifying an additional 10 scholarly articles relevant to the team innovation. As the course progresses students are reminded that topical searches may need to be expanded and / or refined as the initial list of articles may not be sufficient, that some articles that initially appear important may actually not be relevant, and that further research may reveal additional sources.

**Assessment of Student Work**

Assessment from the pre/post quizzes described above focused on four main information literacy ability components or cores developed by FGCU librarians based on the ACRL standards, specifically access points and keyword searching, selection of access tools, the library website as a gateway to information, and classification schemes. Over the three semesters this module has been offered, data has been collected on 132 pre-tests and 164 post-tests. As shown in Table 1 separated by cohort, and Figure 1 in aggregate, student scores increased in all areas assessed over each semester. The only area where additional emphasis needed to be placed in future offerings of the course (i.e less than 70% of the students got the question correct in the post-test) was Classification Schemes (Core 4).

| | Fall 2014 | | Spring 2015 | | Fall 2015 | |
|---|---|---|---|---|---|---|
| | Pre-test | Post-test | Pre-test | Post-test | Pre-test | Post-test |
| Core 1 | 50% | 85% | 65% | 87% | 64% | 87% |
| Core 2 | 70% | 80% | 68% | 85% | 75% | 100% |
| Core 3 | 93% | 95% | 89% | 95% | 86% | 95% |
| Core 4 | 24% | 66% | 24% | 72% | 32% | 70% |

**Table 1. Assessment of Information Literacy Competency in Freshman Engineering Students Before and After Delivery of an Introduction to Library Services Module via Canvas.** The testing focused on four core ability components, including access points and keyword searching (Core 1), selection of access tools (Core 2), the library website (Core 3) and classification schemes (Core 4). The percent shown indicates the percent of students that got the question associated with the ability component correct, either before (pre-test) or after (post-test) the online delivery of the library services module previously described. N=34-54 students per semester.

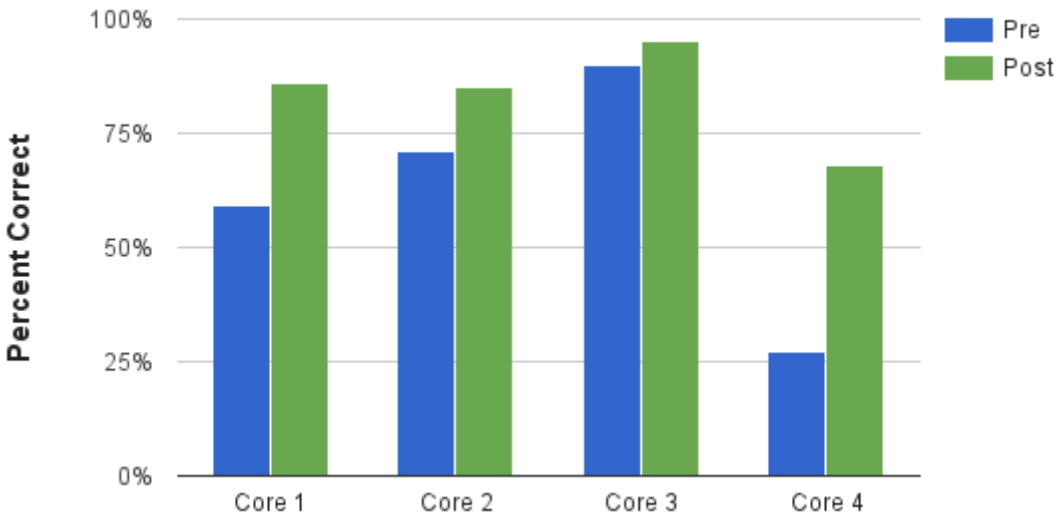



**Figure 1. Assessment of Information Literacy Competency in Freshman Engineering Students Before and After Delivery of an Introduction to Library Services Module via Canvas.** The testing focused on four core ability components, including access points and keyword searching (Core 1), selection of access tools (Core 2), the library website (Core 3) and classification schemes (Core 4). The bars indicates the percent of students that got the question associated with the ability component correct, either before (pre-test) or after (post-test) the online delivery of the library services module previously described. N=132 students for the pre-test and 164 students for the post-test.

In addition to assessing the student's competency after providing them with a module focused on library skills and information literacy, we also looked at the number, type, and quality of the references used in the final group reports for Fall 2015. Figure 2 shows the distribution of the

number of citations per paper for the 26 groups from this cohort. As shown, the average number of references per paper was 14, which was within a range that was expected by the instructors of the course, particularly since an early group assignment was to find at least 10 references associated with the paper topic.

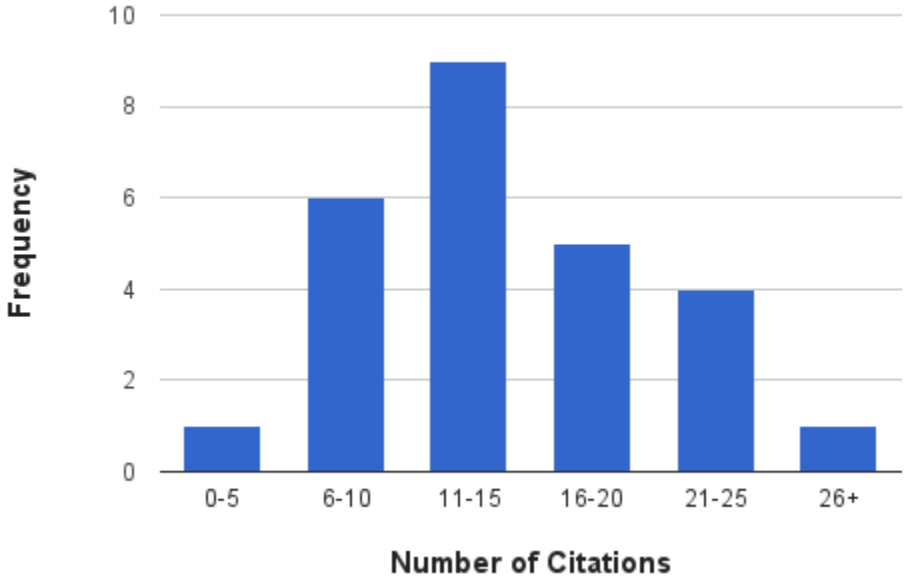
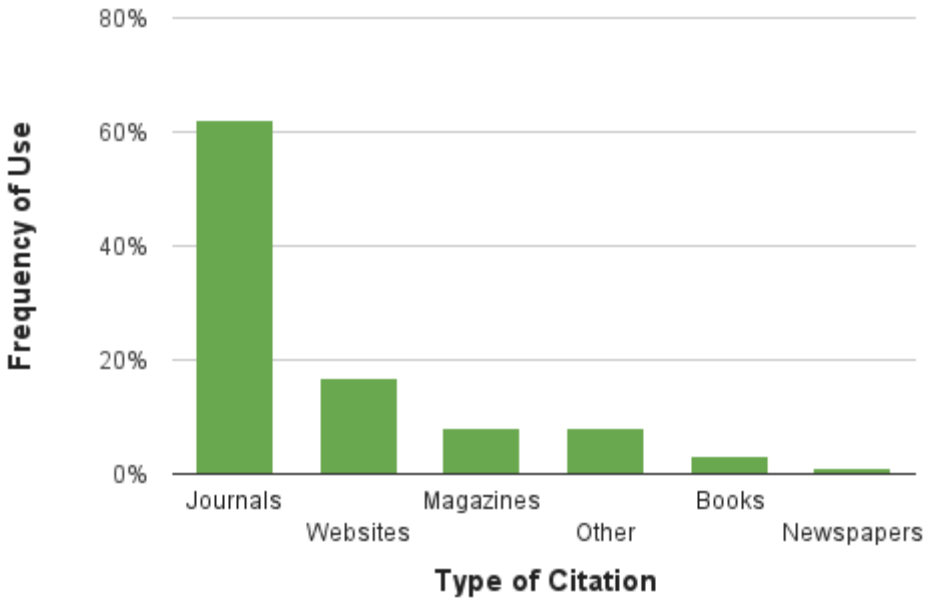



**Figure 2. Number of Citations Provided in the Reference Section of End of Semester Group Papers.** Histogram depicting the number of citations provided in the reference section of each end of the semester paper. No specific requirement was given in the assignment or grading rubrics, however students were expected to find a minimum of 10 references for an earlier assignment associated with this project. N=26 for Fall 2015.

In addition to number of citations, our analysis looked at both the types of references used, as well as the "quality" of the reference (scholarly or non-scholarly). For this analysis, 366 references from 26 papers were categorized based on both their type and quality. Each reference was categorized as either a Book, Journal Article, Magazine Article, Newspaper Article, Website or Other. Several of these categories also contained sub-categories to aid in classifying the reference as scholarly or non-scholarly. For books, each reference was sub-categorized as either a general book (non-scholarly), or a reference book (i.e. a book that was updated on a regular basis, such as a textbook or handbook; scholarly). For magazines, each reference was sub-categorized as either a popular magazine (non-scholarly) or a technical or trade magazine (scholarly). For websites, each reference was sub-categorized as either coming from a commercial website (.com, .org; non-scholarly) or an educational or governmental website (.edu, .gov; scholarly). As shown in Figure 3, a majority (75%) of the references used by the students came from scholarly sources, with a vast majority of references coming from journal articles (62%).




| | | | |
|---|---|---|---|
| **Scholarly** | 75% | **Non-Scholarly** | 25% |

**Figure 3. Types of Citations Provided in the Reference Section of End of Semester Group Papers.** Bars depict the frequency in which each type of citation was used in the reference section of each semester paper. In addition, citations were described as being scholarly (reference books, journal articles, trade magazines, .edu and .gov websites) or non-scholarly (non-reference books, popular magazines, newspapers, .com and .org websites, other). N=26 for Fall 2015.

Multiple sources were used to compare these results to the published literature to gauge the overall success of our introductory module. This literature included data from our own university[24], as well as data from other universities[25,26]. For these comparisons, we looked at data from first year english composition courses, as well as upper level courses and undergraduate science honors theses. As shown in Figure 4, our students' reference list compare favorably to the upper level students in regards to the quality of the references (books and journal versus websites and others), and surpass members of their peer group (as EGS 1006L is a freshman-level engineering course), suggesting that a course with minimal contact time (1 credit hour) can have a positive impact in information literacy. In a comparison to other 1st year engineering courses, a study by Wertz *et al*.[27] looked at memos from first-year engineering students at Purdue University and looked to evaluate their information skills. One of the differences in this study was that these students were not given any explicit instructions regarding information gathering and citation practices other than being encouraged to seek information. Based on our definitions of scholarly vs. non-scholarly materials, data from our cohort demonstrated a much higher percentage of scholarly citations (75% vs. 35%). Again, this data suggests providing instruction and explicit expectations to the students regarding information literacy is a valuable practice in ensuring the inclusion of scholarly work.

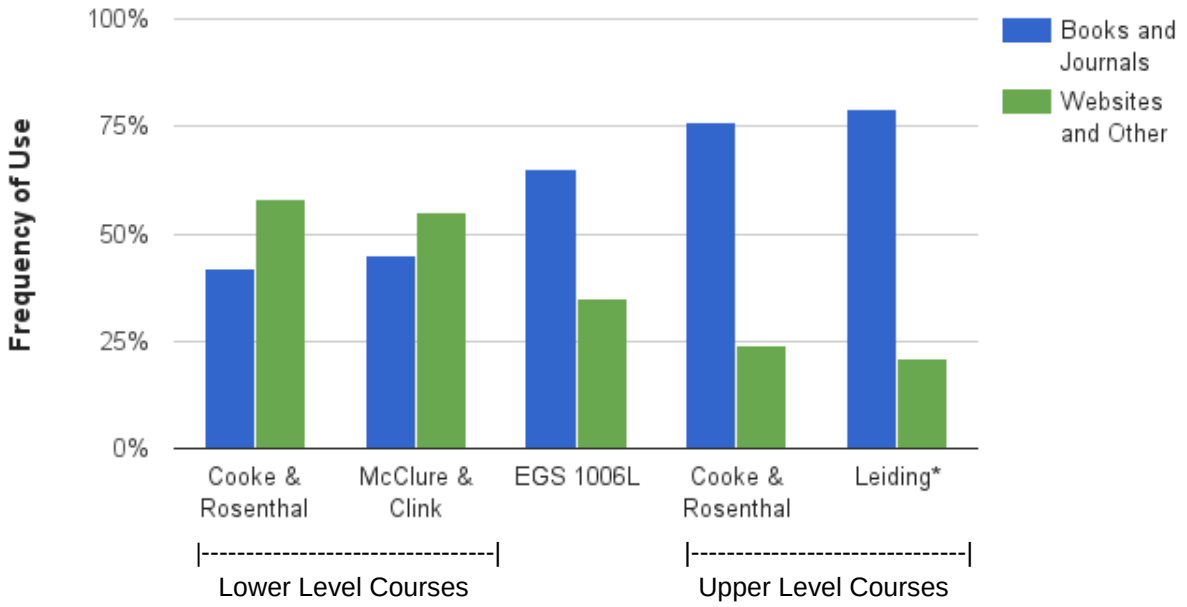



**Figure 4. Comparison of the Types of Citations Provided in the Reference Section of End of Semester Group Papers to Published Literature.** Bars depict the frequency each type of citation (books and journals versus websites and any other type of reference (other)) was used in the reference section of each end of the semester paper. N=26 for EGS 1006L Fall 2015. Data was compared to that from Cooke and Rosenthal[24], McClure and Clink[26], and Leiding[25]. Data from Cooke and Rosenthal and McClure and Clink examined papers from first year English Composition students, while additional data from Cooke and Rosenthal and Leiding looked at papers from upper level courses and science honors theses respectively.

## Module Revisions

One of the challenges identified in the 2014 - 2015 academic year offerings of the course was student identification of relevant sources for a specific innovation. Students were asked to select one innovation from the 4 they found to research further without any direction beyond picking the one that was of greatest interest. To tie this activity more tightly to information literacy, and provide additional experience for the students, the 2015 - 2016 academic year offerings of the course added a current innovations initial references assignment. Before students selected a specific reference from their list of 4, they were asked to conduct literature searches on all of their innovations, and provide 2 - 3 scholarly articles related to each innovation. Students were then asked to select one of these innovations and perform a more extensive review, identifying an additional 3 - 5 sources for the selected innovation. The subsequent group assignment to expand the reference list of the team innovation was retained in its original format.

The Spring 2016 semester witnessed revisions to the quizzes associated with the information literacy module including integration of new videos, updates on available library resources, and the integration of RefWorks into the instruction. The introductory videos had been updated to

reflect changes to the library's website and database interfaces, so these new versions replaced the old ones in the module. Additionally, the course instructors had expressed interest in adding a citation management component to the module. The FGCU Library subscribes to RefWorks, a web-based bibliography manager similar to EndNote, Zotero, Mendeley and the like. All FGCU affiliates are able to create free accounts, with the Library providing training and support. Citations can be exported directly from databases and search engines, saved and organized into folders, and automatically formatted in thousands of citation styles. With a few clicks, bibliographies can be created in the desired citation style in Word or html format. Most students find it well worth the time to learn RefWorks or other citation manager, as it makes the often tedious and confusing nature of citation more manageable, and can be used throughout the course of their college career.

The revised Quiz B then begins with instructions for students to create their RefWorks accounts and includes videos from the company's YouTube channel, ProQuest RefWorks, covering basic tasks: adding references via direct export; organizing references into folders; and creating a bibliography. A "check all that apply" quiz question was also added regarding the various benefits of using a citation manager. The "Avoiding Plagiarism Using Citations" video remained in Quiz B, and the "Finding Books at FGCU Library" video was moved from Quiz A to Quiz B as part of a broader reorganization of content in the two quizzes. As of Spring 2016, Quiz A covers introductory content on information sources, the peer review process, and database searching, while Quiz B covers in-depth database searching, finding books, and citation. This represents a more logical flow of concepts and quiz questions.

## Conclusions and Direction of Future Work

The lack of high quality and robust reference sections were identified as a topic of concern in upper level engineering courses at FGCU. To this end, faculty from Engineering partnered with the University's STEM librarian to integrate a formal introduction to information literacy into the lower level introductory engineering course. Implementation over the past four semesters is aligned with the University's QEP and has resulted in increased information literacy competency as demonstrated by student by performance on pre and post tests. Additionally, submissions include a reasonable quantity of references when compared to assignment expectations with a quality that is predominately in the scholarly (compared to non-scholarly) category. When compared to results from other published analyses, this scholarly versus non-scholarly division of source is more closely aligned to upper level course performance rather than lower level courses.

While the overall results to date appear positive in terms of the number and type of references utilized in student bibliographies, the next step in our analysis is to take a more in depth look at how these references are utilized within the papers themselves. This analysis could provide

information on the extent each source is utilized as well as how effectively students synthesize information from multiple sources. Additionally an analysis of the accuracy of reference section formatting and a comparison between these results before and after RefWorks integration into the course is planned. From a longitudinal standpoint a similar analysis to the one conducted here is planned for upper level courses, with comparisons between students who both experienced and did not experience the introductory engineering course with the information literacy module described within this paper.

## References


1. Duke, L. M. & Asher, A. D. *College Libraries and Student Culture: What We Now Know*. (American Library Association, 2012).
2. Hillyer, N., Parker, L. L. & Gilbert, L. Information Literacy: Reinvention for Digital Natives. in *Philadelphia PA Paper presented at Association of College and Research Libraries (ACRL) Conference* (2011).
3. Information Literacy Standards for Science and Engineering/Technology | Association of College & Research Libraries (ACRL). at <http://www.ala.org/acrl/standards/infolitscitech>
4. Rockman, I. F. *Integrating information literacy into the higher education curriculum: practical models for transformation*. (Jossey-Bass Inc Pub, 2004).
5. Burkhardt, J. M., MacDonald, M. C. & Rathemacher, A. J. *Teaching Information Literacy: 35 Practical, Standards-based Exercises for College Students*. (American Library Association, 2003).
6. Cox, C. N. & Lindsay, E. B. *Information Literacy Instruction Handbook*. (Assoc of College & Rsrch Libr, 2008).
7. American Library Association. Introduction to Information Literacy. at <http://www.ala.org/acrl/issues/infolit/intro>
8. Information Literacy Standards for Science and Engineering/Technology | Association of College & Research Libraries (ACRL). at <http://www.ala.org/acrl/standards/infolitscitech>
9. FGCU. 2012 QEP. at <http://www.fgcu.edu/QEP/background.html>
10. ABET. ABET. at <www.abet.org>
11. Dweck, C. S. *Mindset: The New Psychology of Success*. (Random House Digital, Inc., 2006).
12. Dewey, J. *Democracy and Education: An Introduction to the Philosophy of Education*. (The Macmillan Company, 1916).
13. Vygotsky, L. S. *Mind in Society: The Development of Higher Psychological Processes*. (Harvard University Press, 1980).
14. Anderson, L. W., Krathwohl, D. R. & Bloom, B. S. *A taxonomy for learning, teaching, and assessing: a revision of Bloom's taxonomy of educational objectives*. (Allyn & Bacon, 2001).
15. Mellon, C. A. Library Anxiety: A Grounded Theory and Its Development. *Coll. Res. Libr.* **76,** 276–282 (2015).
16. Onwuegbuzie, A. J., Jiao, Q. G. & Bostick, S. L. *Library Anxiety: Theory, Research, and Applications*. (Scarecrow Press, 2004).
17. Jiao, Q. G., Onwuegbuzie, A. J. & Lichtenstein, A. A. Library anxiety: Characteristics of 'at-risk' college students. *Libr. Inf. Sci. Res.* **18,** 151–163 (1996).
18. Molteni, V. E. & Chan, E. K. Student Confidence/Overconfidence in the Research Process. *The Journal of Academic Librarianship* **41,** 2–8 (2015).
19. Head, A. J. & Eisenberg, M. B. Truth Be Told: How College Students Evaluate and Use Information in the Digital Age. *SSRN Electronic Journal* doi:10.2139/ssrn.2281485
20. Kim, K.-S., K.-S., K. & Sin, S.-C. J. Selecting quality sources: Bridging the gap between the perception and use of information sources. *J. Inf. Sci. Eng.* **37,** 178–188 (2011).
21. Kunberger, T. & Geiger, C. From Catch-all to Clarity: Revising a First-year, Multidisciplinary Introductory Course. in *2015 ASEE Annual Conference and Exposition Proceedings* doi:10.18260/p.24136

22. Geiger, C. & Sweeney, J. Work in Progress: Mini Projects - Using News Articles to Promote Lifelong Learning and Expose Students to Engineering Breadth. in *2015 ASEE Annual Conference and Exposition Proceedings* doi:10.18260/p.25091
23. Zhang, Q., Goodman, M. & Xie, S. Integrating Library Instruction into the Course Management System for a First Year Engineering Class: An Evidence-Based Study Measuring the Effectiveness of Blended Learning on Students' Information Literacy Levels. *Coll. Res. Libr.* crl15–692 (2015).
24. Cooke, R. & Rosenthal, D. Students Use More Books after Library Instruction: An Analysis of Undergraduate Paper Citations. *Coll. Res. Libr.* **72,** 332–343 (2010).
25. Leiding, R. Using Citation Checking of Undergraduate Honors Thesis Bibliographies to Evaluate Library Collections. *Coll. Res. Libr.* **66,** 417–429 (2005).
26. McClure, R. & Clink, K. How Do You Know That?: An Investigation of Student Research Practices in the Digital Age. *portal: Libraries and the Academy* **9,** 115–132 (2008).
27. Wertz, R. E. H., Şenay, P., Fosmire, M. J. & Cardella, M. E. Assessing Information Literacy Skills Demonstrated in an Engineering Design Task. *Journal of Engineering Education* **102,** 577–602 (2013).