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Connecting Students to Discipline Specific Research in Their First Year: A Collaboration between Engineering Faculty and Librarians

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Introduction

In 2017, a collaboration between Cal Poly Pomona College of Engineering faculty members, the first-year coordinator for the College of Engineering and the engineering librarian began, with the intention to examine the impact of intentional information literacy (IL) instruction on first-year engineering students [1]. This collaboration began as a one-time library instruction session and blossomed to a 4-part instruction series, including a curriculum re-design and assessment in 2021. The engineering librarian visited the engineering faculty's first-year engineering courses providing a series of library instructions, all with scaffolding student learning outcomes, and a final goal of improving student information literacy skills. These sessions included a scavenger hunt, finding relevant sources, evaluating sources, creating citations, and how to produce an annotated bibliography. The results of the collaboration showed that having a sustained series of information literacy instruction over the term increased students' proficiency in research [1]. The faculty and librarian felt that the first-year engineering students needed to move beyond the goal of just improving their information literacy skills and move to where students should learn more about the research process, more specifically, how research is conducted in their chosen engineering field. It was decided to embed the librarian within the curricular unit, which consisted of five instruction sessions culminating in a literature review based on research conducted by faculty members in the College of Engineering.

Objectives

The objective of the research was to evaluate the impact of having an embedded librarian integrated within a first-year engineering course. The unit of study was designed to compare the differences in student confidence in information literacy skills and the research process between courses that had five instructional sessions from an embedded librarian versus courses that were only provided with one information literacy instructional session. The idea was to investigate the impact of an increased presence of the engineering librarian within the courses and assess the benefits of providing first-year engineering students with more opportunities to learn from the engineering librarian with focused sessions.

In addition, the researchers wanted to connect first-year engineering students with faculty in their respective fields. More importantly, they wanted to connect students with new faculty in order to garner relationships since both parties would be new to the college. By having students write a literature review based off their faculty's research, it was believed that the students would gain the understanding of the research process and appreciate what it was like to conduct research in a university. In addition, it was theorized that with this experience, students would get excited about undergraduate research and think about graduate school. In addition, by conducting research and working with their faculty, we hoped that students would gain a sense of belonging within their field and have a better understanding of the direction of their academic future.

Literature Review

Information Literacy instruction in colleges and universities has been an important part of undergraduate education. Engineering faculty understand the importance of including information literacy instruction within their courses, recognizing that engineering students should have information literacy and research skills, as it has improved the quality of work produced by their students [2,3]. Information literacy goes beyond the classroom and the course where it was taught. Students who gain information literacy skills have more confidence in their

information searching and use these skills outside of the classroom in their lives [4]. In addition, information literacy skills have become one of several important considerations in the context of accreditation [5, p. 46], in which library services, computing, and information infrastructure must be adequate to support the scholarly and professional activities of the students and faculty [6].

One common approach to teaching information literacy skills to students is to provide a one-time instruction session. This approach has the librarian teaching how to locate, evaluate, and cite information correctly. While this method of instruction has been proved to work, providing valuable information literacy skills to students [7], there are instances in the literature where it suggests that there are more impactful approaches to information literacy instruction [8, p. 388]. One such approach is having a librarian embed themselves into the course curriculum and infuse their instruction into the course curriculum.

The term "Embedded Librarianship" has been used in libraries for a very long time. In fact, it has been used as early as the 1970s, where medical librarians began to join interdisciplinary health care rounds, along with pharmacists, social workers, and other professionals, to augment the expertise of M.D.s and deliver improved medical care [9, p.8]. However, it was not until the mid-2000s that the term created a buzz and began to gain traction appearing in journals, conferences, online discussion, and presentations [10, p.75]. The term embedded librarianship can take different meanings within several types of libraries. More specifically, in academia, embedded librarianship has been defined as a service model where an academic librarian participates in a course or program on a continuing basis in order to understand the learning objectives and determine which library resources best support them [11, p.2]. Being an embedded librarian is a partnership between the faculty and librarian. As an embedded librarian, you are working with the faculty on many aspects of their curriculum and your information literacy instruction learning outcomes and assessments. An embedded librarian is a collaborator, as building a strong relationship with the faculty is seen as one of the critical elements in successful incorporation of information literacy instruction into a university curriculum [2]. Embedded librarianship goes beyond being part of their curriculum, or teaching sections of a professor's course. It is a collaboration or partnership between the librarian and professor with the importance of forming a strong working relationship, understanding each other's expertise [12, p.455] and communicating effectively to integrate information literacy instruction into courses [13]. There are several examples in the literature on embedded librarianship and the successful endeavors of collaborating with faculty on information literacy [12,14], more specifically enhancing the pedagogical approach, student learning outcomes, sense of belonging.

In addition to benefiting the professor, having the librarian embedded within a college, discipline, or course provides new opportunities for the librarian. It allows a librarian to go beyond the "traditional" librarian role and imparts the opportunity to teach course-specific information literacy skills to students that they would more than likely not reach during a traditional library workshop, as well as collaborate with curriculum development, such as creating learning objectives, specific instructional modules, in-class activities, assessments, rubrics, etc. [3,15].

Engineering Identity

The development of an identity as an engineer has begun to be considered a factor in the formation of a professional engineer. Capobianco, French and Diefes-Dux [16] looked at the

connection of a student's ability to identity as an engineer and their persistence in an undergraduate degree and in the field. Much of this work was done longitudinally across an undergraduate's career as a student and has found that identity as an engineer is lowest as a first-year student. Capobianco et al. found that women who had a strong institutional identity and affinity were more likely to persist in the field and see themselves as engineers [16, p. 111]. These women also had a strong academic affinity that seemed to "surpass their gendered identity" [16, p.112].

Methods

The research in this study is part of two larger studies into the success of First Year Experience (FYE) Courses. In 2019, research into information literacy and the embedded librarian begun. This project was then subsumed under a larger university-wide grant and followed the Institutional Review Board (IRB) approval for that grant. This grant seeks to engage students at Hispanic Serving Institutions (HSI) in STEM. In this study, students chose to enroll in the FYE course section that met their schedule needs. During this study, there were FYE sections taught by different instructors. Students who received the full information literacy unit with the embedded librarian were taught by one instructor, while the other students were taught by a different instructor. At the end of the semester, much after the instruction took place, students were asked to complete a survey. The survey was not an additional assignment, it was optional for students and was completed online anonymously through Qualtrics during class time. Students who chose not to participate were not asked to do an additional assignment, and the first question on the survey was informed consent. After the data was collected, the only identifying characteristic of the data was the section of class the student was enrolled in. A comparison of means (ANOVA) was completed for the questionnaire. Those questions with a significant difference in means are shown in the table below. The descriptive statistics reported below give a more complete picture of the data.

Results

Students were asked nine questions on a self-assessment survey. Students who participated in the full IL instruction unit with the embedded librarian were compared to those without the full IL instruction unit but did meet with the engineering librarian once. Sixty-four (64) students who completed the unit and 30 students who did not complete the unit answered the questions. The instrument was designed to better understand students' level of comfort with the research process and their views on research. The first eight questions were Likert scale items ranging from strongly agree to strongly disagree. The ninth question asked students to select all terms they felt related to academic research in the field of engineering. Many of the items showed slight difference in the results, however a few items showed a significant difference in response. The complete results are shown below.

Table 1

Question	% students who agree or strongly agree with full IL instruction	% students who agree or strongly agree without full IL instruction	Difference

Q1: How likely are you to pursue undergraduate research	54%	57%	-3%
Q2: How likely is it that you will consider graduate school	63%	66%	-3%
Q3: I understand the role research plays in the field of engineering	90%	89%	1%
Q4: I have an increased level of confidence in the research process	85%	51% (only 9% strongly)	34%
Q5: I can develop a research question and research plan	81%	54% (40% somewhat agree and 14% strongly disagree)	27%
Q6: I found a topic I am interested in	67%	66%	1%
Q7: I have a better sense of my major (or engineering)	85%	82%	3%
Q8: I have a better understanding of my place in the field of engineering	74%	68%	6%

Q9: How do you view scholarship in engineering

Term	With IL Unit	Without IL Unit	Diff
Collaborative	68%	28%	40%
Boring	1%	2%	-1%
Interesting	73%	77%	-4%
Important	78%	70%	8%
Unnecessary	0%	1%	-1%
For a few smart people	4%	20%	-16%
Other (Helpful)	1%	0%	

Questions four and five of the instrument gave the most significant difference in results. The full IL instruction made students more confident in the research process and felt more confident in their ability to author a research question and formulate a research plan. Students were one and two-thirds more likely to say they have an increased confidence in the research process and one

and a half times more likely to say they can author a research question and develop a research plan. The other Likert scale items showed no significant difference between the treatment group and the control.

The last item on the survey asked students to identify terms that related to research. Two items showed the largest difference. Students who completed the full IL instruction unit were nearly two and a half times more likely to indicate that research is collaborative. To contrast that, students who did not have the full IL instruction unit were five times more likely to say research was for only a few smart people.

Conclusion

Based on the student surveys, embedding a librarian within an engineering course, and providing multiple, intentional information literacy instruction sessions was successful and would benefit continuing in future semesters and implementing in other first-year engineering courses. It was evident that students who participated in courses that included multiple information literacy instruction had a much stronger level of confidence in their overall information literacy skills and understanding of the research process and developing a research plan. Students in courses where the engineering librarian was embedded also viewed scholarship in engineering as a much more collaborative experience.

While there are great benefits to embedding a librarian in a course and providing multiple, intentional information literacy instruction sessions, there are issues that must be addressed for future implementations. While much of the engineering faculty show support for the library and understand the critical role the librarian plays in teaching students the research process, one hurdle to overcome is getting more teaching faculty of the first-year engineering experience courses to include the librarian in their curriculum and/or make time for the librarian to provide multiple information literacy instruction sessions. Suggestions to address this issue could include providing a workshop on findings for the first-year experience engineering faculty to show the importance of our endeavor. Another option would be creating online modules with video tutorials that first-year experience engineering faculty could include in their curriculum.

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