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Using a Flipped Lesson to Improve Information Literacy Outcomes in a First-year Design Class

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Abstract

Does the presentation style of an information literacy assignment affect students' use of scholarly and authoritative sources in the completion of an engineering design project? During spring semester 2017, the information literacy team at the Colorado School of Mines piloted a flipped lesson on evaluating sources for the university's first year engineering design course. Initial feedback on the pilot session was favorable and the team analyzed detailed data to determine if students retained the needed information on evaluating sources through the semester. Student work, specifically bibliographies from team design proposals and final reports, was used to evaluate if changing the style of the information literacy session positively impacted students' use of scholarly and authoritative sources throughout the semester. The "Evaluating Sources" lesson for fall 2016, modeled on previous years, was comprised of a traditional, one-shot session with an activity in the classroom with librarians. Incorporating feedback from teaching faculty, the instruction team piloted a flipped approach for the spring 2017 lesson. The new lesson required design teams to review videos and other information online, take an online quiz, and then meet in person with a librarian. During the course of one week, 93 student teams met with one of 7 librarians. Teams were prompted to bring questions about scholarly and authoritative sources for their specific problem statement. The meeting also provided the opportunity for students to discuss their initial design ideas and brainstorm sources with a librarian. This paper describes the rubric used for evaluation of the student bibliographies and the results of the study. It also discusses the lessons learned from flipping a single class session and aspects to consider when flipping information literacy content.

Introduction

Introduction to Design (ITD) is the required first year technical design course at the Colorado School of Mines (Mines). Each semester, roughly 600 students, in teams of 4-5, tackle a large scale project on topics such as food deserts, urban infrastructure, upcycling or bicycle and pedestrian safety. Throughout the semester they complete milestone assignments including problem definition, design proposal and subsystem reports. At the end of the semester each team presents their final solution in a trade fair setting and demonstrates a working prototype. Their final report describes and validates their concept solution. Both the design proposal, due week 6 of the 16 week semester, and the final report, due week 15, require students to make use of scholarly and/or authoritative sources in their work. For the design proposal presentation, professors assess how well students include a variety of scholarly and/or authoritative sources (minimum 5). For the final report, professors assess how well claims are supported by testing, stakeholder interviews and research that is scholarly and/or authoritative (20-30+ citations).

For the past several years, this course has partnered with the Arthur Lakes library to provide an introductory lesson on identifying scholarly and authoritative sources aligned to the *Authority is Constructed and Contextual* frame of the ACRL Framework. Prior to the spring 2017 semester, the lesson was a one-shot session focused on a source evaluation activity. After an introduction,

student teams were given an article and a website to evaluate. Then, the teams explained the criteria that led to their evaluation to the rest of the class. For most students this was the only required library session in the first year; library collaboration with other core courses was more sporadic at the time. Following this initial one-shot session, few students followed up with librarians later in the semester to discuss the sources or research for their design project.

Late in 2016, the teaching and library team determined the current lesson plan wasn't the most effective way to convey content or effectively support students' work on their projects. While the activity was helpful, faculty felt it became repetitive for students after the first 2-3 teams had discussed their assigned article and website. A one-shot session wasn't the best use of class time, especially when students didn't receive help specific to their unique problem definition. Also, the librarian team was repeating that same one-hour session 24-26 times within a 2 day period. Meanwhile, ITD program leadership had been working for two years to carve out more class time for supervised collaborative work by flipping course content deemed easily grasped by students on their own time. In this way, ITD reduced in-class lecture from over 50% to 30%, allowing supervised collaborative teamwork to dominate the majority of in-class time.

The information literacy content lent itself to flipping, and a new lesson was piloted in spring 2017. First, students completed a module in Blackboard for identifying scholarly and authoritative sources. The module included a quiz counting towards course participation points. After completing the online module, teams scheduled a 30-minute meeting with a librarian to discuss the module, their team's problem definition, and the types of sources they would need for the project, and how to locate the more difficult ones. New content was also embedded in the course at two other points later in the semester to remind students of the need to use scholarly and authoritative sources, and three assignment rubrics were updated to specifically assess the use of scholarly and authoritative sources in their reference lists. Students also had access to the course LibGuide housed on the library's website and linked to in Blackboard.

To test the effectiveness of the new approach, the authors designed a research project, comparing the design proposal and final report bibliographies from before implementation of the flipped lesson (fall 2016) to those from after (spring 2017). Bibliographies were evaluated against a rubric to determine the type and quality of each citation. Using this data, the team sought to answer the following two research questions:

1. Does the use of a flipped lesson and team meeting with the librarian positively impact the quality of student citations on the design and final reports?
2. Is there a difference in the quantity and types of resources cited by students before and after implementing the flipped lesson?

Literature Review

Flipped and partially flipped lessons are increasingly popular instructional techniques in both engineering design and information literacy classrooms. The aspects of the literature that provide the foundation for this research include the flipping of engineering design content, and the flipping of information literacy content for the purpose of allowing more time for student team meetings and applied learning. While these two research areas have often been discussed

separately, this research project seeks to address their intersection in effective information literacy instruction.

After several years of tentatively exploring the appropriateness and the effectiveness of flipping engineering design content, the engineering design instruction community has shifted to questioning specifically which content lends itself to flipping, and how to flip in order to preserve more valuable in-class time for team discussion and process. Tareq Daher and Michael Loehring found in 2016 that indeed their students did take responsibility for their own learning in University of Nebraska's overview ENGR 10 course [1]. They watched the videos on their own time, and then scored higher on the subsequent in-class discussions than students had scored in previous lectures, which gave the authors confidence to pursue more pedagogical innovations. At Ohio State University in 2013, Morin et al found that flipping portions of their first year engineering program was successful in part due to embedded online quizzes, which provided the needed motivation for the preparation required [2]. Jess Everett et al, from Rowan University, explored concerns about student and professor satisfaction with courses incorporating flipped components. They discovered through their study "A Hybrid Flipped First Year Engineering Course" that for their course, as long as students had access to sufficient connectivity, students were satisfied with the portions of the curriculum they had flipped [3]. In addition, professors of this course were pleased with the increased assessment efficiency and flexibility with pedagogical techniques in the classroom. Indeed, Kelly et al found in their 2016 survey of 57 professors who had flipped lessons in engineering graphics courses that overwhelmingly, respondents had used the increased class time "to apply knowledge learned, engage in deeper and richer discussions, and allow for hands-on expansion of learning" [4], a good summary of what has driven the ITD program's curriculum changes in recent years.

Information literacy instruction in engineering and engineering design has become an increasingly common practice [5], [6], [7], [8] and using this time wisely by flipping foundational content to save valuable supervised classroom time is a popular teaching method [9], [10], [11]. Current research focuses primarily on flipping in specific settings; such as course size, course topic, technology used or type of student population. Some authors focus on the technology used to implement the flip, such as Carroll, Tchangalova and Harrington's [12] description of flipping using Canvas and Pecha Kucha, a method for more precisely presenting information. Others, such as Julia Rodriguez [13] and Tasha Maddison [14] discuss flipping relative to the class size. Maddison found the best method for flipping information literacy content and activities can vary greatly depending on the course and section size. Rodriguez's discussion of the issues associated with implementation and grading online lessons for hundreds of students is applicable both for large enrollment courses (100+ students per section) and to large courses spread across many smaller sections, like the Mines ITD course. Insights from flipped information literacy practices across disciplines can provide guidance for flipping lessons in engineering design courses.

While much has been written on the dynamics and composition of student teams in higher education, there is very little literature available on the use of required student team meetings in information literacy instruction. One such example is the work done with the Interactive Qualifying Project at Worcester Polytechnic Institute [15] and [16]. During the study period in Hanlan and Riley's work [16], most faculty required student teams to have a 30-50 minute

meeting with a librarian. 100% of their surveyed faculty considered the research meeting to be a very or somewhat important service for preparing teams. Their team meetings were offered in conjunction with other information literacy tools, including embedded librarians, research guides and workshops. The Mines approach of using only a student team meeting as the active learning component of the flip appears to be a unique approach to an information literacy flip in engineering design courses.

Methodology

Design proposal and final project bibliographies were collected from 5 sections of the course for both fall 2016 (22 course sections total) and spring 2017 (19 course sections total). Identifying information was removed and each was coded based on semester and project type; A or B for fall or spring, D or F for design proposal or final report, and then a sequential number. As seen in Figure 1, 82 bibliographies with a total of 1,391 citations were evaluated. Two final reports were removed as outliers, both had significantly more citations than the rest of the final reports, 73 and 62 respectively. Each bibliography was then evaluated using an in-house designed rubric to identify several key pieces of information about each citation. Each citation was classified as predominantly scholarly, authoritative or neither. For example, journal articles, encyclopedias and sources from university agricultural extensions were marked as scholarly. Parts and specification sheets from industries related to the project topic, government sources and stakeholder interviews tended to be marked authoritative. While scholarly sources are relatively straightforward, the contextual nature of authority allowed for a wide variety of sources in that category. General web sites, such as Amazon, and popular publications such as *Huff Post* or *SF Gate*, were marked neither. All the bibliographies were evaluated in batches by the same rater.

Category	Total Papers	Total Citations	Average Citations	Least/Most Citations
Fall Design	18	115	6.39	4/11
Spring Design	13	68	5.23	3/7
Fall Final	27	556	20	11/30
Spring Final	24	656	27.33	12/48

Figure 1- Paper and citation totals

The criteria for the quality portion of the rubric was adapted from the work of the InfoSEAD team at Purdue University, [17] in which items were assessed for intended audience, authority of the author, purpose of the item and quality of the citation. The portions of the InfoSEAD protocol that were most useful to our team were the evaluation and documentation portions; as we were not considering the context of the citations, the application portion of their rubric was not pertinent for this particular project. Each item was ultimately given a quality score between 0 and 5 [Figure 2]. Citations were then tagged as complete or incomplete. While the documentation portion of the protocol was useful to the team [17], it was only the citation portion that was used. The citation portion of the quality score was added after the source had been initially scored and typically was used to remove a point from the total score. For example,

scholarly articles typically receive a score of 5, but if the IEEE citation was missing large portions of the journal format or was cited as a website it received a score of 4.

Score	Elements Considered for Score	Total
0	Unfindable either from website changes or poor citation	42
1	Popular, no links or author information, citation missing major elements	5
2	Popular but might include author authority or links, incomplete citation	16
3	Average, sites have author and links, citation is mostly accurate	469
4	Authoritative or scholarly, good links or citations, mostly complete citation	568
5	Highly authoritative or scholarly and a complete citation	291

Figure 2 - Quality scores and totals

The source types portion of the rubric was largely adapted from Clark and Chinburg's list of resource types [18]. Each item was tagged as a particular type of resource. Clark and Chinburg's list was compared to the seeking portion of the InfoSEAD protocol [17] as well as source types particular to the Mines ITD project. Due to the types of projects completed in the course, some types were added or modified from Clark and Chinburg's original list. Ultimately, the project team crafted a list of 11 resource types that each citation was evaluated against [Figure 3]. Analysis was conducted on those citation types that had a population of 10 and above.

Type	Definition	Total	Desirability
A	Advocacy groups and nonprofits	126	Medium
B	Scholarly books, handbooks, encyclopedias	26	High
G	Government websites and publications	194	High
I	Industry publications, specification data and websites	419	Medium
M	Magazines, newspapers and news sites	75	Low
O	Popular sites and blogs	144	Low
P	Peer reviewed articles and conference papers	165	High
S	Stakeholder interviews, expert panels and course materials	75	High
T	Patents	13	High
U	University websites, agricultural extensions, research groups	108	Medium
Z	Photo used in design proposal presentation	5	Neutral

Figure 3 - Source types, total citations, and source desirability in technical writing

Results and Discussion

The first research question asked: does the use of a flipped lesson and team meeting positively impact the quality of student citations on the design and final reports? To answer this question, the team looked for an increase in the quality of citations, on the 0-5 scale, after the flipped lesson was implemented. As seen in Figure 4, quality improvements were found in both deliverables after implementing the new lesson. For the design proposals, the improvement amounted to 5.8%, and for the final reports a 2% gain; both are modest yet statistically significant improvements.

The project topic for both semesters was different, fall students worked on food deserts while spring students worked on bicycle and pedestrian safety. A two-way ANOVA was conducted to examine the effect of project type and semester (before and after flipped lesson implementation) on student projects' average citation quality scores. There was not a significant interaction between project type and semester, F (1, 78) = 0.041, p = .84, so the main effects of project type and semester were examined. There was also not a statistically significant difference in average citation quality scores between the two project types, F (1, 78) = 2.246, p = .14. However, citation quality scores *did* differ significantly between the fall semester (M = 3.681) and the spring semester (M = 3.845), F (1, 78) = 4.434, p = 0.038.

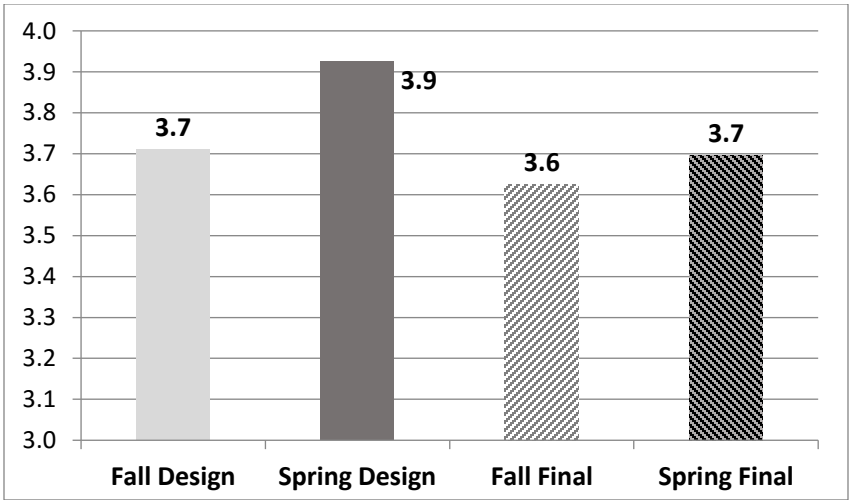

Figure 4 - Weighted average citation scores for both deliverables, pre- and post- intervention

Over 95% of the citations across all four categories were rated 3, 4, and 5, representing average, above average and highest quality citations, however, changes were found in the split among these ratings. After implementing the flipped lesson, the percentage of citations rated 4 increased for both design proposals and final reports [Figure 5]. The number of design proposal citations rating 4 was significantly higher following the flip; jumping from 41% to 69% of the total for each category. The number of citations rated 3 or 5 dropped at the same time. It could be that students used higher quality sources than before the flip, accounting for fewer 3s, but didn't cite all of them properly, accounting for fewer 5s. The formatting of each citation accounted for 1 point in the total score; and poor citing of a 5 quality source could reduce the score to a 4.

The number of final report citations rated 4 also increased, but by a smaller margin, 38.5% to 39.5%. This smaller increase in quality could be due to the more comprehensive nature of the final technical report assignment. In this assignment, students cite everything from the bolts they would purchase at Home Depot to the scholarly articles and government statistics they used to define their initial problem. It may also be due to the significant delay between lesson and implementation. The design proposal is due 3 weeks after the library lesson while the material is still relatively fresh in the minds of the students, and the final report is due a full 12 weeks after this lesson.

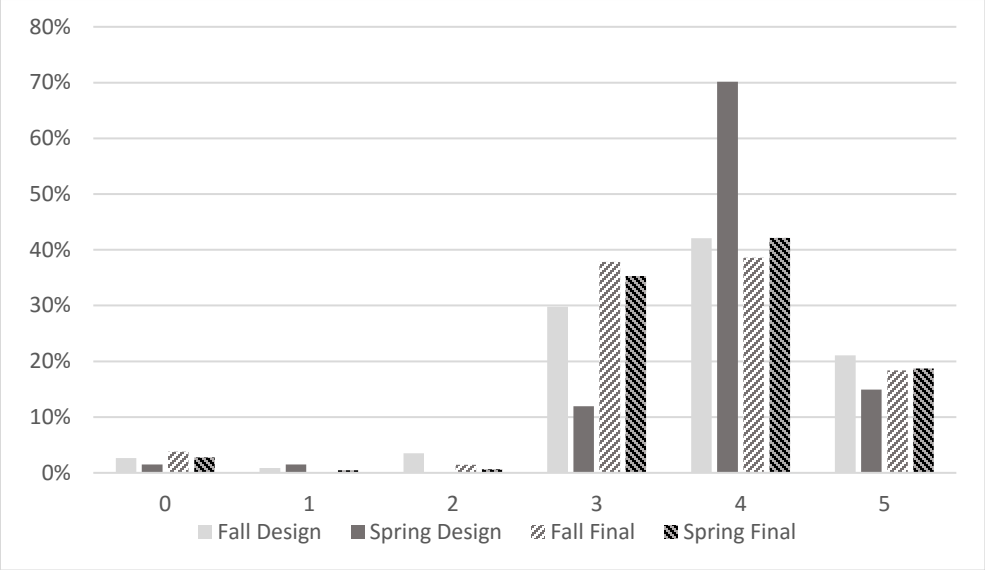

Figure 5 - Breakdown (percentages) for quality of citation

The second research question asked: is there a difference in the quantity and types of resources cited by students before and after implementing the flipped lesson? To answer this question, the team looked for a change in the number of items cited of each type. Also, the types of sources cited by students were analyzed to determine if the types faculty most desire for inclusion in the report, namely scholarly materials, government sites and stakeholder input, increased in use after the flipped lesson was implemented. In Figures 6 and 7, the source types are colored according to their "desirability" as described in Figure 3 above, with darker colors representing the types of sources the team wants to see more of and lighter colors those of lesser scholarliness and authoritativeness.

The most notable changes from before (fall) to after (spring) for the design proposal include a dramatic increase in student use of government websites (G), a solid increase in peer reviewed articles (P), and a corresponding decrease in advocacy websites (A), magazines and news (M), and popular sites and blogs (O). These patterns are exactly what the team hoped to see after the information literacy lesson. The decrease in advocacy (A) sites may also have been influenced by the difference in project type before and after the intervention. The project before the intervention (food deserts) lent itself to more advocacy sites than the project after the intervention (bicycle and pedestrian safety).

Looking at the most notable changes in the students' final reports, while there still is a positive effects of the lesson in an increase in use of government sources (G) and a similar decline in use of the advocacy sites (A), there are also an unwanted declines in use of peer reviewed articles (P) and scholarly sources (B). Some of these large changes can be explained by external factors. For instance, the dramatic increase in type S citations, stakeholder interviews and panels, is likely explained by a separate initiative increasing focus through the spring semester on identifying and approaching stakeholders for continuous feedback on students' solution development.

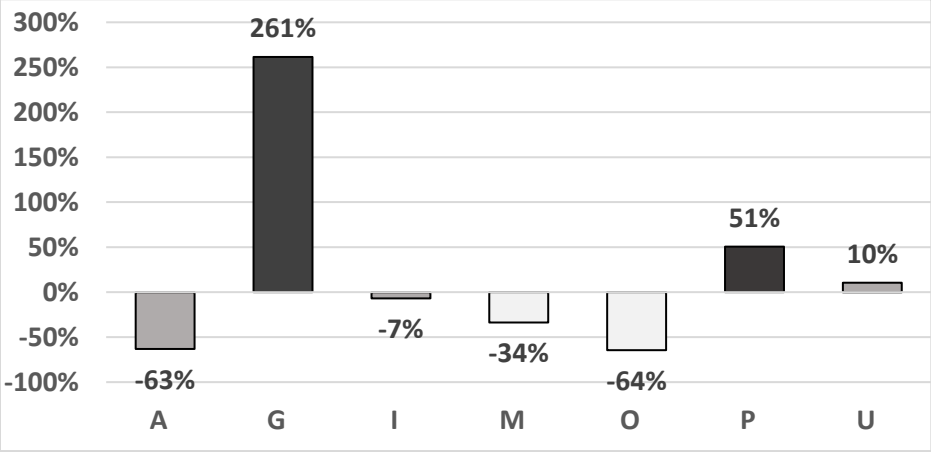

Figure 6 - Changes in use of citation types (as percentage of total citations) for design proposal before versus after the lesson change

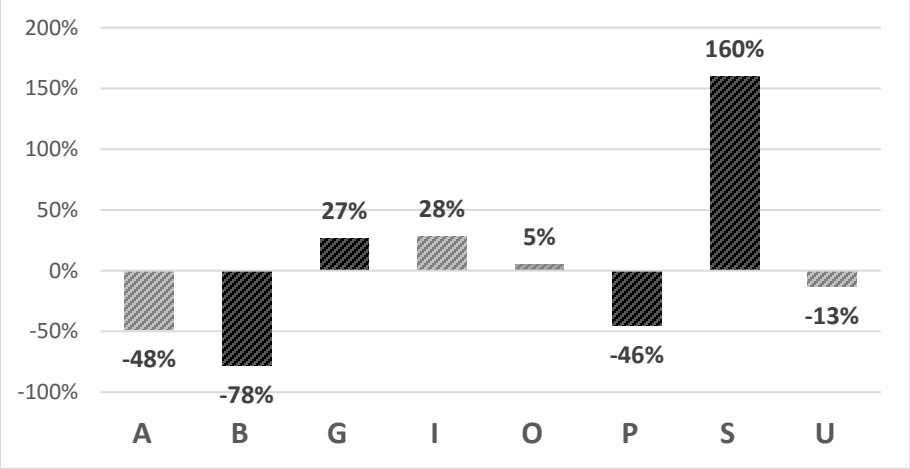

Figure 7 - Changes in use of citation types (as a percent of total citations) for Final Reports, before versus after the lesson change

One would hope that instead of taking the place of other scholarly and authoritative sources, these interviews would simply add substance and quantity to the students' bibliographies, and there is some indication that this happened to a degree. The mean number of citations in the fall final report was 20.0, while after the flipped lesson, that mean was 27.3, and this improvement was also found to be statistically significant. The magnitude of these unexpected changes

warrants future study to better understand underlying causes, as well as to determine a desired end state of source types to which to compare the results.

As demonstrated by the case of the increased Stakeholder interviews, the flipping of the library lesson was not the only curriculum improvement during this time frame. Simultaneously, the ITD program was flipping other lessons in order to bring active learning modules into the classroom. The topics of these were risk identification and mitigation, team function/ dysfunction, technical writing, and soliciting stakeholder feedback. While it is difficult to isolate the citation quality effects attributable only to the information literacy curriculum improvement, there is no reason to expect that flipping these other content areas would have increased use of scholarly and authoritative sources and decreased use of low quality sources, other than in the stakeholder case already noted. Another variable between the study periods was the project that the students were working on. In the pre-intervention semester, the students worked on solutions to food deserts. In the post-intervention semester, the students worked on either pedestrian and bicycle safety, or campus accessibility. It's possible that the latter two project spaces lend themselves to higher quality background sources, such as government statistics and manuals, than the food desert topic.

Also, additional information literacy instruction provided during the semester by the classroom professors varies significantly from section to section. Material was added to the common course material to ensure the students at least considered the degree of scholarliness and authoritativeness in their sources, however, instructions to the students on how to do this was inconsistent from section to section. For instance, in some cases, interviews with stakeholders were only cited in-text and not listed in the bibliography, based on student, and possibly professor, misunderstanding of IEEE citation style. Since the research team only accessed bibliographies, items cited only in-text were missed in this research.

Another limitation encountered was the varying level of student team preparation before their meeting with the librarians. Some teams arrived equipped with a list of questions about their project and research hurdles, while other teams showed up without even a piece of paper on which to take notes. The ability to fully address the unique needs of each team was hampered by this lack of preparation, and in subsequent semesters, instructors pressed teams towards better participation. The research team, and participating librarians, felt that meetings with better prepared teams were quite valuable for the problem-solving process. It would be interesting to follow-up with a study on other ways these personalized meetings helped these better prepared students, perhaps by linking assignments and citations to notes or codes by librarians, or notes by students from their meetings.

Conclusions and Future Work

The first research question explored whether the new pedagogy positively impacted the quality of student citations. While improvements in citation quality were seen for the key assignment immediately after the library lesson, this effect appeared to weaken as the semester progressed. The second question looked for a change the quantity and types of student citations. The team again saw signs of significant improvement on students' choices for sources: an increase in more scholarly and authoritative sources, and a decrease in those less so, at least for that assignment

immediately following the information literacy lesson and meeting. These affects also diminished over the course of the semester. The results of the study raise two critical questions for the teaching and library team. First, since it appears that the use of the highest quality sources diminishes over time, how can instructors reinforce concepts throughout the semester to mitigate this loss? And second, what is the ideal mixture of source types for the various projects in the course? While magazines and popular sites are typically lower quality they still have a place in the final technical report.

It may be that carefully timed and worded reminders to the students before the final report may be necessary to maintain the improved citation quality. Better reinforcement of the materials covered in the module and meetings later in the semester could be useful to help students revisit the concepts they've learned. Perhaps the student teams might be encouraged to schedule follow-up meetings with the librarians as they begin their final report, with the lure of extra credit on the assignment. The Arthur Lakes library partners with another core first year course to offer a research party later in the semester to provide students with additional access to instructors, writing help and librarians prior to the due date for their largest assignment. The team is currently considering if this model could also be effective for helping students in ITD retain and implement concepts covered in the initial module.

Avenues for future research and lesson modifications have been identified through initial implementation of the flipped information literacy lesson and the subsequent research. First, as mentioned above, follow-on study examining the relationship between pre-meeting preparation and team success would help both instructors and librarians to better assist all teams in better meeting course objectives. Also, the interesting trend of common source usage across projects arose during citation evaluation. Several projects across course sections would use the same website or government report for their project; and at times even cited it multiple different ways in the same bibliography. The use of common sources, and the means by which teams located them, was not explored in depth, but would be a useful study to pursue. Finally, the biggest challenge still to overcome is the best placement for the lesson and meetings within the semester schedule. If meetings are held too early, students aren't prepared or even fully aware of the project scope. However, if the meetings are too late in the semester, the students have neared the completion of their first round of research and may well have no questions for the library team. After trial and error through two semesters and two summer sessions, the team finally found the sweet spot in the schedule during spring 2018 semester. The module and librarian meetings were placed 10-14 days after the project challenge was announced and three weeks before the design proposal was due. Anecdotal evidence from participating librarians indicates that this semester students were better prepared than ever before and much more aware of both the Canvas lesson and the project definition and scope.

References

[1] T. Daher and M. Loehring, "Shaping the Engineering Freshman Experience through Active Learning in a Flipped Classroom," *American Society for Engineering Education Midwest Section Conference, Manhattan, KS, USA, 2016*. [Online]. Available: https://conferences.k-state.edu/aseemidwest2016/files/2016/06/Paper-Daher-Loehring-12vettq.pdf. [Accessed January 25, 2018].

[2] B. Morin, K.M. Kecskemety, K.A. Harper and P.A. Clingan, "The Inverted Classroom in a First-Year Engineering Course," *American Society for Engineering Education Annual Conference & Exposition, Atlanta, GA, USA, 2013*. [Online]. Available: https://peer.asee.org/22605. [Accessed January 21, 2018].

[3] J.W. Everett, J.K. Morgan, J.F Stanzione III, and K.E. Mallouk, "A Hybrid Flipped First Year Engineering Course," *American Society for Engineering Education Annual Conference & Exposition, Indianapolis, IN, USA, 2014*. [Online]. Available: https://peer.asee.org/19949. [Accessed January 25, 2018].

[4] D.P. Kelly, A.C. Clark, J.V. Ernst and K.G. Sutton, "Flipped Instruction in Engineering Graphics Courses: Current Landscape and Preliminary Study Results of Instructors' Perceptions," *American Society for Engineering Education Annual Conference & Exposition, New Orleans, LA, USA, 2016*. [Online]. Available: https://peer.asee.org/26920. [Accessed January 30, 2018].

[5] I.A. Parker and S. Veeraghanta, "Embedding Information Literacy within Sustainability Research: First Year Students' Perspectives," *American Society for Engineering Education Annual Conference & Exposition, Atlanta, GA, USA, 2013*. [Online]. Available: https://peer.asee.org/19492. [Accessed January 22, 2018].

[6] D. Denick, J. Bhatt and B. Layton, "Citation Analysis of Engineering Design Reports for Information Literacy Assessment," *American Society for Engineering Education Annual Conference & Exposition, Louisville, KY, USA, 2010*. [Online]. Available: https://peer.asee.org/16508. [Accessed January 25, 2018].

[7] R.E.H. Wertz, M.C. Ross, M.J. Fosmire, M.E. Cardella and S.Purzer, "Do Students Gather Information to Inform Design Decisions? Assessment with an Authentic Design Task in First-Year Engineering," *American Society for Engineering Education Annual Conference & Exposition, Vancouver, BC, CAN, 2011*. [Online]. Available: https://peer.asee.org/17789. [Accessed January 18, 2018].

[8] J. Wilkes, J. Godwin and L.J. Gurney, "Developing Information Literacy and Academic Writing Skills through the Collaborative Design of an Assessment Task for First Year Engineering Students," *Australian Acad. Res. Libr.*, vol. 46, no. 3, pp. 164-175, 2015. [Online]. DOI: https://doi.org/10.1080/00048623.2015.1062260. [Accessed January 26, 2018].

[9] S. Arnold-Garza, "The Flipped Classroom: Assessing an Innovative Teaching Model for Effective and Engaging Library Instruction," *CR&L News*, vol. 75, no. 1, pp. 10-13, 2014. [Online]. Available: http://crln.acrl.org/index.php/crlnews/article/view/9051/9890. [Accessed January 20, 2018].

[10] S. Arnold-Garza, "The Flipped Classroom Teaching Model and its Use for Information Literacy Instruction," *Comm. Info. Lit.*, vol. 8, no. 1, pp.7-22, 2014. [Online]. Available: http://hdl.handle.net/11603/160. [Accessed January 26, 2018].

[11] A.W. Brooks, "Information Literacy and the Flipped Classroom: Examining the Impact of a One-shot Flipped Class on Student Learning and Perceptions," *Comm. Info. Lit.*, vol. 8, no. 2, pp.225-235, 2014. [Online]. Available: https://eric.ed.gov/?id=EJ1089274. [Accessed January 26, 2018].

[12] A.J Carroll, N. Tchangalova and E.G. Harrington, "Flipping One-Shot Library Instruction: Using Canvas and Pecha Kucha for Peer Teaching," *J. Med. Library. Assoc*., vol. 104, no. 2, pp. 125-130, 2016. [Online]. DOI: http://dx.doi.org/10.3163/1536-5050.104.2.006 [Accessed January 22, 2018].

[13] J.E. Rodriguez, "A Massively Flipped Class: Designing and Implementing Active Learning Information Literacy Instruction for a Large Enrollment Course," *Research Serv. Rev.*, vol. 44, no. 1, pp. 4-20, 2016. [Online]. DOI: 10.1108/RSR-07-2015-0033. [Accessed January 25, 2018].

[14] T. Maddison, "A Matter of Size: Flipping Library Instruction in Various Engineering Classrooms," *Iss. Sci. Tech. Libr.*, no. 82, Fall 2015. [Online]. Available: DOI:10.5062/F4QV3JJ5. [Accessed January 25, 2018].

[15] C. Drew and R. Vaz, "Global Projects Preparation: Infusing Information Literacy into Project-Based Curricula," *American Society for Engineering Education Annual Conference & Exposition, Pittsburgh, PA, USA, 2008*. [Online]. Available: https://peer.asee.org/3738. [Accessed January 25, 2018].

[16] L.R. Hanlan and E.M. Riley, "Information Use by Undergraduate STEM Teams Engaged in Global Project-Based Learning," *American Society for Engineering Education Annual Conference & Exposition, Seattle, WA, USA, 2015*. [Online]. Available: https://peer.asee.org/24300. [Accessed January 22, 2018].

[17] R.E.H. Wertz, S. Purzer, M.J. Fosmire and M.E. Cardella, "Assessing Information Literacy Skills Demonstrated in an Engineering Design Task," *J. Eng. Ed.*, vol. 102, no. 4, pp. 577-602, 2013. [Online]. Available: DOI: https://doi.org/10.1002/jee.20024. [Accessed January 23, 2018].

[18] S. Clark and S. Chinburg, "Research Performance in Undergraduates Receiving Face to Face versus Online Library Instruction: A Citation Analysis," *J. Library. Admin.*, vol. 50, pp. 530-542, 2010. [Online]. DOI: 10.1080/01930826.2010.488599. [Accessed January 25, 2018].