Open Pedagogy for Teaching Structures

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Abstract

There is great potential to improve student engagement and retention by using open resources and pedagogies to teach structures. Open Educational Resources, OER, as defined by OER Commons are "…teaching and learning materials that you may freely use and reuse at no cost, and without needing to ask permission". Open Pedagogy is more difficult to define, but Wiley states that "Open pedagogy is that set of teaching and learning practices only possible in the context of the free access and 5R permissions characteristic of open educational resources."[2] The "5R permissions" refers to the fundamental basis of sharing open content that allows anyone to Retain, Reuse, Revise, Remix, or Redistribute the content of the resource in question.

After teaching structures for many years, using several different textbooks, with varying results in student engagement and learning outcomes, the author decided to investigate/develop open pedagogies to use in teaching fundamental structural concepts. This paper will focus on the author's recent experiences in introducing open pedagogies into an existing, second-year, introductory structures course. The primary goal of this experiment was to improve students' retention of course content and engage them more directly in their coursework by challenging them to find, create and share open content. Another goal was to guide students in creating documents containing pertinent structural design information that they could maintain for use in their future structures courses and design studios. Students were required to create their own websites to store and share their work in the course. This exercise exposed students to the "5R's" of open content, at a relatively small scale. The course goals and context in which open resources and pedagogy were used will be explained and described. Future potentials for using open pedagogies to teach structures will also be discussed.

Keywords: Pedagogy, Open, Structures

OER - Open Educational Resources

Open Educational Resources (OER) are now being used much more frequently in higher education for many disciplines. Reasons for this influx of open approaches include reducing, or even eliminating textbook costs for students, and more pedagogically driven initiatives to engage students directly in the creation/sharing of content to improve the achievement of learning outcomes. Many open pedagogies and initiatives focus on more constructionist approaches to teaching, wherein students are challenged to create shareable content and come up with the questions they want, or think, need to be answered to master a particular subject. Content creation by students is also a main tenant of open teaching practices, in an effort to have students take ownership of the material they are learning. As a relatively young field, recent articles on open pedagogy discuss how the field is being defined and how open approaches are being implemented and evaluated.

	Student creates an artifact	The artifact has value beyond supporting its creator's learning	The artifact is made public	The artifact is openly licensed
Disposable assignments	X			
Authentic assignments	X	X		
Constructionist assignments	X	X	X	
Renewable assignments	X	X	X	X

Fig. 1. Criteria distinguishing different kinds of assignments.

Wiley and Hilton also discuss, "OER–enabled pedagogy", while clearly noting that traditional (or disposable) assignments can have learning value, but suggest that more open assignments offer myriad opportunities for increased retention and other possible benefits.[3] (See Fig. 1.)[4] Seraphin et al explore NDA's, "Non-disposable assignments", wherein they "…endeavor to promote a launching ground for empirical research focused on effective practices and learning outcomes for NDA's", and to provide "…support for open pedagogy."[5] Much of the recent literature in this rapidly growing field indicates that open teaching practices offer viable pedagogical approaches in many different subjects. While many courses within NAAB accredited curricula have been utilizing open pedagogies for years, in courses such as community engaged design studios or environmental research courses, there is little evidence so far of open practices being used in structures courses.

Genesis of the experiment

In the last academic year, the author participated in an OER Fellows Program on their campus for a cohort of faculty from any department who were interested in learning more about open resources and how to incorporate them into their courses. Based on that experience and reflecting on the content of the recent literature on open educational practices, the author decided to try using more open pedagogical practices to teach architectural structures. A second year introductory course in structures seemed to be a good course in which to implement open teaching practices.

Course Context

ARCH 335, Structure Form and Order, is a required second year structures course. It is the first course in a three course sequence for the NAAB accredited MArch degree. The catalog description states in part that, the course "…introduces the fundamental concepts of structural form and behavior through a combination of lectures and studio exercises." The course objectives outlined in the syllabus are:

1. To develop a strong structural vocabulary.
2. To understand basic structural forms.
3. To understand the relationship between structural form and behavior.
4. To understand the evolution of structural developments over time.
5. To identify important historical structures, and their designers.
6. To understand the behavior of basic structural elements and materials.
7. To analyze basic structural systems behavior through models and first order calculations.
8. To understand structural load tracing.
9. To understand vector based force representation and manipulation.
10. To model and develop an understanding of basic structural systems to be used in studio design projects.
11. To explore the possibilities of Open Educational Resources.

Not every course goal was specifically targeted to be achieved through open teaching methods, but several key objectives were chosen to be explored through the creation of open education resources by the students. In the first attempt to open the structures course efforts were focused on engaging students in thoughtfully reflecting upon and documenting what they had learned in the course in a medium that could be easily maintained,

shared with other audiences, and easily referenced in the future.

First Open Iteration

In the first iteration of the "open" version of the course, in Fall 2018, students were asked to create "digital notebooks" that summarized the content they learned in the course throughout the semester. The notebooks were created and curated by the students using Google sites. They were instructed to write for different audiences; themselves, their classmates, and other students in the School of Architecture, with the intention of possibly sharing their sites in the future. The goal for this exercise was to challenge students to reflect on what they had learned and then to present that information in a clear accessible manner suitable for future reference. Longer term goals for this project included developing sites with course information that they could use in advanced structures courses or in design studio. Additionally, they were asked to consider the possibility that they could share their sites with other students in the architecture program, perhaps first year mentees. Many students approached the project by organizing their digital notebooks by assignments, while others organized content by themes. Good graphical layout of their sites and clear presentation of information was also emphasized throughout the project. The key objectives of the digital notebook project were:

1. To review and reflect upon course content and course learning objectives.
2. To summarize key terms and concepts from the lecture throughout the semester.
3. To create a resource for future reference in structures courses, studio and practice.

The assignment prompt also required them to include a written reflection on what they had learned during the semester considering the course goals listed in the syllabus. They were also encouraged to populate their web-pages with a variety of media, written passages, lists, images, sketches, drawings, links, webpages, journal articles, current events, images of models, and a bibliography. The creation of new content/documentation about architectural structures was also required for this project, to challenge the students to build upon what they learned, and avoid merely cataloging their assignments submitted throughout the semester. (See Fig. 2)

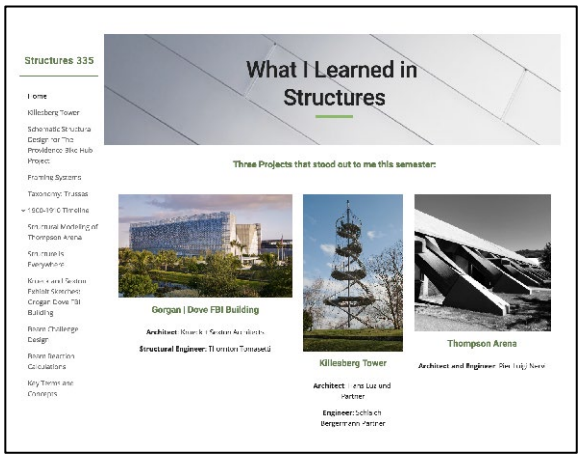

Fig. 2. Student Digital Notebook front-page, Evelyn Chambers.

In place of a traditional written final exam (perhaps the quintessential example of a disposable assignment), the last class meeting of the semester was devoted to a two-hour session for the students to present their websites to a public audience. The session was held in a multimedia room in the campus Learning Commons. Multiple large format touch screens were available for all the students to take turns displaying their websites to an audience from all over campus. The public presentation proved to be an important learning experience for the students as they were required to explain the both the project and the content they created, to an audience of non-architects. Verbally explaining the project's genesis and parameters forced students to think carefully about their audience. It was an opportunity for the students to share their newly acquired knowledge about structures and practice their oral presentation skills.

Current Initiatives

Based on the positive experience in the Fall 2018 version of ARCH 335, a second iteration of the course, with additional open assignments, was launched in Spring 2019. Student feedback regarding process and content was incorporated into this version of the course. Some of the most valuable comments from students suggested providing more assistance in understanding proper attribution protocols for citing "open" sources. The students also recommended, quite perceptively, that the digital notebook project should be introduced earlier in the semester, allowing them to build up the website gradually. With these recommendations and other student feedback in mind the author endeavored to "open" up the course even further, by incorporating more opportunities for students to create and share content about architectural structures. The course began with a guest lecture from our University Scholarly Communications Librarian, who introduced the students to the basic concepts of copyright laws and how they relate to academic work. A second class session was offered by the librarian, who specializes in open content issues, is planned for this semester. The second meeting with the librarian will focus on developing students' skills for in finding open source materials and the proper citation or attribution of these open sources.

Opening Up Assignments

For several years, the author has typically started each class with a "Structure du Jour", one slide of an important, or cutting edge building with an elegant structural system. This is done to grab students' attention and to get them excited about the informative possibilities of well integrated structure in building projects and to develop their ability to identify structural systems by name and materials used. Additionally, it often provides a good segue to the topic of the that day's class. After students began suggesting ideas for, or requesting a specific Structure du Jour, the author realized the potential benefits of having all students participate in selecting and presenting their own Structures du Jour. To facilitate the process, the instructor's graduate assistant created a Google slide show with a formatting template that was shared with the class. Students were encouraged to find a structure of distinction to discuss at the start of each class. Several pedagogical outcomes were achieved by doing this. It as an effective way to develop their structural vocabulary as well as their critical thinking skills by challenging them to find efficient, elegant structures. An unexpected, but positive benefit to this approach is that students can see what their classmates are researching as the site grows with entries throughout the semester. Students are often excited to share their own photographs of buildings they have visited or to present a structure they may have learned about in their design studio or history class. (See Fig. 3.)

Fig. 3. Sample Structure du Jour, Alexis Violet.

The second assignment adapted to be more open from previous versions of the course is a short biographical sketch of a significant structural engineer. Students were asked to research a structural designer of their choice and create a small poster presentation on their life and major works. Again, the collection and sharing of the information between classmates provided a broader range of learning opportunities for all students. In prior semesters, this assignment would be shared between just the student and the professor. Having a digital collection of all the students' posters (60+) allowed the instructor to easily display the slide show in class and have the students to see the rich legacy of structural engineers and make connections between the different

eras covered, which ranged from 18th century to present day. (See Fig. 4.)

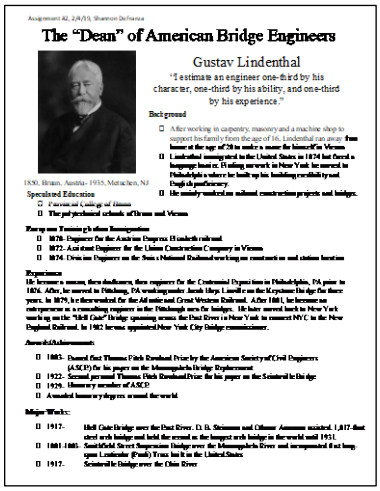

Fig. 4. Sample Designer Biography, Shannon Defranza.

The designer biography assignment led directly into a class project that is ideally suited for the collective efforts of students researching a topic individually and then sharing their results communally. Two of the course goals achieved in this assignment included developing students' understanding of the relationship between structural form and behavior, and the evolution of structural developments over time. In a little more than a week, the class collectively assembled a comprehensive slide show showing the historical development of structures over the past 10,000 years. Each student was assigned a specific time period to research. They were each asked to create a few slides with text and images covering the important structures, designers, and structural or material innovations from their specific time period. The next step in this project will be an in-class workshop where students will work together in small groups to evaluate and edit the content of the timeline slides. Ultimately, the information will be incorporated into an online searchable timeline, that can be expanded, updated and/or revised by future classes. It will also serve as a good reference for students in studio and other future courses. (See Fig. 5)

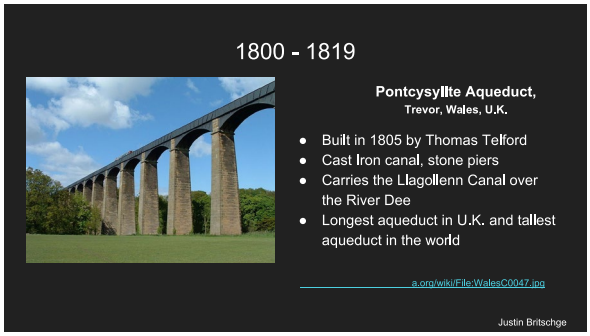

Fig. 5. Sample slide from Timeline of Structural Developments through History, Justin Britschge.

Reflections and Challenges

Several benefits have been found in these first few attempts at "opening" up the structures course. In previous versions of the course, most assignments were "disposable"; produced by individuals or small groups of students, and shared only with the instructor for grading purposes. After the graded assignments are returned, they are rarely seen again. The digital notebook project was an attempt to create a non-disposable assignment that would be useful for students in future courses, even if only for the creator of the notebook. Other assignments that involved communal research and content creation allow students access to much more information that they and their classmates have collected in completing their assignments, and sharing the results. For this to be effective, it is essential that quality control of the accuracy and efficacy of the content be ensured by the instructor. Another goal of the digital notebook is for students to refer to it in their future design studios. It remains to be see how effective it would be to share with a wider audience such as the wider student body of the school of architecture. Additionally, when students share the methods and resources they use in completing assignments, their classmates are exposed to many information references that they can also utilize. The instructor has also found it very helpful during lectures to show slides created by students to review the content and provide feedback to the entire class. This method

also fosters more in class discussion when students see their work displayed on the screen. Students have also been encouraged to research and use "open sources" such as Creative Commons licensed content and images for all their assignments. However, more class time needs to be devoted to instructing students on how to find and properly document open content. This has proven to be one of the biggest challenges in ensuring the student created content is both correct and properly attributed. An in-class workshop with our university librarian is scheduled for the current semester to review best citation practices and to provide the students with a better understanding of the underlying philosophy of creating and sharing open content.

Future Directions

Future initiatives for incorporating OER-enabled pedagogy in the structures course will investigate ways of actually sharing more student created content to wider audiences. Evidence from Seraphin et al suggests that, "Student generated instructional materials represent some of the best examples of culturally rich and effective learning objects." [6] The "pay-it-forward" philosophy has great potential for increased learning and retention for the student authors and their shared audience. Efforts to assess the realized benefits of sharing student produced learning materials will be conducted in future versions of the course, perhaps with past students returning to visit the course to discuss their experiences with their digital notebooks and other non-disposable assignments. Furthermore, the author should also have the opportunity to work with many of the students from the first two "open" versions ARCH 335, as they also teach the second and third structures courses.

Conclusions

While open pedagogies can be incorporated into a course in any discipline, they have been used with great success in the social and natural sciences among other fields. It is not yet apparent that they have been widely introduced into architectural structures courses. It is evident, even from limited recent experiments in using OER, that a NAAB accredited architecture curriculum is ripe with opportunities to leverage many positive benefits for retention and learning outcomes that these methods offer. Given that many of the required courses in architecture curricula rely heavily on precedents from the built environment, OER-enabled pedagogies, such as non-disposable assignments certainly have the potential to play an effective role in helping students achieve different learning objectives in various courses, not just in structures.

Notes:

1 "Getting Started with OER." OERcommons.org. https://www.oercommons.org/about (Accessed Oct. 10, 2018).

2 Wiley, David. "What is Open Pedagogy," Iterating Toward Openness (blog), October 21, 2013. https://opencontent.org/blog/archives/2975. Creative Commons Attribution license version 4.0.

3 Wiley, David, and John Hilton III. 2018. "Defining OER-Enabled Pedagogy". The International Review of Research in Open and Distributed Learning 19 (4). p.136 https://doi.org/10.19173/irrodl.v19i4.3601.

4 Wiley and Hilton, p. 137.

5 Seraphin, Sally B., J. Alex Grizzell, Anastasia Kerr-German, Marjorie A. Perkins, Patrick R. Grzanka, and Erin E. Hardin. "A Conceptual Framework for Non-Disposable Assignments: Inspiring Implementation, Innovation, and Research." Psychology Learning & Teaching, (November 2018). doi:10.1177/1475725718811711.

6 Seraphin et al. p. 11

Acknowledgements

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