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# Sciences and Technology Open Resources: A Collaborative Effort Between Libraries and Faculty

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## The Pilot Project

College costs are rising. Students who are paying more in tuition, more on housing, more fees, may not have enough to cover textbooks. The changing landscape of scholarly publishing gives colleges and universities new ways of providing resources for not just those students who may not have the resources, but for all students, no matter what their financial resources. Michelle Baildon (2018) discusses open access as part of a social justice framework. While she also discusses some of the limitations, open access is a step to equality of access to information for faculty and students alike. An additional benefit is opening the avenues of publishing outside the traditional publishing landscape.

Open Oregon Educational Resources (2018) researched the changes open educational resources have had on textbook affordability in community colleges in Oregon between 2015 and 2017. One comparison in the report is the number of hours a student working minimum wage would need to work to afford course materials. In 2017, at a two-year col-



lege that was 176 hours of work. While similar data is not yet available for Oregon four-year universities, one may assume it is near to double or more, topping 300 hours of work.

Open access is in relation to the license type of a text or material. A copyright license such as Creative Commons attribution allows people to use materials without the traditional barriers of the publishing industry. Add to this the wide accessibility of the internet, and there is a new model for creating and sharing of information that many can use. For the Oregon Institute of Technology (Oregon Tech), this does not only mean easier access for students across socioeconomic barriers, but also the ability of the library to publish materials created by faculty, and for faculty to work with other services such as OpenStax and LibreText to publish materials on a larger scale. This paper seeks to provide two views of the process at Oregon Tech. First, the library sponsored a pilot to support use and creation of open materials. Second, the paper gives one faculty member's experience in the creation and use of such resources.

According to data compiled by Amy Hofer, Coordinator, Statewide Open Education Library Services, in 2018, three Oregon Tech programs, Mechanical Engineering, Medical Laboratory Science, and Radiological science, with the average cost of general education texts totaling \$1205.09, pay an average of \$4251.35 for textbooks. At the upper end of this scale students could pay as much as \$7602.65 for just textbooks needed in the major. These numbers are before tuition, laboratory fees, housing costs, transportation, and any other personal expenses a student may have. With much of the transferrable credits and 200 level or below, textbook affordability being worked on at the state level; Oregon Tech identified a gap with the upper division science and engineering courses.

In fall 2017, the Oregon Tech Libraries sent out a mini-survey to faculty to identify where open texts were already in use. While there were only four responses to this survey, it opened the door for a wider conversation. In discussion with the university bookstore, nine classes in fall of 2017 were identified as using OERs. During winter 2018, the library used 10,000 dollars from its existing budget to launch a pilot program to support faculty financially in the adaptation, adoption, and creation of open and low-cost text alternatives. With the support of the Provost, Academic Assessment, and the Commission on College Teaching, the committee was able to spread the word across the university.

The committee made up of two librarians, a representative from the college commission on teaching, and two teaching faculty members who were already using open resources, designed a funding application for faculty. While the application relied heavily on information from a previous Open Oregon Educational Resources application, an emphasis was put on recruiting upper division and science specific courses. One thousand dollars was offered for creation of a resource and \$500 for the adaptation or adoption. In spring term of 2018, the same committee reviewed 14 applications from 12 faculty members covering texts from 24 courses. The library was able to give some money to each applicant. The Commission on College Teaching offered extended application time for those applicants that the library could not fully fund in order to additionally support them through a different program. In addition to this, the library hosted Amy Hofer to talk about reviewing OER. Through this, Open Oregon Educational Resources funded four reviewer grants.



Using a \$100 per text average (Open Oregon Educational Resources, 2017) and an average class size of 20, the mini-grants from the library are saving Oregon Tech students \$48,000 in the current academic year. As of fall 2018, 32 classes have been identified as using OER—up by 23 classes since fall 2017. It will take more than one term to determine if this is an upward trend, and if there is any correlation to the grants from the library. It should also be noted that not all 24 classes with texts changed through the mini-grants are taught in fall term.

The process the library used was new to Oregon Tech. The concept of OER does make some people uncomfortable, and there have been some challenges identified along the way. Discussions continue with faculty, administration, and staff to smooth out the process as this pilot is continued for a second year.

### **Why Two Unique and Different Courses Required a Distinct OER Solution**

General Chemistry I and II as well as Environmental Chemistry and Toxicology, are very different courses. The student populations are different (general chemistry sections using this new OER text mainly serve engineers while environmental chemistry is usually a mix of biology health science and environmental sciences majors). General Chemistry is a 200-level course while Environmental Chemistry and Toxicology is 300-level. General Chemistry typically sees around 100 students in each part (I & II) while over the past two years, about ten students enroll in Environmental Chemistry and Toxicology. So why use OERs in both these courses (besides the obvious hundreds of dollars saved by my students)?

- Personalization to a specific course.
- A text that matches cutting-edge science and breaking news.
- The ability to use online supplements.
- Engagement in immediate feedback from students about the text.

The answers are really endless.

### **General Chemistry I and II**

A perfectly adequate textbook for General Chemistry I & II was in use. It wasn't in an ideal order, so there was a little bit of jumping around involved. Serving a population of engineers (not chemistry majors) there were parts of the text that were skipped all together. The textbook was used mainly for pre-reading on concepts (followed by an online quiz before class) and practice problems at the end of the week before a Friday quiz. It also served as a reference for students and for instructors. It cost \$300 new and most students used it for two terms (20 weeks). In class, mainly homegrown activities that draw upon the concepts from the textbook were used to cement material, but these were not in any way tied to that particular \$300 book.

When the opportunity presented itself to invest time and resources into a free (or low-cost) text for students, it was an easy choice to make. An already existing open education chemistry textbook was chosen as a jumping off point, and the work began. This textbook was not perfect (not that any one text is for most courses). There were parts of explanations that felt lacking. There were concepts covered in our previous text that were not covered at



all in the new book. In some cases, concepts were covered in a completely different order than the established structure of our course.

To address explanations that were “lacking,” supplemental materials were brought in. There was a series of popular videos (Crash Course Chemistry) already being used in class that were brought into the text as either additional explanations (sometimes having a chemistry concept explained in slightly different words makes it click for students) or as summaries at the end of a section. In addition to those, new, well-produced series of videos from Fuse School were used. These were nice five-minute animated explanations of concepts. In a similar vein, there were often TED-Ed videos that went along with topics as well (or sometimes even expanded on the topics giving them real-world contexts). Due to the platform chosen for hosting the new text (explored later in this article), embedding these videos in the text was simple and turned a flat text into a multimedia experience.

To address the concepts not covered, again the platform chosen allowed for adding additional information, example problems, etc., seamlessly into the existing text. The greatest challenge was probably the different order in which things were covered in this textbook versus the previous traditional text. These were easily overcome by adjusting the curriculum slightly or (more often) reordering the sections of the text to be presented in a way that matched the curriculum. Making this switch in a way that made sense to the students and faculty without rebuilding the entire curriculum around a new book, but instead building a new book around our existing curriculum was essential.

This switch also presented an opportunity to integrate more of the interactive simulators that exist for General Chemistry curriculums into various lessons. The online platform allowed these simulators to be embedded into the online text, and then to use them in class or in the pre-class reading quiz as we saw appropriate.

### **Environmental Chemistry and Toxicology**

Two years ago in Environmental Chemistry and Toxicology, a well-regarded text was required for the course. The text was not perfect (lacking a suitable section on Toxicology), but it covered the majority of the material and supplements were given to students as necessary. The text cost around \$200 new, and the course was 10 weeks long. Older editions of the textbook were not an option because the information in this field is fairly outdated as soon as the book is published, let alone in the previous edition. Students were stuck with a \$200 bill that most of them couldn't afford, and, while the book was used as much as possible to make it “worth it,” something different had to happen the following year to make the course more affordable.

Last year there was no traditional textbook for the course. Instead, a couple of “popular science” texts that had been vetted by the instructor and had won or been finalists for some major prizes were used. However, if the students needed supplemental information beyond those texts or slides presented during class, it was up to them to find the information they needed—a dangerous place to be if you're just typing “Climate Change” into Google. When open resource texts were explored, there wasn't really one that fit the needs of the course. Presented with the opportunity to create one, the funding was applied for (and awarded) and work began.

The creation of this text was a lot more laborious than the process for General Chemistry. Writing a text from scratch as opposed to editing an existing document is a completely different the subject matter. With Adelaide's Ph.D. in Environmental Analytical Chemistry



(but a specialization in air quality research), references were typically used when discussing chemistry in water, soil, or any sort of toxicological studies in the course slides already. This presented an advantage: a number of texts to reference on these subjects to read and compile into one living document (with proper citations) were already available.

Admittedly, this job was more labor-intensive than anticipated (especially when coupled with the simultaneous General Chemistry work). The time it takes to read and annotate information and then write it up later in a way that properly cites the appropriate sources while not infringing on the copyright of any of these traditional texts was a challenge. Nevertheless, it was worthwhile to create the living, instantly updateable resource for students.

Another challenge was graphics. Chemists are rarely also trained as graphic artists. In addition, while a lot of graphics were available from open sources like government websites, some just didn't exist. Thanks to the grant, a copy of the Adobe Creative Suite was purchased and online tutorials have been used to create other necessary graphics as needed. In addition, some scientific journals will relicense figures from articles (especially older articles) for no cost if you're using them in a free educational resource, which has been useful in a number of topics.

A third challenge was the organization of the text itself, and that is something that remains a struggle in its creation. There are, unfortunately, a number of logical ways to organize these topics, but the "just right" one remains elusive. When topics can be so interdependent on one another, it's hard to elucidate the correct presentation (whereas, if using a traditional text, it is easy to go in the order those authors chose without thinking about it). Thankfully, the fully editable document being created allows for the movement of topics as its being created, as well as hyperlinks back to previous sections when necessary. Additionally, the entire text could be rearranged in subsequent terms if the final arrangement for this year just doesn't work.

The benefits of this text will be worth the challenges it has presented. Environmental Chemistry remains an ever-changing field and being able to link and reference the most up to date science in a reading for students will prove invaluable. It also will allow the same multimedia benefits that the General Chemistry text allowed for, with videos, moving graphics to illustrate trends, and so much more.

### **Finding a Platform to Host This Vision: LibreTexts**

When this journey to create Open Resources began, there were questions of where the final product would end up. In General Chemistry, it was imagined that by using an existing open access textbook, that instructors would continue doing what had been done when with a traditional text: providing supplemental materials through class Blackboard "shells" that students would have to seek out in addition to their reading. The only difference would be that the text no longer cost students \$300. What was actually created, however, was so much better than anyone involved in this project could have imagined.

LibreTexts, which was recommended by a colleague, is the world's most popular online textbook platform, with an estimated 154 courses serving 223 million students. Recently, it was awarded a five million dollar Open Textbooks Pilot Program award from the United States Department of Education and hosts texts for courses in fields including Biology to Business. It functions similar to a Wiki, but with a tighter rein on who can edit the documents that live within it.



For these texts, LibreTexts became an obvious hosting choice. The texts would no longer going to be bound to the constraints of a pre-made text. Thanks to Creative Commons Licensing of the open access text chosen for General Chemistry, it was possible “remix” the sections, add where necessary, delete where necessary, and create a fully customized text for the course needs. And, the best part was the text chosen had already been fully digitized on LibreTexts. Working with the LibreTexts team, it was possible to copy the sections needed for the course in the order that made sense to the course, and then, with editing access granted, it was possible to delete irrelevant information, add more information to places, embed video supplements, embed the HTML-based simulations, and hand-pick the end-of-chapter problems that were relevant to students. The opportunity to choose end-of-chapter problems has been a huge benefit, because not only are students given end-of-chapter problems directly relevant to concept they’ll be tested on, we were also able to acquire a separately purchased software for iPad to create self-narrated solution videos for selected problems. Now, students can see an instructor work out the problem outside of class and office hours. Short links to each section have also been integrated at the top of their in-class worksheets so that if students are struggling with their in-class homework, they can go straight to that book section from any internet-enabled device. The text is mobile browser compatible, so they can pull it up on their phones if necessary.

The editing platform for LibreTexts is fairly user-friendly. The only drawback has been in the writing of the Environmental Chemistry text. In General Chemistry, for the most part, the equations were already written. At worst, some editing was required. In Environmental Chemistry, equations will be written from scratch—and the editing interface has no built-in equation editing tool. Instead, the equations have to be written in LaTeX, a document preparation system production of technical and scientific documentation. Online equation builders that will translate into LaTeX have had to be used. While time consuming, it is a workaround.

Another benefit to this online “living” system has been the ability to elicit immediate feedback from students as they use the text. Oregon Tech gives faculty access to Qualtrics Survey platforms and survey links for various forms of feedback have been created through this platform. At the end of every section, there is a link for anonymous feedback about the text itself. Another link has been made that allows students to submit typos they encounter for extra credit—eliminating the need for proof-reading everything ahead of time. There is also a link in the various end-of-chapter problems where students can submit if they think one of the answers was incorrect. In addition, there is a link in those sections where they can suggest problems that may also need solutions videos (for future terms).

### **Future Directions**

The pilot program for mini-grants will continue this year. In winter 2019, the library will identify committee members and start publishing the applications and the timeline. Much of the process is already in place, and Dawn has already been reaching out to people on how to make the processes smoother. The previous grant recipients will give presentations in winter and spring terms of 2019 on their experiences. Future grant recipients will be required to do the same. It is the hope that these will sway more faculty to use open resources, and more creation of resources for those upper division science and engineering courses.



The bookstore manager is also involved in these conversations. Currently this revolves around notifying students what classes have OER, but also on working with faculty to notify the bookstore of their OER use for more discoverability. There is hope to continue these collaborations past the current discussions.

Finally, but certainly not least, the library is collecting data to support such initiatives in the future. Starting with a \$10,000 investment and offering a potential savings of \$48,000 in the 2018–19 academic year to students is just that—a start. 🐘

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