Adapting, Remixing, and Adopting an OER in General Chemistry I and II

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Abstract

Through the generous support of the CHE Library and Open Oregon, General Chemistry I and II (CHE 201 and 202) at Oregon Institute of Technology has been able to switch to OER texts this academic year. It is estimated that this shift has saved each student up to $300 per term. The switch from Openstax Chemistry as our text and multimedia and is hosted online via LibreTexts. A printed version was also created to give students an option who prefer printed textbooks. Besides lowered student cost, benefits include specific tailoring of information for the course, supplements to suit different types of learners, and instant updates of information. Student reactions to the text have been mostly positive, with a majority of students reporting using the text more than a traditional textbook. Additionally, a statistical difference has been found in the number of students completing pre-class Reading Checks.

Introduction

At Oregon Tech, CHE 201 and CHE 202 (CHE 20X) are offered:

- Fall/Spring (Fall and Winter) and "Winter Session" (Winter and Spring)
- Approximately 80-110 students annually
- For most of the engineering majors on our campus (except Civil Engineering)
- CHE 20X has traditionally used the textbook. A Measurement and Introduction to Chemistry lab
- Students had been able to purchase the 4th ($300 new) or 3rd (Used Only; not available through campus bookstores)
- Bookstore availability is important particularly to our large veteran student population
- Students used textbooks for 2-4 years and CHE 20X class per year
- None of those students are chemistry majors – no reason to keep textbook, leading to selling back at fraction of initial cost

Objective

Adapt and remix existing materials for chemistry into one resource, eliminating extraneous sections not explicitly covered in these courses as they are currently taught at OIT.

LibreTexts: An Overview

From the website: "The LibreTexts mission is to unite students, faculty and scholars in a cooperative effort to develop an easy-to-use open platform for the construction, curation, and dissemination of open educational resources (OER) to reduce the burdens of unreasonable textbook costs to our students and society.

- 398 textbooks, 1671 supplemental texts, and LibreTexts
- 154 courses using LibreTexts
- $31 million dollars saved
- Subjects include: Biology, Business, Chemistry, Engineering, Geosciences, Humanities, Mathematics, Medicine, Physics, Social Sciences, Statistics, and Workforce

LibreTexts began as the ChemWiki (UC Davis), aiming to create a large number of chemistry resources, including 17 textbooks and maps for General Chemistry, were already available:
- Chosen base resource: Openstax Chemistry (entirely mapped on LibreTexts)
- CHE 20X supplements: Crash Course & Sci Show Videos and others (embedded in LibreTexts to insert on pages)
- The availability of interactive resources for students was a large selling point

Benefits of LibreTexts to CHE 20X

LibreTexts are:
- Open, free, and accessible to everyone with an Internet connection
- Comprehensive, with new texts being developed and shared regularly
- Topical and always up to date
- Active, with a community of collaborators
- Interactive, with visualizations, simulations, and videos
- Accessible through assistive technologies across the platform

Fig. 1: Institutions using some form of LibreTexts in the United States

Fig. 2: Screenshot showing the link to define a changelog in Fall 2018

Fig. 3: Example page from course pack with online links

Student Use of the Text

We started by making a list of all the sections of the Tru textbook we taught in both courses and the sections that could be substituted from Openstax, deleting irrelevant information (to our course). We then curated our collection of supplements, and as a last resort for a few pieces of information, we wrote ourselves. We then chose the relevant end of section problems, determined the answers for even problems, and made solution videos for select problems. CHE 201 was mostly completed in Summer 2018 and ready for use in Fall 2018. CHE 202 was mostly completed in Fall 2018 and ready for use in Winter 2019.

Because some students still like to have a physical copy of the textbook, an online-only text could not be the only version. Because of this, in early adoption terms students were given the option to purchase the physical copy of Openstax and the appropriate reference sections and practice problems were made available to them where possible. In the subsequent trailer sequences, a course pack (PDF) was created from the online material, with shortcuts and QR codes generated for online only material to maintain a degree of high accessibility for students (Fig. 3). Working with Open Oregon, future course pack printings will be available through Lulu for less than $25 per text ($50 for both CHE 201 and 202 instead of $300).

The Creation Process: Online and In Print

We started by making a list of all the sections of the Tru textbook we taught in both courses and the sections that could be substituted from Openstax, deleting irrelevant information (to our course). We then curated our collection of supplements, and as a last resort for a few pieces of information, we wrote ourselves. We then chose the relevant end of section problems, determined the answers for even problems, and made solution videos for select problems. CHE 201 was mostly completed in Summer 2018 and ready for use in Fall 2018. CHE 202 was mostly completed in Fall 2018 and ready for use in Winter 2019.

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Student Outcomes

Comparisons are made between students in the traditional textbook (CHE 201 W 18 and CHE 202 W 18) and the OER version (CHE 201 FA 18 and CHE 202 FA 18) in all sections.

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Fig. 6: Comparison of pre-class "Reading Check" completion for sections using the traditional print text (t) vs. LibreTexts (L). All sections of CHE 201 and CHE 202 were compared using Chi-Square with significance levels being computed using Yates' correction for continuity. This is a significant improvement over the previous semester's data (Fig. 7).

Fig. 7: Comparison of student performance on pre-class Reading Check completion. The traditional print textbook was significantly better (p < 0.05) than the LibreTexts version in both CHE 201 (t) W 18 vs. (L) FA 18 and CHE 202 (t) W 19 vs. (L) W 19 (p < 0.05).

Conclusions & Future Work

- An online (free) and in print (cost) resource has been created for General Chemistry I and II at Oregon Tech, which is fully tailored to the information presented in the courses and contains online supplements previously listed separately in LMS or sought independently by students.
- Most of the students opted to use the online resources over the print resource and the majority of students in CHE 201 and CHE 202 self-report using the textbook a lot or a little more than they would have used a traditional textbook.
- Students self-reported not utilizing the practice problems at the end of sections, which seems to not have had an adverse effect on final grades (Fig. 7).

Future Work: Short-links to the end of section problems were added to the bottom of homework assignments this quarter to make the resource more readily available. Students will be surveyed at the end of this quarter for feedback on this inclusion as well as asking about use repair of print text.

Results within the cohort will be combined to see if use improved.

The online resource appears to offer a statistical difference over the pre-class Reading Check completion.

We hypothesize that this is due to the increased ease and universality of access while taking an online quiz.

Future Work:

- We intend to continue collecting usage data from cohorts for at least another year and assess any improvements that can be made. We will also continue soliciting other student feedback on the text.
- A section on "Non-Dipole Intermolecular Forces" needs to be added to CHE 202 (SUI 2019).

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