UTA CARES GRANT FINAL REPORT –

Introduction to Industrial Engineering

Bonnie Boardman

INTRODUCTION TO INDUSTRIAL ENGINEERING OER TEXTBOOK DEVELOPEMENT

Bonnie Boardman, PhD

Project Summary

This project involved the development of an Open Education Resource (OER) textbook for an Introduction to Industrial Engineering course. The project involved remixing an existing OER document to better fit the needs of IE 1205 at the University of Texas at Arlington (UTA).   The remixing included adding content from other sources, adding original content, and removing content that was not applicable to the existing course at UTA.   Video media and interactive exercises in the form H5P content were also added to the text. The text was developed in Pressbooks and was supported by a UTA CARES grant.

Motivation

An introductory class to the discipline of industrial engineering has been a part of the curriculum for the BSIE degree at UTA for at least 20 years. For many of those years, no written resource was referenced in the course, because none existed. In 2012, a document titled "Introduction to Industrial Engineering" available in pdf format was introduced. The document was written and shared by Dr. Jane M. Fraser, a faculty member at Colorado State University-Pueblo. Dr. Fraser shared the document online and licensed it openly. The document was used, as it was written, for several years. In 2016, specific chapters of the document were updated and converted to an HTML format for use in the commercial system TopHat. This switch to a commercial system was made in order to include some interactive content within the text, allowing students to answer questions on the reading and participate with each other while reading. TopHat access cost each student $25/semester to access the content.

In 2018, a seminar on OER and Pressbooks was conducted at UTA. I attended to learn about Pressbooks thinking it might be a way to get the material to my students in place of TopHat. That seminar was my first exposure to OER, what it meant, and the many benefits. I realized I had remixed an OER and after learning about Pressbooks I knew that I could better represent OER by offering my remix there. I attended another seminar about UTA's Coalition for Alternative Resources in Education for Students (CARES) Grant and applied to add additional content to my resource and include interactive material via H5P content.

Development

The OER was developed in Pressbook in the Spring 2019 and Summer 2019 semesters. The first step was to take the document that was developed by Dr. Fraser in a pdf and get into Pressbooks. This step was accomplished by the OER team at UTA Library. That pdf transfer was the start of the development. Next, content was deleted that was not needed for the text being developed for the Introduction to Industrial Engineering class at UTA. Each chapter was then reformatted and edited. Pictures and graphics were very rare in the original source. License appropriate pictures and graphics were sourced to add visual interest and further explanation to each chapter. Graphics were developed where more specific examples were

needed. Interactive H5P activities were added to the end of each chapter to encourage engagement with the material.

Dr. Fraser's resource offered material for a lot of the content that needed to be covered for UTA's Introduction to Industrial Engineering text, but there was some missing content. New chapters were added to cover Teamwork and Problem-Solving Techniques.   Content from University of Minnesota Libraries Publishing and from the MIT Office of Digital Learning was included in these two chapters, along with original content.

The text was edited throughout the Fall 2019 and Spring 2020 semesters to correct errors and add missing content.

Implementation

The text was beta-tested in the Fall 2019 and Spring 2020 semesters in IE 1205, Introduction to Industrial Engineering. Students were assigned a chapter to read each week. Students were required to annotate the text using Hypothesis annotation software. They were asked to annotate their choice of content from the chapter with observations, questions, and/or experiences. They were also asked to find and annotate any typographical or grammatical mistakes, quite a few mistakes were caught and corrected thanks to the students. Test questions were given over the reading, many of which were similar to the H5P exercises presented at the end of each chapter. Table 1 presents excerpts of a sample of student annotations from those two semesters.

"In a city building and simulating game, I use the exact process outlined in this paragraph whenever I build an industrial district. I take into account where to put on and off ramps to the highway, where to place key buildings and how traffic flows. This process allows me to build the most efficient and effective industrial district, with minimal travel time between buildings and easy access to the highway. I can say I have experienced this paragraph."
"This definition speaks volumes. I feel like this defines what we will be doing not only in class, but also for our future careers as IE's. Without reading the definitions of the bold face words, I could easily understand the overall goal of an IE. The key to a good system is the perfect balance of efficiency and effectiveness."
"This is a debatable point because not all team members are always reliable and affect productivity. I went through this when working at Whataburger because as soon as one station fell behind another employee from another station had to go help which just slowed down the entire team even more."
"The bullet points in this section made me realize how un-effective my group was in my Technical Business Writing course."
"Let me tell ya, this sentence right here made me burst into bitter laughter."

Table 1: Sample of Student Annotations

The text was published in the Summer of 2020 and the first published version is currently being used by the Fall 2020 IE 1205 students.

Dissemination

This final report was prepared in the Fall 2020 semester. Dissemination of information about the development and use of OER in an introductory engineering course is planned. The author will be part of team presenting at Open Education Global 2020. Presentation proposals are also being submitted for the 2021 American Society for Engineering Education and 2021 Institute of Industrial and Systems Engineering conferences. The planned presentations will cover the benefits of using OER, the development process, and a summary of student reactions to the developed OER.

Observation on OER Implementation

Pressbooks was very intuitive and easy to use. The development interface shows you almost exactly what the final version will look like so there were no surprises when going to Preview mode. I had a little bit of trouble knowing exactly what metadata needed to be entered for pictures and graphics. I had to edit a lot of those after my review by the UTA OER team.

The H5P interactive material was fun to work on. It did take a lot of back and forth between the H5P interface, the Pressbooks chapter, and the Preview mode to ensure that everything was working correctly. I barely skimmed the surface of the available H5P content types. I do have concerns about the H5P activities and students who prefer to use pdf or printed copies of the text. That's not something I thought through enough during development.

I regret using Hypothesis during the development phase. For some reason some of the Hypothesis annotations were showing up in the Pressbooks version of the text and when getting ready for the final publication I needed to remove those, which was not easy. Sections of the text which were annotated had to be removed and rewritten completely. If I removed an annotated section and then rewrote it, the annotations would reappear if the rewritten text was too similar to the original text. It was a real challenge to get them removed from the text. That didn't seem to happen for annotations that were made in Hypothesis integrated within Canvas, which is how the students were supposed to use it. But there seems to be a Pressbooks/Hypothesis in Canvas bug that prompted students to log into Hypothesis even though they were trying to use in within Canvas. The Hypothesis team is aware of the bug and they are working to rectify the problem. In the meantime, **my recommendation for OER developers would be to turn Hypothesis off prior to publication.**

Sponsor Support

The OER team at the UTA Library was immensely helpful during the development of the text. Just a few of the tasks that they performed include:

- Transferring original pdf material into Pressbooks
- Creating the cover art for the text
- Performing accessibility checks and providing specific recommendations

- Constant technical and emotional support

The OER team also provided regular training on many topics that were essential in the development of the text. Training was offered on Pressbooks, accessibility of materials, licensing options, Hypothesis, H5P use, and team development strategies. I learned from each of these training opportunities and continue to learn from the OER team.

Recommendations and Future Work

Future revisions of the text will include adding material on Microsoft Excel. A significant portion of the class for which this text has been development is on the use of Microsoft Excel. Students come to the class with a wide variety of pre-attained skills in that area. Students have expressed in course evaluations that written resource covering Excel would be useful. It doesn't really fit in with the content of the developed text so a separate resource may be a better option.

The H5P interactive exercises make the text more engaging. Adding more of this throughout each chapter, instead of just at the end of each chapter would be desirable. The downside, being that it is not useable by students who prefer a pdf or printed version of the text. Caret on how to make the material interesting and usable by readers in all modes would be important for any future additions.

Conclusion

I have learned so much in the development of this text. I truly believe that OER is a viable option for all courses, no matter the subject matter. If we would all commit to its use, it would become the norm in a very short time. I hope to advocate for that change in our educational system.

I can't think the OER team at the UTA Library enough for their support in this endeavor. Michelle Reed leads an excellent team and I, my students, and the University and larger community as a whole are much better off for their efforts. Thank you.