Abstract

This article details a set of team-based assignments in a college-level integrated English and human biology course. In this semester-long assignment sequence, student teams rotate through a series of activities to create open educational resources for a nonmajors, general education human biology class. These student-generated materials facilitate engagement with course content at high cognitive levels in order to "write the book" for the class. Finally, an end-of-semester synthesis project asks students to compile and present their finished work for wider distribution via student-made websites.

Key Words: OER; team-based assignments; English; anatomy; physiology.

Introduction

Textbooks are an essential component of content mastery; however, the rising cost of textbooks and tuition is forcing many college students to tighten their belts and budget where their limited funds are allocated. Multiple studies suggest that 64–67% of students do not purchase a required textbook due to cost (Florida Virtual Campus, 2012; Martin et al., 2017; Rokusek & Cooke, 2019) and that the cost of text materials significantly influences course enrollment decisions (Florida Virtual Campus, 2012; Selnack, 2014). Open educational resource (OER) materials have been created, in part, to address the issue of rising costs. OERs can include open textbooks and support materials with licenses that allow instructors to remix content to fit their classroom needs. Numerous studies suggest that OER text quality is perceived as being equal to or greater than that of traditionally published texts (California OER Council, 2016; Hilton, 2016; Watson et al., 2017); however, scientific data on the efficacy of OER texts are still in question (Delgado et al., 2019).

While OER materials may address financial burdens, they do not automatically fix utilization issues. Only 18% of students frequently read material before coming to class, as most students do not consider textbooks to be a critical part of their learning; when they do crack open the text, it is usually just prior to an exam (Sikorski et al., 2002; Berry et al., 2010). Additionally, strong students appear to read in order to understand material, whereas weaker students are prone to stop reading when the material becomes challenging, which decreases the textbook’s benefits (Phillips & Phillips, 2007).

In an attempt to solve the cost and engagement issues, we created a collaborative English and biology course in which students practiced writing and composition skills while designing textbook materials for their biology course content. These assignments have the added benefit of enabling students to synthesize knowledge they gain in content-heavy courses, thereby enhancing their retention of the material and reinforcing relevant writing skills. Finally, the team-taught design of this initial pilot course was an engaging and important part of our experience, though not necessary for replicating the student-driven OER framework.

OER Production: Classroom Work Flow

The implementation of student-generated OER materials stemmed from the integration of an introductory, one-semester human biology course for nonmajors (BIOL 1020) and a required, general education introductory writing course (ENGL 1010). The students were divided into permanent teams that collaborated throughout the semester. As part of the requirements for both courses, student teams designed and executed a series of OER activities for each unit of BIOL content. To assist students with the creation of these materials, students analyzed several biology textbooks looking for common elements of each chapter. Content lectures and online resources (Table 1) also provided content knowledge.

Each student team completed one collaborative, writing-intensive OER assignment per exam unit, rotating through the other OER activities during subsequent units (Figure 1). As part of the course, we allowed in-class workshop days for teams to draft materials, as well as in-class peer-review days where students could receive feedback on their materials from peers. Ultimately, the following activities – on their
own or as part of a major course redesign – can help (1) better incorporate high-impact practices, such as writing-intensive and collaborative pedagogies, recommended by the American Association of Colleges & Universities; (https://www.aacu.org/leap/hips) and (2) increase student investment in course material by giving them control over its production.

O Student-Generated OER

1. Student-Generated Study Questions

Research over the past few decades indicates that creation of student-generated exam materials correlates strongly with better performance on a variety of end-of-semester evaluative measures (Foos, 1989; Walsh et al., 2016). For this activity, group members created 10 practice questions for each chapter covered in their assigned unit. We allowed a maximum of five multiple-choice questions for each chapter and required at least one essay question.

We also used this activity to challenge students’ meta-awareness of learning, discussing Bloom’s taxonomy and what exactly good test questions are trying to measure. Because good practice questions require students to think about material on a variety of different levels, each chapter required one question that fulfilled each of the four lower levels of Bloom’s taxonomy (Remember, Understand, Apply, and Analyze), while the act of writing the questions themselves fulfilled the higher levels (Evaluate and Create).

Table 1. A selection of free online resources for the assignment sequence.

| Resource                                      | Link                                                      |
|-----------------------------------------------|-----------------------------------------------------------|
| Writing Spaces: Readings on Writing, vol. 1   | http://writingspaces.org/volume1                          |
| Anatomy and Physiology (OpenStax)            | https://openstax.org/details/anatomy-and-physiology       |
| Wilkin, Human Biology                        | https://www.textbookequity.org/wilkin-human-biology-2015/ |

Figure 1. Work flow for the semester-long assignment sequence in which students create open educational resources.
2. Identifying Important Concepts: Chapter Outlines/Big Idea Sheets

Chapter outlines or “big idea sheets” asked students to identify the big ideas or learning objectives in a given OER textbook chapter and then provide a summary of information pertinent to the big idea. Groups summarized each chapter’s main ideas and concepts, ranking these from most to least important. We used this activity to challenge students’ analysis and synthesis abilities, ultimately asking them to build hierarchies of course content that would aid their peers in studying. Content outlines have been a part of basic paper composition for many years. The process of creating outlines helps students organize and see relationships between pieces of content, which can get lost in the jumble of facts and information. A side benefit of this activity is that students are introduced to document organization and design principles, as well as word-processing skills and procedures.

3. Application Practice: Did You Know?/Clinical Reference

This activity was designed to mimic textbook sidebars, challenging audience awareness by asking teams to adapt detailed scientific information using a more accessible tone around topics that are interesting to a mixed audience. These were approximately 200–300 words long and should be written in language appropriate for a general audience. We used this activity to challenge students’ content knowledge, asking them to restate, adapt, or apply that knowledge for different audiences or circumstances. This activity created opportunities for artistic license and creative pursuits in a subject where this is not common. When given complete freedom, students chose more traditional topics (e.g., blood type, bone fractures) as well as more creative items (e.g., “What is a sneeze?” or tissue development in the embryo).

4. Multimodal Composing: YouTube Video, Diagram, or Figure

For this activity, teams created a visual representation of a biological concept or process using various media formats of their choosing. We used this activity to challenge students’ creativity and holistic knowledge, asking them to represent content in a medium other than writing. For example, addressing the endocrine system with this activity went beyond a simple listing of hormone-producing glands, requiring an understanding of where they are located and how they operate together. It is well documented that creating visual explanations of complex processes in the STEM field increases student learning (Evagorou et al., 2015; Bobek & Tversky, 2016). Our students created everything from puzzles and tables to practice diagrams for labeling anatomy.

Applications & Reflections

At Southern Utah University, the assignment sequence detailed above was put into practice in a face-to-face, team-taught course combining learning outcomes and grading rubrics from both English and science curricula. Team-teaching courses can be a time-intensive and lengthy process; however, implementing these assignments does not necessitate team-teaching. Whether in a college or a secondary setting, instructors could collaborate to align some assignments in a much looser way, integrate these activities independently, or pick and choose just one activity per instructor from the ideas presented here. You can also use the activities we have provided as singular in-class workshop activities or as formal/recurring homework assignments (i.e., students generate exam questions as part of a review activity the day before an exam). Furthermore, each activity can be tailored to work within rigidly standardized curricula.

In terms of faculty workload and course sustainability, student-created OERs do not require the generation of large amounts of new materials by the instructor; instructors are encouraged to use what they already have. By relying on existing OER materials as supplements to the student-generated materials, we were able to distribute a portion of course preparation efforts to students while still reinforcing essential information literacy skills and providing course content. Finally, peer-review sessions for student-generated materials are also effective at improving the sustainability of the course by reducing faculty workload because students become first-line evaluators of their own materials and have room to make changes before being graded. The students providing feedback in these sessions are also the primary audience for the course materials being designed. In this way, students engage with unit content multiple times and on multiple cognitive levels before each exam: (1) as students studying the materials, (2) as textbook authors packaging the materials for other students, and (3) as peer reviewers providing feedback on their peers’ packaged materials. Examples of final student synthesis projects as well as assignment sheets are available as Supplemental Material with the online version of this article.

The initial pilot of these OER activities also had important measurable benefits in terms of student learning. While this pilot did not produce enough data to draw concrete conclusions, we found improvements in student performance, particularly on cognitive measures of content synthesis and analysis when compared to a traditional lecture section. A supplemental benefit was improved performance on biology-specific writing tasks. Students were also given traditional exams to assess content knowledge, and preliminary data suggest that scores, on average, were higher than in traditional lecture courses. Ultimately, these activities benefit instructors by reducing course preparation load, and benefit students by placing them at the center of real-world processes that require knowledge synthesis and skill development beyond rote content memorization.

References

Berry, T., Cook, L., Hill, N. & Stevens, K. (2010). An exploratory analysis of textbook usage and study habits: misperceptions and barriers to success. College Teaching, 59(1), 31–39.
Bobek, E. & Tversky, B. (2016). Creating visual explanations improves learning. Cognitive Research: Principles & Implications, 1, article 27.
California OER Council (2016). OER adoption study: using open educational resources in the college classroom. California Open Educational Resources Council white paper.
Delgado, H., Delgado, M. & Hilton, J., III (2019). On the efficacy of open educational resources: parametric and nonparametric analyses of a university calculus class. International Review of Research in Open and Distributed Learning, 2011.
Evagorou, M., Erduran, S. & Mäntylä, T. (2015). The role of visual representations in scientific practices: from conceptual understanding and knowledge generation to ‘seeing’ how science works. International Journal of STEM Education, 2, article 11.
Florida Virtual Campus (2012). 2012 Florida student textbook survey. http://www.openaccessstebooks.org/pdf/2012_Florida_Student_ Textbook_Survey.pdf.

Foos, P.W. (1989). Effects of student-written questions on student test performance. Teaching of Psychology, 16, 77–78.

Hilton, J., III. (2016). Open educational resources and college textbook choices: a review of research on efficacy and perceptions. Educational Technology Research and Development, 64, 573–590.

Martin, M.T., Belikov, O.M., Hilton, J., Wiley, D., & Fischer, L. (2017). Analysis of student and faculty perceptions of textbook costs in higher education [online]. Open Praxis, 9(1), 79–91.

Phillips, B.J. & Phillips, F. (2007). Sink or skim: textbook reading behaviors of introductory accounting students. Issues in Accounting Education, 22(1), 21–44.

Rokusek, S. & Cooke, R. (2019). Will library e-books help solve the textbook affordability issue? Using textbook adoption lists to target collection development. Reference Librarian, 60, 169–181.

Selnack, E. (2014). Fixing the broken textbook market: how students respond to high textbook costs and demand alternatives. Washington, DC: Center for Public Interest Research.

Sikorski, J., Rich, K., Saville, B., Buskist, W., Drogań, O. & Davis, S. (2002). Student-use of introductory texts: comparative survey findings from two universities. Faculty Forum, 4, 312–313.

Walsh, J., Harris, B., Tayyaba, S., Harris, D. & Smith, P. (2016). Student-written single-best answer questions predict performance in finals. Clinical Teacher, 13, 352–356.

Watson, C.E., Domizi, D.P. & Clouser, S.A. (2017). Student and faculty perceptions of OpenStax in high enrollment courses. International Review of Research in Open and Distributed Learning, 18(5).

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