FEATURE ARTICLE

Evaluation of Cost Savings and Perceptions of an Open Textbook in a Community College Science Course

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Abstract

Open textbooks are free, online resources that can replace traditional textbooks and save students money. The costs of traditional textbooks continue to increase, and this can particularly affect at-risk, low-income students. Few studies have analyzed student perceptions of open textbooks and how they influence academic achievement, but the emerging trend is positive. In the present study, I assessed student perceptions of an open textbook and calculated the subsequent cost savings. Although there were some limitations to my study, such as a low sample size, my results closely mirror previous studies in that most students had favorable opinions of the open textbook and would prefer to use them over traditional textbooks. The average cost savings per student was $81 for one course, determined using a novel method that does not assume all students buy new textbooks. These savings were likely important to the students, the majority of whom worked five hours or more and have received Pell Grants or other tuition waivers.

Key Words: *open textbook; open educational resources; environmental science; free text; student perceptions; textbook quality; cost savings; community college students; low-income.*

Introduction

Textbooks promote student success (Bushway & Flower, 2002; Yu, 2011; Skinner & Howes, 2013), but their rising cost may impose substantial financial hardship for students with limited income. Textbook costs increased 1,041 percent between 1977 and 2015, which is more than three times the rate of inflation (Popken, 2015). The estimated costs of textbooks and supplies per annum for community college students in 2016 was $1,390, representing 39 percent of the total cost of yearly tuition (College Board, 2017). A study of community colleges in California calculated this number to be higher at 59 percent (California State Auditor, 2008). Consequently, the cost of textbooks is a concern to both students and faculty (Petrides et al., 2011; Chae et al., 2015; Student PIRGS, 2016).

The two most important features of the open textbook were cost savings and having immediate access.

The high cost of textbooks creates less-than-desirable outcomes for students. A survey of college students in Florida found that 64 percent of students did not purchase a textbook at some point because of high cost (Florida Virtual Campus, 2012). To save money, students may illegally download pirated copies (Young, 2008), buy an older edition, or simply go without a textbook (Fischer et al., 2015). Other money-saving options include renting a textbook, which may prevent students from annotating their books, an effective learning strategy (Wolfe & Neuwirth, 2001).

The high cost of textbooks may negatively impact the proportion of students who achieve their academic goal, a metric known as persistence rate. At risk are economically disadvantaged students, who can have lower persistence rates than wealthier students (Paulsen & St. John, 2002). For these students, the financial burden of textbooks can cause them to take fewer classes per term (Fischer et al., 2015). This is problematic because persistence rates are also substantially lower for part-time students compared to full-time students (NSCRC, 2016). Thus, students who are low-income and part-time are particularly vulnerable.

If textbooks are important to student achievement but prohibitively expensive for some, then what are students to do? Open textbooks, a type of open educational resources (OER), offer a potential solution when faculty adopt them. OER are free to access online or low-cost in print and thus very accessible. Students can view OER such as open textbooks online, by downloading to their computer, tablet, or smartphone; or by printing an inexpensive copy. Several online libraries are now available that disseminate free open textbooks. A popular resource for science texts is OpenStax (www.openstax.org), operated by Rice University. OpenStax claims to have saved students $39 million in the 2015–16 academic year alone (Boyd, 2016). Like traditional textbooks, open textbooks released by OpenStax are written by experts and peer reviewed (Boyd, 2016).

The American Biology Teacher, Vol. 80, No. 6, pp. 410–415, ISSN 0002-7685, electronic ISSN 1938-4211. DOI: https://doi.org/10.1525/abt.2018.80.6.410.

The potential benefits of open textbooks go beyond affordability, however. Faculty appreciate open textbooks because they are customizable (Chae et al., 2015), thanks to open licensing. This allows faculty to modify the text by choosing which chapters to use, adding new material, and revising existing text. Faculty can also make sure that content is up-to-date, and they can contextualize it by including culturally and regionally relevant information.

Open textbooks benefit students through cost savings and empower faculty through customizable content, but are they a viable replacement? The research on this is nascent, but the emerging trend is affirmative. The most complete review to date analyzed 16 studies that encompassed student and faculty perceptions of OER and/or the effect of OER on student achievement (Hilton, 2016). These studies indicated several important things. First, the use of open textbooks resulted in no reduction in student achievement. In some cases, students who used open textbooks demonstrated small positive improvement. Second, students perceived open textbooks favorably, finding them easy to use and up-to-date, and were likely to recommend them to other students. Additionally, many faculty viewed them as being equal or better in quality compared to traditional texts (Hilton, 2016). Based on the available dataset, open textbooks appear to be a viable replacement for traditional texts because they do no harm, and may have several benefits including cost savings and increased student achievement.

For the present study, I wanted to understand students' perceptions of open textbooks to determine if they are a viable alternative to traditional textbooks in my own teaching context. Second, I wanted to determine how much money students saved by the implementation of an open textbook. This was important to me because I teach in a rural county where the median income is 18 percent below the state median (U.S. Census Bureau, 2017). To achieve these goals, I surveyed students after they used an open textbook for an entire 11-week course.

○ Methods

I developed an open textbook for an introductory, college-level environmental science course. It was produced using publicly available, openly licensed materials and supplemented by small amounts of original content. The resulting textbook, titled *Environmental Biology*, is available at https://openoregon.pressbooks.pub/envirobiology and can be viewed using a web browser or downloaded in a variety of file formats, including PDF and EPUB.

The open textbook was used in a four-credit course at a small community college. The 11-week lecture and lab course, titled Environmental Science: Biological Perspectives, included topics such as ecology, biodiversity, climate change, food production, and environmental health. Students were given an overview of the open textbook at the beginning of the course to ensure that they could properly access and use it.

During the final week of the course an online survey was administered to all active students. The survey assessed their use of the textbook, views of its quality, and aspects regarding their actions in previous courses, such as if they tended to buy new or used textbooks, if they have purchased digital texts, or if they have chosen to not purchase a required textbook. Because the survey was given during the final week of the term, students had been thoroughly exposed to the open textbook. The survey was a mix of closed and open questions and was adapted from the work of Bliss et al. (2013a) and Jhangiani et al. (2017). The survey was anonymous and voluntary, allowing students to answer honestly. Approval for the ethical use of human subjects in this study was granted from the institutional review board at a larger regional community college that provided oversight.

One goal of this study was to quantify the average cost savings that resulted from using a free, open textbook. In the survey, students were asked to identify the ways that they had acquired traditional textbooks in the past. Responses included purchasing new or used, print or digital copies, renting the textbook, and getting the textbook for free by borrowing from the library, sharing with a friend, or pirating a copy. Based on the relative frequencies of the responses from the entire class, I estimated the various ways that students would have acquired a traditional textbook, if one were actually used in my class, and used that to calculate an average cost of a textbook. This novel method is more accurate than assuming that every student will buy a new copy.

○ Results

The survey was completed by 18 of 19 students. The class was nearly split between males and females, with 17 percent identifying as belonging to an ethnic minority. One-third of students had received student loans, and two-thirds had received Pell Grants or fee waivers for their tuition. Two-thirds of students were employed at the time of the study, with 39 percent of the class working more than 20 hours a week.

Students indicated a variety of means of obtaining traditional textbooks in one or more previous courses (Figure 1). The most commonly used method was buying used print copies, as indicated by 74 percent of students. The next most common methods were renting a print version (37%), followed by buying a new print copy (32%). Overall, 37 percent of students indicated they did not purchase a textbook at some point, whether borrowing a copy from a friend or library (26%) or illegally downloading it (11%).

There were several other indicators that students previously chose not to purchase required traditional textbooks. For example,

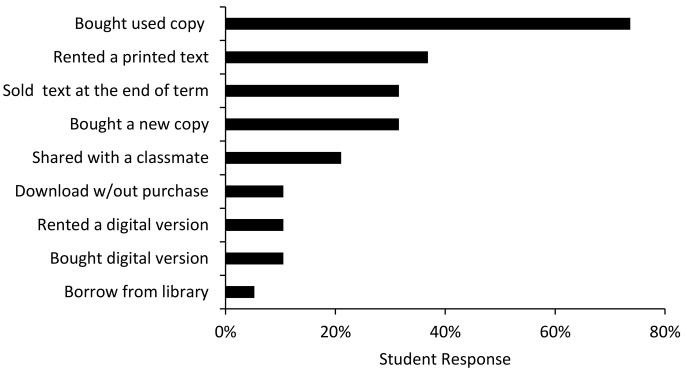

Figure 1. College students were asked to indicate the various ways of acquiring textbooks in previous courses. Shown here are the percentages of students who chose each option at least once (N = 18).

two-thirds of students indicated that they do not always purchase the required textbook (Figure 2). In a separate survey question, fewer students, 44 percent, indicated they had not purchased a required textbook at some time. One-third of students said that not purchasing the textbook caused them to earn a lower grade (Table 1A).

When asked about the open textbook used in the course, 72 percent of students indicated that they used it 2 to 3 times a week.

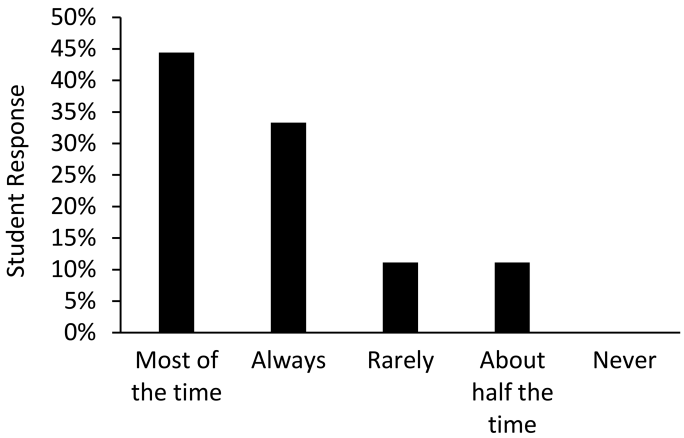

Figure 2. The percentages of college students indicating how often they purchase required textbooks for their classes (N = 18).

The most common method of viewing the text, used by 78 percent of students, was online through a web browser, as opposed to downloading a copy to their device or printing it. The two most important features of the open textbook were costs savings and having immediate access, each indicated by 49 percent of students as being extremely important or very important (Table 1B).

Results from the survey indicated a large majority of students perceived the overall quality of the textbook as being similar to or better than traditional textbooks; only 6 percent of students indicated that the quality was worse (Figure 3A). When asked to explain why they felt the open textbook was superior in quality, the most common theme, given by 50 percent of respondents, was that the textbook was tailored to the class. For example, one student remarked, "Very little wasted space or irrelevant information. All material was 100% relevant and discussed in class." Another student added, "the fact that it was free, of very high quality . . . and dealt with only the information that we would be discussing in class made it an extremely good textbook. Again, the best I have used in any course."

When presented with the option of having to choose between two identical courses that differed only in the type of textbook used, 61 percent indicated that they would choose the course with an open textbook over the course with a traditional textbook. Additionally, 83 percent of students specified that they would be very willing to register in a class with an open textbook (Figure 3B).

Table 1. Responses from two survey questions, one regarding the impact of textbook costs on student actions (top) and another in which students were asked to rate the importance of features in an open textbook (bottom) (N = 18).

(A) Question: How often have you taken the following actions as a result of the cost of textbooks?					
Survey Options	**Never**	**Rarely**	**Sometimes**	**Most of the time**	**Always**
Taken fewer courses	61.1%	16.7%	22.2%	0.0%	0.0%
Not registered for a course	55.6%	16.7%	22.2%	5.6%	0.0%
Dropped/withdrew from course	88.9%	11.1%	0.0%	0.0%	0.0%
Earned poor grade because couldn't afford the text	66.7%	27.8%	0.0%	5.6%	0.0%
Did not purchase the text	55.6%	22.2%	22.2%	0.0%	0.0%
(B) Question: How important to you are the following features of your open textbook?					
Survey Options	**Extremely important**	**Very important**	**Moderately important**	**Slightly important**	**Not at all important**
Cost savings	61.1%	22.2%	16.7%	0.0%	0.0%
Having immediate access	61.1%	22.2%	16.7%	0.0%	0.0%
Convenience & portability of digital format	50.0%	22.2%	16.7%	11.1%	0.0%
Ability to print	16.7%	16.7%	22.2%	38.9%	5.6%
Ability to keep forever	16.7%	11.1%	27.8%	27.8%	16.7%
Ability to share w/others	16.7%	11.1%	50.0%	11.1%	11.1%

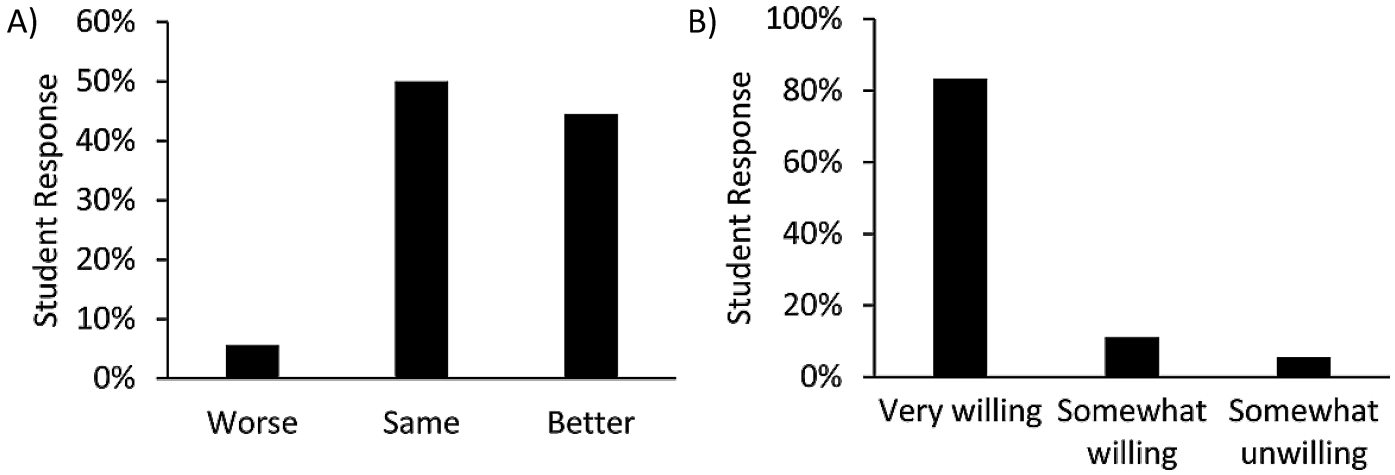

Figure 3. (A) College students rated the quality of the open textbook compared to a traditional textbook (N = 18). **(B)** Students were asked to rate their willingness to take a future course with an open textbook (N = 18). The options "neutral" and "very unwilling" had values of 0% and were omitted from the graph.

I estimated that the average cost savings per student for using an open textbook in this class was $80.78. If I had assigned a traditional textbook for this class, it would have sold in the campus bookstore for $158 new and $118 used. Prices for digital copies and rentals were taken from Amazon.com and ranged from $28 to $75. From the survey results, I estimated that 16 percent of students would have bought a new print copy, 38 percent a used copy, 5 percent a digital text, 25 percent would rent a digital or print copy, and 15 percent would not purchase the text and either borrow it from a friend, get a copy from a library, or illegally download it.

○ Discussion

The results from this study align with previous research: (a) the high cost of textbooks can potentially impede student achievement, and (b) most students have favorable opinions of open textbooks. First, student achievement is impeded when the high cost of textbooks causes students to exhibit actions not conducive to academic success, such as not purchasing a required textbook or reducing their course load. My results indicated that 37 to 66 percent of students, depending on the survey question, had not purchased a required textbook at least once, and one-third of students earned a lower grade because of it. Additionally, 11 to 44 percent of students dropped a class, did not register, or took fewer classes because of textbook costs. These results mirror those from a survey of 320 college students in British Columbia (Jhangiani & Jhangiani, 2017).

Open textbooks offer low- or no-cost options that have the potential for preventing the detrimental actions described above. The students in this study saved an average of $81 by utilizing an open textbook in one course. Considering the number of courses taken by each student per year, widely adopting open textbooks throughout the college would lead to substantial cost savings over time. These savings would likely have meaningful benefits for students, many of whom demonstrated financial need. For example, two-thirds of students received Pell grants or fee waivers, and 39 percent were employed more than 20 hours a week during the course. This may be why 49 percent indicated that costs savings was either an extremely important or very important feature of open textbooks.

Making college more affordable would likely have many benefits for economically disadvantaged students. It is known that students from low-income, rural areas are less likely to attend college than those from higher-income backgrounds, and that those from lower-income backgrounds who do attend college drop out at higher rates (U.S. Dept. of Education, 1999). Although the causes for this are more complex than just the cost of attendance (COA), minimizing those costs makes college more accessible. One specific way that reducing COA could help students is by reducing the number of hours they need to work while enrolled. This is especially important for students that work more than 20 hours per week, which is associated with a lower GPA and more time to complete their degrees (BYU Employment Services, 2006).

A second important finding of this study was that students had favorable views of the open textbook. In terms of quality, 94 percent of students rated the open textbook the same or better than the textbooks used in other classes, a value very similar to the findings of other studies (Bliss et al., 2013a, 2013b; Pitt et al., 2013; Allen & Seaman, 2014; Cooney, 2017; Hendricks et al., 2017). Additionally, 61 percent of students indicated that they would prefer open textbooks to traditional texts, a value close to the two-thirds found by Feldstein et al. (2012). As indicated on an open-ended survey question, students in the present study found accessibility, portability, cost savings, and quality of content to be the most important features of the open textbook.

From my perspective as the instructor, using an open textbook for the first time was a transformative experience. I enjoyed having the freedom to control the material within the textbook. I reorganized content, added new material, and changed formatting, such as bolding terms that I wanted to use in vocabulary quizzes. Also, in keeping with the recommendation to move away from the "mile wide and inch deep" approach to teaching content (AAAS, 2011), I streamlined the text by removing material. This was appreciated

by several students who recognized there was "[v]ery little wasted space or irrelevant information."

There were several limitations to this study, including a small sample size. Although my results cannot be extrapolated to other classrooms, they align with the consensus formed by other research and further support the notion that a diversity of students hold favorable opinions of open textbooks. In terms of experimental design, this study was limited by lack of a control group and it did not assess the efficacy of open textbooks. Further studies are needed, especially in the sciences, to determine whether learning and other measures of academic achievement, such as persistence, are affected by open textbooks.

Surveys of college faculty show varying degrees of familiarity with open educational resources (OER). Allen & Seamen (2014) surveyed 2,144 college faculty across the United States at a variety of institutional types, including community colleges and four-year universities, and found that only 34 percent of faculty were aware of OER. Meanwhile, Chae et al. (2015) surveyed 780 community and technical college faculty in Washington State and found that 82 percent were familiar with OER. Within the archive of *The American Biology Teacher*, I could find no prior mention of OER. No results were found when using the following search terms: "open text*", "free text*", and "open education* resource*". Open textbooks are a promising area in which faculty can make a significant, positive impact on students, especially students from low-income backgrounds. Increased awareness among faculty and additional studies by educational researchers will help determine the best way to implement this important resource.

○ Acknowledgements

This research was supported by a grant from Open Oregon Educational Resources (OOER), which also published my open textbook on their Pressbooks profile (https://openoregon.pressbooks.pub/). Amy Hofer from OOER & Linn Benton Community College provided critical support during development of my open textbook, and provided valuable feedback on this manuscript. Special thanks also goes to the reviewers of this manuscript.

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