Open Educational Resources (OER), No-cost Textbook Alternatives, and Student Success

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Abstract

Textbook prices continue to increase, affecting the cost of higher education and disproportionately impacting students from low-income backgrounds and marginalized communities (Jenkins et al., 2020). This article provides a brief review of the pertinent literature on the impact of high textbook costs on student success metrics and the potential solution offered by Open Educational Resources (OER). High textbook costs are found to be a major source of stress for low-income students, affecting their performance in college classes (Collins et al., 2020). OER has the potential to address this issue by providing students free access to course materials from the beginning of the course. Most research studies indicate that students perform at least as well and sometimes better with OER materials than with traditional textbooks, although OER resulted in performance losses in a few studies (Hilton, 2016). Both students and faculty generally view OER materials favorably and feel the flexibility they provide allows faculty to better match the course materials to the course learning objectives (Fischer et al., 2015). Faculty have noted that switching to OER materials requires considerable time and effort to vet the materials and to create the supplementary materials that would have been provided by a traditional publisher. Nevertheless, many faculty who have designed and taught courses using OER materials would be willing to redesign other courses to utilize OER (Delimont et al., 2016). .

Keywords: Open Educational Resources, OER, textbook costs, textbook prices, equity, course redesign, student success, successful completion rate, free textbooks, textbook alternatives

Open Educational Resources (OER), No-cost Textbook Alternatives, and Student Success: A Literature Review

College education costs have increased significantly in recent years. Tuition, fees, and housing costs have increased exponentially, doubling the percentage of higher education costs paid out-of-pocket by students over the last 3 decades. Scholarships and government aid have not kept pace, resulting in tripling student debt between 2004 and 2012 (Martin et al., 2017). Textbook prices are one significant aspect of the rising cost of a college degree, with price increases that have outpaced the rate of inflation since at least the 1980s (Jenkins et al., 2020). On average, college students now pay over $1,200 yearly for their textbooks (Cozart et al., 2021). In certain parts of the country, this exceeds the annual cost of community college tuition (Martin et al., 2017).

The high cost of textbooks can negatively affect student performance, retention, and completion. In one study, high textbook costs resulted in over half of the students failing to purchase a required textbook, and many students reported taking fewer courses because of textbook costs (Martin et al., 2017). Failure to purchase a textbook around which the course is designed likely results in lower grades or the need to repeat the course altogether (Nipa & Kermanshachi, 2020). The impact of textbook costs on student performance is magnified among those students with low family incomes, particularly those

from historically marginalized communities (Jenkins et al., 2020).

Open Educational Resources (OER) are a potential solution to the increasing cost of textbooks, with the potential to help close equity gaps for those students who are most vulnerable (Nusbaum et al., 2020). OER consists of textbooks, e-books, and other digital media with open licenses permitting low or no-cost access, customization, and redistribution (Nkwenti & Abeywardena, 2019; Valentino, 2015). OER tends to lend itself to better customization by instructors and is often more up-to-date and relevant to local educational needs than books published by traditional publishers (Cozart et al., 2021). Students and faculty favorably view OER's reduced cost and relevance (Fischer et al., 2015). Multiple studies have shown that student performance in many courses redesigned using OER has been equal to or better than performance in the same course using traditional textbooks (Cozart et al., 2021; Jenkins et al., 2020). However, other studies have shown no significant increase in student performance with OER, while a few studies have shown that student performance dropped with OER materials compared to traditional textbooks (Clinton & Khan, 2019; Smith et al., 2020). Large-scale OER course redesigns can be costly and time-consuming for colleges to undertake, so it is important to determine if they are effective.

The literature on the topics of high textbook costs, OER, and textbook-free courses has been extensive, particularly over the past 20 years. This review will explore the history of OER and consider its potential to address issues of equity and justice as they relate to high textbook costs. Maslow's theory of motivation and hierarchy of needs is applied to textbooks and course design as the theoretical framework for understanding the effect of OER on student performance. Literature on OER's impact on student performance and student and faculty perceptions of OER-based courses is also reviewed.

Definition and History of OER

The term Open Educational Resources (OER) was first coined in UNESCO's (2002) forum report on the Impact of Open Courseware for Higher Education in Developing Countries. The forum, convened in partnership with the William and Flora Hewlett Foundation and other non-profit and educational organizations, discussed the need for contextualized, open resources that could serve the need for equitable, affordable, and relevant educational resources around the world (UNESCO, 2002). The forum recommended the following definition for OER: "The open provision of educational resources, enabled by information and communication technologies, for consultation, use, and adaptation by a community of users for non-commercial purposes" (UNESCO, 2002, p. 24).

OER Expansion

Since then, numerous groups have worked to expand the availability and quality of OER. Chief among those groups has been the William and Flora Hewlett Foundation, which is frequently mentioned in the research literature (Choi & Carpenter, 2017; Clinton & Khan, 2019; Doan, 2017; Farrow et al., 2015; Fischer et al., 2015; Hassan et al., 2019; Jenkins et al., 2020; Jones & Nyland, 2020; Ozdemir & Hendricks, 2017; Phillips et al., 2021; Valentino, 2015). In addition, the Foundation has worked over the past 20 years to provide grants, resources, and leadership to the increased development of classroom technology, the creation of educational and distribution networks, and the development of OER content (DeBarger & Casserly, 2021). While proud of its accomplishments, the Foundation acknowledges that additional work is required to ensure that OER continues to become more diverse, inclusive, and accessible (DeBarger & Casserly, 2021).

The Achieving the Dream (AtD) organization launched a multi-year project in 2016 to research and expand the use of OER in community colleges nationwide. Funded by the William and Flora Hewlett Foundation, the Bill and Melinda Gates Foundation, Ascendium, and others, AtD sought "not only an opportunity to significantly scale OER but also try to answer important questions about the academic and economic impacts of broad institutional adoption of openly licensed materials" (Griffiths et al., 2020, p. iv). A 2020 AtD report found that "students who enrolled in OER courses earned significantly more credits with roughly the same cumulative GPA," with savings averaging "$65 or more per OER course" (Griffiths et al., 2020, p. 42). Furthermore, AtD found that "instructors increasingly reported that use of OER prompted changes in pedagogy, suggesting that the OER programs can influence the quality of instruction as well as affordability" (Griffiths et al., 2020, p. 42).

Equity, Justice, and High Textbook Costs

Textbook prices are one significant aspect of the rising cost of a college degree, with price increases that have outpaced the inflation rate since at least the 1980s (Jenkins et al., 2020). On average, college students pay over $1,200 yearly for their textbooks (Cozart et al., 2021). Collins et al. (2020) attribute the steep increases in textbook costs to the rising cost of healthcare and assert that similar factors are to blame. For example, students are required to purchase a product they did not have input in selecting and which was likely designed by a publisher with features geared primarily toward meeting the instructor's needs. Publishers are also updating textbook editions at an increasing rate, often with price increases associated with the new edition(Collins et al., 2020).

Furthermore, publishers often entice faculty members by bundling textbooks with supplemental resources like online access codes, workbooks, and study guides, increasing the total cost to the student. Faculty surveys indicate that less than half frequently use the bundled resources (Collins et al., 2020). Publishers have reacted by producing online textbooks to reduce the cost of printing and, therefore, the cost for the student. However, this is not without problems because the access typically expires after a year, and students are left without a tangible product to resell (Collins et al., 2020).

The increasingly prohibitive cost of textbooks is perceived to negatively impact student performance, retention, and completion. Martin et al. (2017) report on multiple studies of negative student perceptions of textbook prices, including one Florida study that found that high textbook costs prevented 63% of students from purchasing a required textbook. Over one third of students in the study took fewer courses than they wanted because of textbook costs. Cozart et al. (2021) suppose that high textbook costs could determine whether students choose to complete a course. Additionally, failure to purchase a textbook around which the course is designed likely results in lower grades or the need to repeat the course altogether (Nipa & Kermanshachi, 2020). The impact of textbook costs on student performance is magnified among those students with low family incomes, particularly those from historically marginalized communities (Jenkins et al., 2020). Students from marginalized communities were more likely to drop a class, register for fewer classes, or not register at all because of high textbook costs (Nusbaum et al., 2020).

Theoretical Framework

Maslow's theory of motivation is relevant to the problem of high textbook costs and their negative impact on student success. Maslow's (2021) theory asserts that before higher needs like self-esteem and self-actualization can be met, a person must feel that their more basic physiological and safety needs have been satisfied. Physiological needs can include, among other things, food, water, sleep, and shelter. These are fundamental to life and can become all-consuming desires for the individual who is lacking or feels she may soon lack one of these needs (Maslow, 1943). Safety needs are harder to define but relate to having a sense of security, stability, and familiarity (Maslow, 1943).

Basic Needs

In an article published in the middle of the Covid-19 pandemic, Ansorger (2021) related the struggles of students from marginalized groups and those with financial difficulties to Maslow's motivational theory. She points out the stress of the pandemic resulted in the inability of many of these students "to attend to physical, mental and emotional health [and, therefore] these students are not going to be able to maintain focus in a remote setting" (Ansorger, 2021, p. 13). The same can be said for those students who struggle to purchase food for themselves, pay rent, or provide healthcare for their children. These basic needs override the need to purchase a costly textbook, even if it is a requirement for an online course. Students in this situation start their course significantly disadvantaged, not only because of their external situation but also because of a growing sense that they are unprepared and unable to succeed academically.

In a similar vein of thought, Milheim (2020) adapts Maslow's theory specifically to distance education and makes the acquisition of a textbook, class materials, and high-speed internet equivalent to Maslow's basic physiological needs category. Milheim's (2012) suggestion to address this issue is to have instructors provide "clear, concise checklists of essential items that should be obtained by students ahead of the date when classes are scheduled to begin" (p. 131). While this is a reasonable suggestion for some students, it does not solve the problem for students,

it does not solve the problem for students whose access to the textbook is limited by their access to financial resources. Milheim's argument does, however, indicate the importance of the textbook to the prospect of successful course completion.

Safety and Security

The need for a sense of safety and security—the second need in Maslow's hierarchy—also applies to textbook access. A sense of loss or impending loss is the greatest threat to security and, according to Milheim (2012), can affect a student's performance in an online course. The lack of textbook access and the potential for poor grades on assignments until a textbook is acquired can lead to a sense of uncertainty and impending failure. Even if the textbook is acquired before the course ends, the student is already behind, and the sense of loss could continue to plague the student's performance. "Predicting these issues and attending to them in advance of as well as during an online course can aid in mitigating negative student emotion and enhance[e] the [student] experience" (Milheim, 2012, p. 162).

Maslow's Theory Applied at HBCUs

The application of Maslow's hierarchy to college student performance is further supported by comments made in the study by Collins et al. (2020) of OER textbook usage at Historically Black Colleges and Universities (HBCUs). According to the researchers, major concerns for HBCU students include affordability of and prompt access to course materials that are portable. The use of OER materials can "reduce the anxiety and frustration related to not being able to purchase course materials or having to make tough choices between academics and basic needs" (Collins et al., 2020, p. 115). The study also indicated that "OER use helped to reduce worry and stress [among students] related to the financial burden of course materials, while also improving their attention, participation in the course and confidence in their abilities" (Collins et al., 2020, p. 120). These same concerns and opportunities are likely applicable to other college students at non-HBCU institutions, particularly those from economically challenged backgrounds.

Impact of OER and Textbook-free Courses on Student Performance

Multiple studies have shown that student perfor-mance in many courses redesigned using Open Educational Resources has been equal to or better than performance in the same course using traditional textbooks (Cozart et al., 2021; Jenkins et al., 2020). However, other studies have shown no significant increase in student performance with OER, while a few studies have shown that student performance dropped with OER resources compared to traditional textbooks (Clinton & Khan, 2019; Smith et al., 2020).

Focused Studies

A study of a required teacher certification course at the University of Georgia found no statistically significant difference between end-of-course grades for students using OER versus those using a traditional textbook (Cozart et al., 2021). Researchers conducted the analysis using a standard t-test, with the results $t(208) = -1.195$, $p = 0.233$. The same study found no significant difference between failure and withdrawal rates for the two cohorts (Cozart et al., 2021). Cozart et al. (2021) concluded "that student outcomes in the OER condition …were not negatively affected using OER, thus supporting the equal quality of OER to traditional textbooks" (p. 8).

A similar study of nearly 300 students in two introductory art class sections was conducted at Boise State University in Idaho, with approximately half the students in a section using a traditional textbook and half in a section using OER. The study compared the results of student responses to a Likert-scale survey asking how often they utilized the textbook, with possible responses of always, most of the time, about half the time, sometimes, and never. The researchers found that students using OER were more likely to read their text than those in a course using a traditional textbook (Jones & Nyland, 2020). This determination was based on an evaluation of the survey results using a Wilcoxon Signed-Ranks Test ($Z = -5.604$, $p < 0.001$). Approximately 40% of students using the traditional textbook indicated they read the textbook "always" or "most of the time" compared to over 80% of students using the OER text. Surprisingly, even though students said they were more likely to read OER, there was still no statistically significant difference in the mean end-of-course grade as determined by a Welch Two Sample t-test, also known as a Welch unequal variances t-test ($t - 1.011$, $p = 0.3129$) (Jones & Nyland, 2020).

Choi and Carpenter's (2017) study of students in Human Factors and Ergonomics course sections at Georgia Tech also found no significant difference in end-of-course grades after the course was redesigned using OER. The study based its assessment on class grades from the midterm and final exams and the final course average. Data from courses taught in the two semesters before the redesign was collected and compared to data from 3 post-redesign semesters. The mean of final grades in the two semesters prior to the OER-based redesign were 90.45 (SD = 3.49) and 88.08 (SD = 4.18). For the three semesters following the OER-based redesign, the mean of final grades was 88.54 (SD = 4.39), 87.41 (SD = 3.64), and 88.48 (SD = 3.64).An unfortunate and significant shortfall in the published results is the study's lack of indication of the statistical tests used to determine the statistical significance of its results (Choi & Carpenter, 2017).

A smaller-scale study of students in American Government and Social Problems courses at a Texas HBCU compared exam grades and final grade distributions before and after the adoption of OER materials (Collins et al., 2020). Using t-test comparisons of exam scores in the Social Problems course, the study found that students using OER materials performed consistently higher on all four course exams than students using the traditional textbook. The t-statistic was 2.59 with p = 0.001 for a comparison of the average exam grades before and after the course was converted to use OER. Students in the OER-based section had an average score of 83 on the exams, compared to an average score of 77 in the section using a traditional textbook (Collins et al., 2020). In the American Government course, t-tests confirmed that students using OER materials performed better on the first two course exams than those using the traditional textbook and performed neither better nor worse on exams 3 and 4 (Collins et al., 2020). In both courses, the study used t-tests to confirm that students using OER materials were more likely to have final course grades of A or B and less likely to score a C or D. For the American Government course, the overall success rate increased from 73% to 81% once the course was redesigned using OER materials. In the Social Problems course, the success rate increase was even more dramatic, increasing from 68% to 86% (Collins et al., 2020). The study confirms that well-designed OER-based courses have the potential to make significant improvements in student performance.

Broad-based Studies

A wide-ranging study involving data from over 16,000 students by Fischer et al. (2015) looked at results from four different 4-year colleges and six different community colleges across the United States. Unlike the studies mentioned above, this study was not limited to students in a particular course or even a particular subject area. Instead, it looked at 15 different courses, including courses in business, math, biology, psychology, and English. It was also a more diverse study, with minority students making up 57.5% of the sample and female students making up 59.8% (Fischer et al., 2015). The study utilized propensity score matching to "create subsets of students who were statistically similar across…age, gender, and minority status" to "reduce variance associated with covariates" (Fischer et al., 2015, p. 165). In an introductory business course, students using traditional textbooks outperformed those with OER in both pass rates and overall grade distributions. Pass rates were analyzed with chi-square tests of independence, while overall grade distributions were analyzed using an Independent Samples t-test. Approximately two thirds of the courses analyzed showed no statistically significant differences in either of those metrics. Approximately one-third of the courses found an improvement in both the course pass rate and overall grade distribution after being converted to OER (Fischer et al., 2015). The study also found that students enrolled in OER-based courses took higher credit loads—"an indicator of student progress toward graduation"— as determined using an analysis of covariance (ANCOVA; Fischer et al., 2015, p. 168). While the study is wide-ranging and provides a broad look at OER's potential to reduce textbook costs while supporting student success, a limitation of the report is its failure to provide the numerical results of its statistical analysis for some of the outcomes.

A meta-study of OER-related literature indicated that the use of OER generally results in either a slight improvement in student performance or the differences between OER and traditional textbooks are statistically insignificant (Hilton, 2016). Hilton, however, does report that students using OER in a particular business course received "on average almost a full grade lower than their peers" (Hilton, 2016, p. 579). Similarly, students in an "OER vers-

ion of [a] psychology course…received a half-grade lower for their final grade" compared to students using a traditional textbook" (Hilton, 2016, p. 579). It is clear from these studies that the impact of OER on student performance can vary from course to course and college to college. Whether or not the difference in results is dependent on the student population, faculty buy-in, the quality of the OER material, or a combination of factors remains to be determined.

A more recent study by Marsh et al. (2022) examined the impact of Open Education North Carolina (OENC) grants on the closing of equity gaps between White and non-White students. OENC grants were awarded to many colleges within the North Carolina Community College System (NCCCS) for the purpose of redesigning courses to use OER. Specifically, the study compared student success rates in introductory biology courses at colleges receiving OENC grants to the success rates at similar colleges that did not receive the grant (Marsh et al., 2022). Student success was defined as a final grade of C or above in the biology course. A propensity matching algorithm was used to "identify colleges [in the control group] that were most similar to the treatment group" (Marsh et al., 2022, p. 9). Equity gaps were measured in the pre-OENC year and the OENC implementation year. The study found that the average equity gap between White and Black students increased 3.06% in the control group but declined 6.00% in the treatment group. A two-sample t-test confirmed that the change in gaps was significant, with t = -2.265, p = 0.04 (Marsh et al., 2022). Additionally, the equity gap between White and Hispanic students increased 7.17% within the control group but decreased 5.17% in the treatment group. Again, a two-sample t-test found the gap difference to be statistically significant, with t = -2.192, p = 0.05 (Marsh et al., 2022). The researchers concluded that while "OER implementation is not a panacea for student success gaps, it is a reasonably inexpensive approach to addressing equity issues at both the institutional level and at the classroom level" (Marsh et al., 2022, p. 11)

Student Perceptions of OER and Textbook-free Courses

OER is typically viewed favorably for cost and relevance by both students and faculty (Fischer et al., 2015). Cozart et al. (2021) performed a study of un-

dergraduate education students' perceptions of OER and no-cost course materials. Students in a course section using a traditional textbook were surveyed, as were students in a section of the same course that used OER materials. Open-ended questions on the survey were evaluated using a qualitative analysis (Cozart et al., 2021). Their findings suggest that many students in the study did not purchase a traditional textbook even when it was available, and some who did purchase it used it rarely (Cozart et al., 2021). Those students who used OER and other no-cost materials appreciated "the cost savings, easy access, and relevant content" the materials provided (Cozart et al., 2021, p. 13). While some students stated they would have preferred having a traditional textbook, the majority "felt a traditional textbook would not have helped them be more successful in the course" (Cozart et al., 2021, p. 13).

In a similar study, surveys were sent to over 2000 students enrolled in Fall 2014 OER-based courses at the University of Massachusetts to assess student perceptions of their courses (Delimont et al., 2016). The authors report that the majority of students supported this type of course design because of the cost reduction and used the OER material "somewhat more than a normal textbook" (Delimont et al., 2016, p. 6). A minority of students still supported OER-based courses but for different reasons like ease of access and the customization of resources to fit the course instead of the other way around (Delimont et al., 2016). Those few students who did not like the OER-based courses indicated that they would have preferred to have a physical textbook or preferred reading from paper rather than a screen. Less than 5% of respondents had technical issues with the resources or felt they were of lower quality than traditional textbooks (Delimont et al., 2016). Unfortunately, this study fails to consider the financial status of the student, which could greatly influence their appreciation of OER.

To determine the perception of HBCU students utilizing OER materials, an important study by Collins et al. (2020) used surveys containing quantitative and open-ended qualitative questions. Quantitative "yes-no" questions were used to determine if students felt that OER materials helped them improve or increase their participation, interest, satisfaction, performance, confidence, engagement, collaboration, and study habits related to the course. The results of the quantitative survey questions were over-

whelmingly one-sided, with nearly 90% of the more than 200 respondents indicating OER improved or increased each of the course-related categories mentioned above (Collins et al., 2020).

A single open-ended question in the study by Collins et al. (2020) provided an opportunity for qualitative responses focused on whether students felt that free course materials impacted their course mastery. Using content analysis, the researchers identified two main themes—mental health and course success—and also identified a few student critiques (Collins et al., 2020). Students indicated that the reduced stress resulting from free course resources allowed them to have improved attitudes toward the course and a greater interest in learning. Students also indicated that the ease of digitally accessing OER materials increased their learning by increasing their ability to study while on the go. Improvements in course success were also attributed to having access to course materials beginning with the first day of class, increasing students' confidence when interacting with the instructor and other classmates (Collins et al., 2020). Critiques of the OER-based courses included a lack of a physical textbook when desired, inconsistencies in phrasing between exam questions and the OER materials, and a perceived lack of depth in some parts of the OER textbooks (Collins et al., 2020).

Faculty Perceptions of OER and Textbook-free Courses

OER tends to lend itself to better customization by instructors and is often more up-to-date and relevant to local educational needs than books published by traditional publishers (Cozart et al., 2021). Surveys of faculty in the study by Delimont et al. (2016) provided Likert-scale questions with open-ended follow-up questions. The study indicated that most faculty felt students performed at least as well using OER as with traditional textbooks (Delimont et al., 2016). Many faculty also felt student learning was better because OER-based courses "were more up to date," and some felt more "confident referring students to [OERs] to learn outside of classroom time" (Delimont et al., 2016, p. 8). Interestingly, even though most faculty felt there was some difficulty in creating or adopting OER, the vast majority surveyed enjoyed teaching with OER because of the ability to customize the content (Delimont et al., 2016).

A survey of faculty who had been involved in stipend-funded OER course designs at Central Washington University was designed to determine the level of difficulty in identifying OER materials (Valentino & Hopkins, 2020). Of the 23 faculty completing the survey, most "found the materials easy to find, while only two rated the difficulty a 7 out of 10 (10 being most difficult)" (Valentino & Hopkins, 2020, p. 508). Sources of difficulty for these two respondents included the need to search through multiple Internet sites. Some of the most common materials utilized by faculty in OER redesigned courses included "open textbooks, articles from the library, open access articles, e-Books from the library, websites, and government sources" (Valentino & Hopkins, 2020, p. 508). The majority of the 23 faculty participating in the survey indicated they would consider redesigning another course using OER materials (n = 15) or that they had already participated in additional OER redesigns (n = 3; Valentino & Hopkins, 2020).

Synthesis Graphic

Figure 1 illustrates the expected relationship between the design of OER-based courses and positive outcomes for both students and faculty.

Figure 1

Expected Effects of OER-based Course Designs
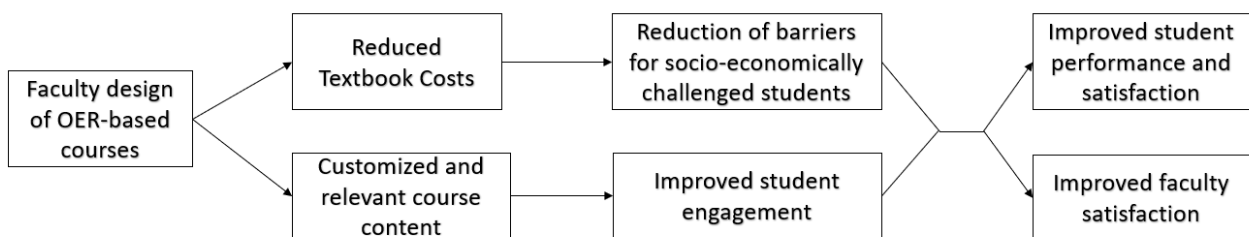
Gaps in the Literature

A study by Jenkins et al. (2020) indicates that additional research on the impact of OER on underserved and marginalized communities is needed, along with research on other social justice-informed approaches to course design and pedagogy. The research literature has also failed to focus specifically on the impact of OER and textbook-free course designs at rural community colleges. Most studies have taken place at larger, more urban institutions. Naturally, most OER studies are limited in scope to specific courses or specific types of institutions. As a result, additional studies are required to further determine the effectiveness of OER course designs on student success metrics.

Summary

This paper has presented a review of the scholarly literature related to the use of OER resources to address inequities by reducing textbook costs, improving student performance, and engaging faculty. The literature review has shown that textbook costs are a barrier to student success, particularly for students from traditionally marginalized and economically disadvantaged communities (Jenkins et al., 2020). OER has been proposed as a potential solution to this problem and has extensive support from organizations like Achieving the Dream and the William and Flora Hewlett Foundation. Maslow's theory of motivation and the accompanying hierarchy of needs has been shown to be a theoretical framework that relates the ready availability of course materials to student success metrics (Milheim, 2012). Previous research on the impact of OER-based courses on student performance has generally shown that students perform as well or better with OER materials compared to traditional textbooks. However, some studies indicate that OER-based courses could result in decreased student performance, indicating the need for further study (Hilton, 2016). Students and faculty generally have positive perceptions of OER-based courses, but there are still potential factors to be addressed. However, additional research on the impact of OER on underserved and marginalized communities is needed, along with research on the impact of OER on college students in rural communities.

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