

Open Educational Resources (OER) Efficacy and Experiences: A Mixed Methods Study

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abstract: This study compared course passing and completion rates of undergraduate students to determine if there was any relationship between use of open educational resources (OER) and these two outcomes. Students who took OER courses and faculty who taught with OER shared their perceptions of the impact of such resources on learning outcomes and teaching methods.

The quantitative analysis revealed that using OER had a positive impact on course passing rates (7 percent increase) and completion rates (10 percent increase) for all students. The qualitative analysis revealed the student perception that OER had some positive impact on their course participation and ability to pass, but less influence on course completion. Faculty perceived little to no increase in passing or completion rates. As a result of OER, students and faculty observed a significant increase in student engagement, and all faculty reported an evolution in pedagogical approaches.

Introduction

UNESCO defines open educational resources (OER) as teaching, learning, and research materials in any medium—digital or otherwise—that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation, and redistribution by others with no or limited restrictions. OER have been in existence at least since the 1990s¹ and can include such materials as lesson plans, quizzes, videos, open textbooks, software, lab experiments, and assignments. Funding to support OER at public academic institutions has grown exponentially in the last few decades, evolving teaching methods and enhancing learning, challenging traditional publishing models, and openly disseminating educational information.

portal: Libraries and the Academy, Vol. 23, No. 4 (2023), pp. 773–798.

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OER removes cost barriers for students by eliminating expenses for course materials.

The principles and characteristics of open educational resources align with many of the priorities of the University of Northern Colorado (UNC) in Greeley. Teaching is strongly valued at UNC, which started as a teacher's college in 1889. According to the university's 2021 Fall Census Enrollment Profile, 42 percent of the undergraduate students had first-generation status, 36.2 percent were from underrepresented minorities, and 28 percent were low income and eligible to receive Pell Grants.² Like many universities, the UNC's planning priorities include eliminating student barriers to progress and engaging them while supporting creativity and discovery.³ OER removes cost barriers for students by eliminating expenses for course materials. Beyond cost savings, additional benefits to using OER include greater student engagement and increased pedagogical innovation.⁴

Maintaining and increasing undergraduate enrollment is an ongoing challenge for many higher education institutions. According to a report accessed on December 1, 2021, full-time undergraduate students at UNC had a retention rate of 69 percent from fall 2019 to fall 2020. To keep students and to encourage faculty to adopt OER, we need to better understand student and faculty experiences using such materials and how they may impact students' academic success and faculty's teaching. This study explores how OER affects students' course passing and completion rates and engagement, and how such materials influence faculty pedagogical approaches. There are many definitions of student academic success⁵ and engagement.⁶ For the purposes of this study, course passing and completion rates, as well as student-generated definitions of success and engagement, provide the overarching measure of academic achievement.

The University of Northern Colorado formally launched an OER initiative in 2018. In 2018, 2019, and 2020, the university received funding from the Colorado Department of Higher Education to support interested instructors in switching from commercial to open materials. The state funding also supported professional development activities and financed a graduate student to promote the work of the university's Open Educational Resources (OER) Committee.⁷

During the first two rounds of grants, 21 faculty (who included 3 graduate students on small teams) received funding through an application process with oversight by the OER Committee. Faculty who obtained funding to change to all OER materials represented various disciplines, and their courses ranged from first year through graduate level. Four years after the implementation of the university's OER initiative, this mixed methods research study asked the following overarching research question: To what extent has OER contributed to student academic success? To answer this question, the author developed the following quantitative and qualitative questions:

- Does taking a course using open educational resources (OER) have a relationship to student academic outcomes of course passing and course completion rates?
- Which student demographic populations appear to benefit most from use of OER?



- What are student and faculty perceptions of the impact of OER on student outcomes and engagement?
- Did faculty change their pedagogical approaches because of teaching with OER, if so, how?

The study sought to extend the existing research on the impact of OER on students and faculty in a variety of ways. It provides results from an investigation at a doctoral/professional university, whereas other OER efficacy studies typically focus on R1 institutions, undergraduate colleges, and community colleges. This study adds to the body of analyzed quantitative and qualitative data from courses using OER in a variety of disciplines and levels (first year through senior) and includes many types of OER, in addition to open textbooks. Travis York, Charles Gibson, and Susan Rankin suggested in 2015 that researchers expand their definitions of student success to go beyond academic achievement.⁸ Therefore, it was important to interview students and faculty regarding their perceptions of learning and engagement with OER. Finally, the qualitative aspect of the study gives a fuller picture of OER impact by highlighting student satisfaction with their educational experience using such resources.

Literature Review

T. J. Bliss and Mike Smith describe the early history of OER as the years 1994 to 2004.⁹ Several states in the United States have since created programs and legislation to increase use of OER and affordable learning.¹⁰ Many faculty and instructors at academic institutions, either through grant programs or of their own volition, have adopted, adapted, created, and implemented OER in their courses. Because of this continued increase in the use of OER, a large and growing body of research strives to determine what impact OER has on teaching and learning.

Many quantitative studies connect OER use and positive changes to various student outcomes. Two seminal studies are worth noting. In 2015, Lane Fisher, John Hilton, T. Jared Robinson, and David Wiley found that 16,727 students enrolled in OER courses performed as well as or better than students in non-OER courses in completion and final grade, and enrolled at higher rates the following semester.¹¹ Nicholas Colvard, C. Edward Watson, and Hyojin Park studied 21,822 student metrics in 2018. They found students had higher grades and a lower DFW rate, the proportion of students who received a D or F or withdrew, than did their counterparts in OER courses.¹² An examination of 78,593 students from across 11 studies found that courses with open textbooks had withdrawal rates 29 percent lower than courses with commercial textbooks.¹³ In 2017, Kim Grewe and William Davis considered student achievement in an online history course to determine if OER use impacted grades. Their results showed a moderately positive relationship between taking an OER course and academic achievement.¹⁴ In a 2012 study at a public university, higher grades were correlated with core business courses that used open textbooks.¹⁵

Some research found that use of OER had only a small impact on student outcomes.¹⁶ Other studies found no effect on student outcomes such as grades or the likelihood of passing or withdrawing from a course. Jennifer Engler and Randi Shedlosky-Shoemaker



in 2019 attempted to discern whether OER versus commercial textbooks influenced content proficiency as measured by exam performance in a psychology course. They found that commercial texts were no more effective than no-cost alternatives.¹⁷ In a 2017 study, Emily Croteau reported on primarily quantitative findings of student outcomes related to a state grant program. She found no significant differences in completion rates, grades, and final exam scores pre- and post- OER. She concluded that OER “helped save students money without negatively impacting learning outcomes.”¹⁸ Phillip Grimaldi, Debshila Mallick, Andrew Waters, and Richard Baraniuk in 2019 provided a constructive critique of OER and educational research literature. They concluded that standard research methods may not detect the learning benefit of OER, which is why some studies show null effects.¹⁹

John Hilton’s 2016 review included 16 studies on the influence of OER on student outcomes in higher education settings or the perceptions of students and instructors regarding OER. Hilton found that OER did not appear to negatively influence learning

OER did not appear to negatively influence learning and that students and instructors alike perceived open resources as more likely to help students learn.

and that students and instructors alike perceived open resources as more likely to help students learn. He noted that cost savings may have influenced students’ perceptions of OER and that the teachers surveyed had selected the materials, so there may have been some bias in these responses.²⁰ Hilton’s follow-up 2019 review found similar results; more than 95 percent of the published research shows OER does not lead to lower student learning outcomes.²¹

Studies focused on student and faculty perceptions of OER have found appreciation of the cost savings, accessibility, and more diverse materials. Young Mi Choi and Cathy Carpenter found no significant difference in student grades after OER was implemented, but students said they appreciated the multiple perspectives afforded by the materials.²² In a perceptions study of OER by Cailean Cooney, students reported that their learning habits had improved and they observed enhanced teaching methodologies from their instructors.²³ A 2013 study by T. J. Bliss, T. Jared Robinson, John Hilton, and David Wiley included perceptions from community college students and instructors using OER. Many students felt their learning improved, and most teachers reported a change in their pedagogical practice.²⁴ In 2020, Jennifer Lantrip and Jacquelyn Ray described perceptions among community college faculty of how OER impacted their pedagogy and influenced student learning. Faculty in Lantrip and Ray’s study believed OER increased student access to higher education and boosted engagement, possibly because of modifications to their teaching practices.²⁵ At least two studies focused on faculty perceptions of OpenStax, a nonprofit publisher of free, peer-reviewed textbooks. Results showed that instructors perceived students performed the same or better with the OpenStax books.²⁶ A 2014 report provided recommendations based on interviews with faculty in Washington state’s community and technical college system. The interviewees declared that benefits of OER included an ability to evolve course content, more active student involvement, and more diverse subject matter. Challenges included lack of time to implement OER and wading through large amounts of content. Their recommendations included setting clear college-level policies to support and sanction OER on campuses.²⁷



Few OER efficacy studies combine quantitative and qualitative (specifically interview) data. In 2020, Ian McDermott recommended that “qualitative approaches used in OER studies could be incorporated more often to center students’ voices.”²⁸ Studies with qualitative approaches have typically relied on surveys to gather student and faculty input. This study seeks to fill a gap by bringing together quantitative data from an institution and qualitative data from students and faculty interviews to more fully understand the impacts of OER on student success and faculty pedagogical practices.

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Theoretical Framework

This study sought to understand the potential effects of OER using the cost outcomes usage perceptions (COUP) framework. Bliss, Robinson, Hilton, and Wiley developed the framework in 2013, classifying OER impacts into four categories: (1) cost—the financial impacts of OER; (2) outcomes—learning impacts, such as academic performance, of OER; (3) usage—ways of using OER; and (4) perceptions—opinions and feelings of learners as well as instructors toward OER.²⁹ The COUP framework is the Open Education Group’s approach to studying the impact of OER in secondary and postsecondary education.³⁰ Because of the framework’s prominence, the author decided to align this study with COUP and to combine quantitative and qualitative data using two of the categories outlined in the framework, outcomes and perceptions. The study expands on the existing literature by asking students and faculty about their experiences learning and teaching with OER.

Methods

Design

This study employed a concurrent mixed methods design. Mixed methods research is “research in which the investigator collects and analyzes data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of inquiry.”³¹ This design was deemed the most appropriate because the goal was to compare the quantitative and qualitative results to reach a well-substantiated conclusion.³²

Figure 1 shows a diagram of the mixed methods design used in this study. The quantitative and qualitative methods were employed concurrently and given the same weight.³³ Therefore, the two types of data were collected and analyzed separately to answer the encompassing research question, to what extent does OER contribute to student academic success? The quantitative analysis looked at the overarching impact OER has on student passing and completion rates and how OER influences various demographic groups, such as those with first-generation status or Pell Grant eligibility and underrepresented minorities. The qualitative analysis of the interview data provided



further insight into whether OER influenced student academic outcomes and other, less measurable indicators of success, such as class engagement. The qualitative analysis also provided insight regarding how OER use influenced faculty pedagogy.

Data Collection Procedures

The university's Institutional Review Board (IRB) approved the use of institutional data for the project's quantitative analysis and its approach to qualitative data gathering, and assigned it exempt status (protocol #2107027901). The author also received data steward approval from the registrar and the director of the Office of Institutional Research and Effectiveness to use the quantitative data. Course registration numbers (CRNs) for 18 courses with 84 sections that used OER between the fall 2019 and summer 2021 semesters were provided, as well as CRNs for 67 sections of the same courses that did not use OER during the same semesters. Courses were identified as using OER by instructors' participation in fall 2019 and fall 2020 in the university's OER grant program, which provided competitive stipends for interested faculty to switch from commercial materials to OER. The demographic factors gathered for analysis were first-generation status, Pell Grant eligibility, and underrepresented minority status. The academic outcomes collected included final grade for the course (passing or failing) and whether the student withdrew from the course or received a grade of incomplete.

The qualitative data collection of the study consisted of semi-structured interviews of UNC undergraduates who had taken a course using OER from the fall 2019 semester through summer 2021 and interviews of UNC faculty and instructors who taught with OER and no-cost materials for the same period. The interviews took place via online video. Semi-structured interviews were conducted to elicit experiences teaching and learning with OER. Interview questions were intentionally designed to add to the understanding of how OER impacted course passing and completion rates. The student interview questions (see Appendix A) revolved around student perceptions of using OER in a course, if the OER had a role in their academic outcomes or other university success, and how they perceived the benefits and challenges of the materials. The faculty interviews (see Appendix B) focused on whether OER had an impact on student academic outcomes and on faculty motivations to use OER, on challenges and successes, and if and how their pedagogical approaches changed because of using such resources in their course.

The Office of Institutional Research and Effectiveness initially provided the researcher with e-mail addresses of students who had been identified as taking an OER course between fall 2019 and summer 2021. The invitation to interview was e-mailed to students in groups of 200 between September 27 and October 22, 2021. The researcher requested a final group of e-mails to recruit more students to help assure saturation in the interview themes. Saturation means that adding more participants to the study would not result in additional data. Seeing similar instances repeatedly allows the researcher to become more empirically confident that a category has reached saturation.³⁴ The students were e-mailed using blind carbon copy to protect their privacy, and all potential student participants were offered a \$20 gift card to thank them for their time and feedback. All student and faculty interviewees received a consent form and the

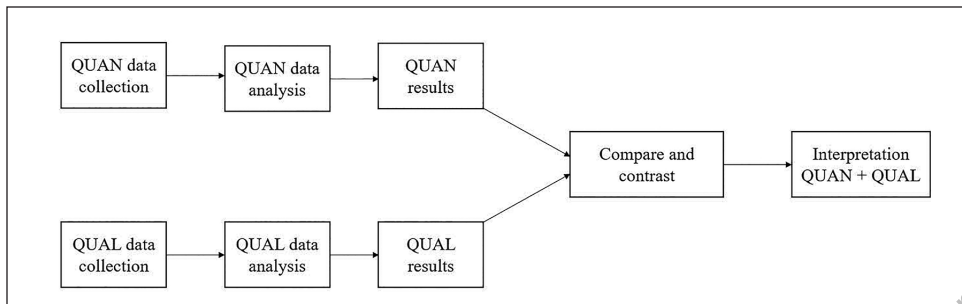


Figure 1. A diagram of the mixed methods design employed in this study, which used both quantitative and qualitative methods to investigate the research questions.

interview questions before the online interview appointment. Interviewees could ask any questions before the start of the interview, and they provided their verbal consent to participate in the interview and have it recorded. A unique instructor ID was used in the data collection, and a limited amount of demographic information was gathered about interviewees to protect privacy. First name aliases were used for all interviewees. The researcher contacted all departments with courses involved in the project to confirm that none of them underwent a significant restructuring from 2019 to 2021, which could have influenced student outcomes.

Participants

The quantitative data included a total of 6,669 students for the terms fall 2019 through summer 2021. The breakdown per semester appears in Table 1.

For the qualitative portion of the study, of the 1,203 students e-mailed, 18 were interviewed between September 29 and October 29, 2021. Of 21 faculty members contacted, 8 agreed to be interviewed; the faculty interviews occurred between October 5 and October 27, 2021.

The student interviewees represented a variety of majors and academic levels. The demographic information gathered for students covered their year in school, area of study, and college affiliation (see Table 3). Demographic information for faculty included their tenure status, years teaching at UNC, and college affiliation (see Table 4). On average, student interviews lasted 25 minutes, and faculty sessions averaged 41 minutes in length.

Study Variables

Demographic variables included first-generation status (defined by UNC as students who do not have a parent or guardian who graduated from a four-year college); Pell Grant eligible status (defined by UNC as students who submitted the Free Application for Federal Student Aid or FASFA requesting financial assistance that year and were found to be financially needy); and underrepresented minority status (defined by UNC as students who are U.S. citizens or legal permanent residents who identify as Black/African American, Hispanic/Latino/a, American Indian or Alaskan Native, or Native Hawaiian or Other Pacific Islander either as a sole ethnic identity or as a multiethnic



Table 1.
Participants in OER versus non-OER courses, by semester

Semester	OER courses	Non-OER courses
	N(%)	N(%)
Fall 2019	407 (22.2%)	1,424 (77.8%)
Spring 2020	282 (17.6%)	1,317 (82.4%)
Summer 2020	74 (28.2%)	188 (71.8%)
Fall 2020	904 (59%)	629 (41%)
Spring 2021	799 (65.2%)	427 (34.8%)
Summer 2021	126 (57.8%)	92 (42.2%)
Total	2,592 (38.9%)	4,077 (61.1%)

person). The dependent variables were passing rate, meaning the student passed the course with a grade of C– or above or a satisfactory, and completion rate, meaning the student did not withdraw from the course or receive an incomplete grade.

Quantitative Data Analysis

The quantitative analysis was conducted in four stages. First, descriptive analyses of all study variables were performed. Second, chi-square analyses were carried out to assess whether the students' demographic characteristics were the same between OER and non-OER sections of courses for each semester (fall 2019, spring 2020, summer 2020, fall 2020, spring 2021, and summer 2021) and overall. Third, chi-square analyses were performed to assess whether students' passing rates (C– and above) and completion rates were significantly different based on whether they were enrolled in OER course sections for each semester and overall. Finally, chi-square analyses were done to assess whether the passing rates of first-generation, Pell Grant eligible, and underrepresented minority students were significantly different based on whether they were enrolled in OER course sections for each semester and overall. All analyses were performed using IBM SPSS Statistics Version 27.0 at the 1 percent level of significance (p -value < .01 indicated if findings were statistically significant).

Qualitative Data Analysis

Qualitative data analysis began as the data were collected and involved constant comparison and thematic analysis. Barney Glaser and Anselm Strauss suggest that when used to generate theory, the comparative analytical method can be applied to social

units of any size.³⁵ Constant comparison will also contribute to the validity of the scale items. Matthew Miles and A. Michael Huberman suggest that data should be coded descriptively or interpretively.³⁶ A thematic analysis consisting of six steps as described by Virginia Braun and Victoria Clarke was used to analyze the qualitative data.³⁷ To ensure credibility of the interview data, the transcripts were sent to all interview participants to give them an opportunity to provide any corrections needed. After interviewee answers were sorted by question (that is, all the responses to question 1 were grouped together, and so on), the researcher identified frequency of terms and concepts, which assisted with development and identification of codes. The author was comfortable that “saturation in salience” was reached—that is, the most salient items had been obtained—with the two groups of interviewees, a concept that Susan Weller and her coauthors point to as key to meaningful analysis for smaller sample sizes.³⁸

Results

Quantitative Analyses

The quantitative analysis maps to the outcomes component of the COUP framework.

Students' Characteristics

The results of the chi-square tests indicated no difference in the characteristics of the students who attended the OER and non-OER courses from the fall 2019 to summer 2021 semesters. In fact, the chi-square tests revealed that the proportions of first-generation, Pell eligible, and underrepresented minority students were the same between the OER and non-OER course sections. The results are presented in Table 2.

Furthermore, the proportions of first-generation, Pell Grant eligible, and underrepresented minorities were the same for each semester that offered both OER and non-OER courses. Therefore, the distributions of students based on their characteristics were the same between the OER and non-OER course sections.

Final Grades

The results of the chi-square tests showed that OER courses had an overall higher passing rate than non-OER courses ($\chi^2(1) = 5.4729, p < .001$), whether or not students were first generation, Pell Grant eligible, or underrepresented minorities. The passing rate in OER courses was 87.2 percent compared to 80.2 percent in non-OER courses. When assessed semester by semester, this significance difference observed in passing rate between OER and non-OER courses was valid for the fall 2020 ($\chi^2(1) = 37.549, p < .001$) and spring 2021 ($\chi^2(1) = 89.496, p < .001$) terms.

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Completion Rates

The results of the chi-square tests showed that OER courses had an overall higher completion rate than non-OER courses ($\chi^2(1) = 280.156, p < .001$). All students in OER courses,



Table 2.
Chi-square results for student demographics

		Non-OER	OER	Chi-square	p-value
First generation	Number	1,746 (4,124)	1,083 (2,592)	.201	.654
	Percentage	42.3%	41.8%		
Pell eligible	Number	1,258 (4,124)	762 (2,592)	.926	.336
	Percentage	30.5%	29.4%		
Underrepresented minority	Number	1,342 (4,124)	803 (2,592)	1.785	.182
	Percentage	32.5%	31.0%		

whether or not first generation, Pell eligible, or underrepresented minority, completed their courses, while about 10 percent of students in non-OER courses withdrew and did not complete their courses. When assessed semester by semester, this significance difference observed in completion rate between OER and non-OER courses was valid for the fall 2019 ($\chi^2(1) = 34.421, p < .001$), spring 2020 ($\chi^2(1) = 27.290, p < .001$), fall 2020 ($\chi^2(1) = 114.7925, p < .001$), and spring 2021 ($\chi^2(1) = 217.119, p < .001$) terms.

First-Generation

The results of the chi-square tests revealed that an overall higher percentage of first-generation students passed their OER courses than their counterparts in non-OER courses ($\chi^2(1) = 13.885, p < .001$). About 84 percent of first-generation students passed their OER courses, compared to about 79 percent of first-generation students in non-OER courses. When assessed semester by semester, this significance difference observed in passing rate among first-generation students between OER and non-OER courses was valid for the fall 2020 ($\chi^2(1) = 7.428, p = .006$) and spring 2021 ($\chi^2(1) = 42.342, p < .001$) terms.

Also, an overall higher percentage of first-generation students completed their OER courses than did their counterparts in non-OER courses ($\chi^2(1) = 65.069, p < .001$). All first-generation students in OER courses completed their courses, while about 9 percent of first-generation students in non-OER courses withdrew from their courses. When assessed semester by semester, this significance difference observed in completion rate among first-generation students between OER and non-OER courses was valid for the fall 2019 ($\chi^2(1) = 9.443, p = .002$) (spring 2020 ($\chi^2(1) = 15.741, p < .001$), fall 2020 ($\chi^2(1) = 37.309, p = .006$), and spring 2021 ($\chi^2(1) = 84.594, p < .001$) terms.



Pell Grant Eligible

The results of the chi-square tests revealed that an overall higher percentage of Pell eligible students passed their OER courses than did Pell eligible students in non-OER courses ($\chi^2(1) = 12.060, p < .001$). About 84 percent of Pell eligible students in OER courses passed, compared to 78 percent of Pell eligible students in non-OER courses. When assessed semester by semester, this significance difference observed in passing rate among Pell eligible students between OER and non-OER courses was valid for the spring 2021 ($\chi^2(1) = 21.656, p < .001$) term.

In addition, an overall higher percentage of Pell eligible students completed their OER courses than did Pell eligible students in non-OER courses ($\chi^2(1) = 65.069, p < .001$). All Pell eligible students in OER courses completed their courses, while about 8 percent of Pell eligible students in non-OER courses withdrew. When assessed semester by semester, this significance difference observed in completion rate among Pell eligible students between OER and non-OER courses was valid for the fall 2019 ($\chi^2(1) = 5.770, p = .016$), spring 2020 ($\chi^2(1) = 13.770, p < .001$), fall 2020 ($\chi^2(1) = 7.617, p = .006$), and spring 2021 ($\chi^2(1) = 54.351, p < .001$) terms.

Underrepresented Minority

The results of the chi-square tests revealed that an overall higher percentage of minorities passed their OER courses than did minorities in non-OER courses ($\chi^2(1) = 8.861, p = .003$). About 82 percent of such students passed their OER courses, compared to about 77 percent who passed their non-OER courses. When assessed semester by semester, this significance difference observed in passing rate among minorities between OER and non-OER courses was valid for the spring 2021 ($\chi^2(1) = 18.877, p < .001$) term.

In addition, an overall higher percentage of minorities completed their OER courses than did minorities in non-OER courses ($\chi^2(1) = 91.677, p < .001$). All minorities in OER courses completed their courses, while 10 percent of those in non-OER courses withdrew. When assessed semester by semester, this significance difference observed in completion rate among minorities between OER and non-OER courses was valid for the fall 2019 ($\chi^2(1) = 11.497, p < .001$), spring 2020 ($\chi^2(1) = 12.685, p < .001$), fall 2020 ($\chi^2(1) = 29.912, p < .001$), and spring 2021 ($\chi^2(1) = 53.656, p < .001$) terms.

Qualitative Analyses

The qualitative analysis maps to the perceptions component of the COUP framework. Student responses to 15 interview questions helped reveal the answer to the question "What are student perceptions of the impact of OER on student outcomes and engagement?" The demographic information of interview participants is presented in Table 3. There were four sophomores, eight juniors, and six seniors whose majors represented four of the five academic colleges.

Answers to the questions "What are faculty perceptions of student learning from OER, and what are their experiences teaching with OER?" were revealed through responses to 16 interview queries. The demographic information of interview participants is presented in Table 4. They consisted of four associate professors, one assistant



Table 3.
Class level, major, and college of student interview subjects

Class level	Major	College
Junior	Education	Education & Behavioral Sciences
Senior	Sport & Exercise Science	Natural & Health Sciences
Senior	Criminal Justice	Humanities & Social Sciences
Junior	Art History and Mexican American Studies	Performing & Visual Arts and Humanities & Social Sciences
Junior	Biology Pre-Health and Biomedical Science	Natural & Health Sciences
Sophomore	Pre-Nursing	Natural & Health Sciences
Junior	Psychology	Education & Behavioral Sciences
Junior	Biology Pre-Health	Natural & Health Sciences
Sophomore	Criminal Justice and Psychology	Humanities & Social Sciences and Education & Behavioral Sciences
Sophomore	American Sign Language & Interpreting	Education & Behavioral Sciences
Senior	Secondary Education for History	Humanities & Social Sciences
Sophomore	Psychology	Education & Behavioral Sciences
Senior	Sociology	Humanities & Social Sciences
Senior	Criminal Justice	Humanities & Social Sciences
Junior	Mathematics	Natural & Health Sciences
Senior	Elementary Education	Education & Behavioral Sciences
Junior	Music Education	Performing & Visual Arts
Junior	Economics	Humanities & Social Sciences

professor, one lecturer, one adjunct faculty, and one doctoral student, from four of the five academic colleges.

Student Perceptions

Fourteen student interviewees defined academic success as learning something new and building on and retaining information. Ella stated, "I would define academic success as learning all the information you can, especially the information that you feel is important to your future careers or endeavors. Whatever you want to do in the future, I think it's a lot more than just getting, like, an A."



Table 4.

Status, years at institution, and college of faculty interview subjects

Rank and tenure status	Years at the university	College
Associate professor, tenure track	5 years	Natural & Health Sciences
Adjunct professor	10 years	Performing & Visual Arts
Doctoral student and instructor	5 years	Natural & Health Sciences
Senior lecturer	20 years	Natural & Health Sciences
Associate professor, tenured	8 years	Education & Behavioral Sciences
Associate professor, tenure track	9 years	Education & Behavioral Sciences
Associate professor, tenured	8 years	Humanities & Social Sciences
Assistant professor, tenure track	5 years	Humanities & Social Sciences

Course Passing and Completion Rates

Students were divided regarding if the OER used in class had an impact on their course passing and completion rates. The reasons given by the seven students who said that OER helped them improve their grade and the five who felt OER helped them complete the course included access, the support of their professor, the variety of the resources, enhanced learning, and engagement. Six students believed that OER made no difference to their course grade; most suggested that if you work hard, you will get the grade you deserve, whether the materials are OER or commercial. One student mentioned that OER did not impact their grade “since it was an easy class.” For the eight students who felt OER made no difference to completing the course, the most common reasons given were that they had to stay enrolled because the course was a program requirement, they wanted to graduate on time, they would lose financial aid if they dropped credit hours, or some combination of those reasons.

Access and Support

Twelve students felt that OER made a difference to their passing and completing the course because they had no-cost access to supplemental materials and could use and ac-



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cess them easily. Other reasons students shared were that the materials seemed more relevant and that they felt supported by a professor who used OER. Britney said, “I think it did impact my course grade because it gave me materials that were accessible to use and then also

to apply to my work in the course.” One student talked about her grade improving because she felt more involved with the course, explaining:

I do think it helped for the overall course grade. And it helped, it was a lot easier to want to stay involved because it feels like your professor is setting you or giving you additional help to, like, to succeed in the class. And I do think it made a pretty big difference in the grade if I didn't have those open resources.

Jiu shared that it was easier to participate because the OER expedited the work in the course:

It's improving the course involvement for me. It's really hard for me to just pull out a giant textbook that I had to buy, but for whatever reason, to just download a couple of links and to go through that and even having an online resource, I can quickly search a word, which makes it easier.

Marcus and Rita both said they felt supported and cared for by instructors who used OER, which motivated them. Rita put it this way, “It almost feels like the professor is setting you up for success rather than, like, having you worry about paying for a bunch of other additional stuff that you need for the class.” Marcus shared:

Honestly, I feel that open resources should be definitely used a lot more. Because it does help, like, students be more successful, and it helps us feel supported as students, and they particularly really do care about, like, students of color and the type of struggles that we go through here on campus.

Variety of Perspectives and Materials

Students who perceived OER positively impacted passing and completion frequently mentioned the variety of authors and material types. Ten students indicated that this variety made a difference to their passing the course. Jiu, Kathy, and Johnny said the OER materials provided them with real-world examples in a “very approachable voice.” Johnny added that real-life OER economic cases were much more useful to him “as opposed to a textbook going with the definition of hypothetical examples that worked out perfectly.”

Trinity stated:

I think it's made a difference in my course grade because there's so much more information that I can draw from, and it enriches my papers. It enriches my test taking and being



able to gather information and know what I'm learning, so I think it enriches the class in a way that traditional textbooks don't do that.

Multiple students mentioned that the various perspectives and writing styles helped them learn, rather than hearing only the single voice of one resource. Zuri felt that OER afforded the chance to hear from more female scholars: "When I had to do my psychology classes when we get our textbooks, I feel like they're more so from males. I feel like the male dominance is definitely more so in the textbooks than OER in one of my other classes, too." Two students mentioned that their professor using OER signaled to them that these works were important, since the professor selected them, instead of simply assigning a commercial text.

Multiple students mentioned that the various perspectives and writing styles helped them learn, rather than hearing only the single voice of one resource.

In addition to a variety of scholarly voices, 16 students shared that the different material types, such as videos and practice questions, helped them learn, rather than just a single textbook or other format. Rita volunteered:

It's a lot easier to be able to study through the Quizlet or look at a YouTube on how to do an equation or even, like, for, I don't know, something like cell biology to see what's going on in the cell, rather than just looking at words on a textbook. I think it's just a lot more interactive and easier to absorb the information.

Increased Engagement

Twenty-four student comments indicated that OER meant increased engagement in the course for them. They described engagement in a variety of ways, such as taking a more active role in their learning, participating in discussion, attending class, and engaging more deeply with the material.

Seven students, on the other hand, said OER did not encourage their engagement in any meaningful way. For students who felt it did not enhance engagement, reasons given included that they took the course because it was a liberal arts core requirement and they were not interested in the subject matter. Another student declared that they participated at about the same level in all their courses, no matter what. Amaya shared, "I would say it didn't impact my engagement in the course . . . I've been showing up to the courses every day, and so regardless of whether I had the textbook or not, I would still probably be showing up." Most students, however, felt strongly that OER increased their engagement levels, and some noted that OER allowed for more effective teaching practices by their professors.

Vihaan said the OER "didn't make it easier, but it made learning more interactive and fun," because in his experience, OER enabled the professor to be more engaged with the students via multiple resources and formats. Hannah noted that OER would be handy for future learning: "Let's say I were, like, very interested in that topic, like, foster a bigger passion for me. I think it'd be cool to have access to something like that because, like, let's say I rented my textbook. Well then, I'm going to give it back."



Rita explained the importance of taking an assertive role in learning, saying, “It’s giving a little bit more of yourself to actively try and learn the material that is given to you now, then not just going to class, looking at a lecture and then going home.” Kathy elaborated:

I feel like a lot of the times when professors strictly used, like, textbooks to teach and lecture their information . . . there’s a very set track. But with this class that had OER, it was much more flexible, and she could reference the parts of it that she wanted to that applied to what she wanted to teach us.

Several students described how their professor used OER to enhance their participation. Kathy commented, “So I did really like how she used the OER to facilitate discussion.” Vihaan observed:

We had really good discussions in that class because there wasn’t a cost to it, he just gave it to us and that’s what we had. I feel like sometimes in class is when you have to read a textbook, like some people don’t read because either, one, they don’t have it, or two, it just seems boring. So, I feel like with his class it was fun, it was. He gave us resources that weren’t boring.

Seventeen students felt the OER improved their learning, even if some perceived it did not enhance their passing and completion rates. Two comments, on the other hand, indicated that OER did not impact their learning, that the OER functioned like a commercial textbook, and that they learned from it the same way.

Students who felt OER enhanced their learning shared the following observations about using such materials: the access helped them stay focused and connected during COVID-19, that OER was curated by their professors, the multiple voices and formats were a bonus, and that OER was more flexible and fun to learn from and provided increased opportunities for class discussion. Two students suggested that it would be helpful to have faculty explain at the beginning of the course what open educational resources are and why they teach with them.

Faculty Perspectives

All eight faculty interviewees indicated one reason they implemented OER was that they wanted to save students money on course materials. One participant mentioned her

All faculty reported that their teaching approaches changed because of the autonomy, flexibility, and culturally responsive teaching OER provided.

experiences as a student for whom the cost of materials was a barrier. Although most faculty did not think using OER impacted student course passing or completion rates, all felt it improved class engagement and participation because the resources were free and included a variety of materials. All faculty reported that their teaching approaches changed because of the autonomy, flexibility, and culturally responsive teaching OER provided.

Course Passing and Completion Rates

Six of the eight faculty interviewed perceived that using OER made no significant difference to final course grades. Five faculty did not believe OER helped students complete



the course. Two mentioned it was difficult to tell what the impacts on grades were, in part due to COVID-19 and remote learning. Colleen observed a small uptick in quiz grades, which she attributed to the OER living study guides. Peter felt OER did not impact student grades, “but many of them appreciate it.”

Student Engagement

Seven faculty felt strongly that student engagement increased because of OER, even if they did not think OER impacted passing and completion rates. James said, “I think it has improved the quality in the experience for students, and I think they’re more engaged with the reading.” Themes that arose from faculty interviews related to perceptions of higher student engagement were free online access to course materials and the variety of resources.

Several faculty interviewees said higher engagement resulted from OER being freely available to students from the first day of classes. Two faculty members mentioned OER and access through a social justice lens. Lori said, “In my work with diversity, equity, and inclusion (DEI), I really think OER as being something that can help us fill some of that need in terms of equitable access to course materials.” According to Peter, “It helps cost saving and then it engages them right away. They have no excuse, like, I couldn’t get the textbook and I did this chapter request. So yeah, the class goes immediately on the regular track.” Julie shared direct feedback she received from her students: “One hundred percent of them said that they were happy we used the OER, and they said it impacted their motivation because it was a lot easier to access the material primarily on their phone that they didn’t have to get out their laptop or the heavy book.”

Seven faculty felt strongly that student engagement increased because of OER, even if they did not think OER impacted passing and completion rates.

Daniel observed more students doing the homework as a result of him offering free homework modules. He said, “I feel that there’s more students that do the homework. In past semesters, I had some students, and they would just say I’m not going to spend \$150 on this homework program and I will just take my B.”

Most faculty did not feel using OER had any impact on students staying enrolled and completing the class. Cecelia stated, however:

I think being able to access course materials from day one without having to make decisions as to whether they can buy this book now or not might really, I think, set the tone for a lot of them, and to just persist in the course across the entire semester in the face of everything they were dealing with at that time.

Lori declared:

In terms of persistence, I’ve heard a couple of stories from students that it was easier for me to stay up on the content in this class because I had that access right there. I’ve had a number of students talk about how sometimes they would intend to purchase a text, but the money wasn’t there . . . and it’s really difficult to catch up in those situations.

James shared, “So I had better feedback with OER; I think it has improved the quality in the experience for students, and I think they’re more engaged with the reading.” Cecelia said, “I’d like to think at the very least I offered students a different way to approach the course, so that really speaks to what I think is sort of engagement and motivation.”

Faculty were asked if OER impacted student learning. Two felt learning outcomes increased. James added, “The only empirical evidence that I have is that on every exam there are questions that are only from the reading . . . and there’s a success on those questions. It has gone up since I’ve been doing the OER.” Cecelia felt the use of OER made a difference to learning: “So, I think the learning outcomes and student learning that was, that’s a function of me making sure that my resources actually matched the objectives and content that the course spells out.” Even though faculty provided mostly anecdotal observations, they believe that OER helped students engage with and learn from the course material.

Impact on Pedagogy

Faculty made a total of 12 comments that using OER had a positive impact on their pedagogical approaches, which in turn may have increased student engagement and learning. Themes related to changes in pedagogy were autonomy and flexibility, and an increase in culturally responsive teaching approaches and content.

Autonomy and Flexibility

The majority of faculty shared that having independence and flexibility to control their course curriculum enabled them to evolve their teaching. Lori described the freedom it gave her to change her pedagogy:

I really feel like it’s supported my autonomy as an instructor in terms of creating assignments and feeling the flexibility of being able to really think through what are my goals for this class and how can I assist students instead of feeling like, here is the assessment that I’m giving you. I have more flexibility to be able to provide those materials in ways that they can really support that deeper learning.

OER inspired Julie to create new assignments that she hoped would be more engaging for students. Colleen described the changes to her teaching as the biggest impact of OER:

The majority of faculty shared that having independence and flexibility to control their course curriculum enabled them to evolve their teaching.

“So, I have some assignments now that I use in every class because the students seem to learn more from them. I have a living study guide, so it makes the students create a study guide when a test is coming up.” Other benefits of OER that faculty mentioned included being able to make quick changes to the materials, whereas with a commercial textbook, they felt more “locked in” to approaches and content.

Culturally Responsive Teaching

Most of the faculty stated that OER positively impacted culturally responsive teaching and DEI content in their courses. Cecelia said, “As cultural beings, we find ourselves



in classrooms with the ways in which cultural practices influence the ways that we learn. And so, by virtue of being in that class, every single bit of OER helped feed that purpose.” She added:

So having more flexibility in the content that I share and how I share that content has opened up more space for me to consider elements, like how many students are personally relating to topics. It allows me . . . to add in elements that are more culturally responsive than if I was just teaching out of a straight textbook.

Colleen commented:

You know, it’s easy to kind of, like, fill in gaps, add other topics, and kind of tailor the content more to whatever students are either interested in, curious about, or maybe just have more experience. I’ve been trying to build [in] more opportunities to kind of get students content and examples, both for culturally responsive teaching and also just to try to make it more accessible to everyone.

She gave an example of how she incorporated more diversity with OER: “I mean, there’s, like, half a dozen male (philosophy) figures that are always talked about, but there are 12 or so women who are never talked about, and there’s a website that just includes, like, their writings. So, we’re actually spending a pretty significant portion of the course . . . to cover these figures.” Daniel, a mathematics professor, shared, “Content, I mean I added the Mayan number system, which is definitely culturally relevant for some.” Peter added non-Western music examples to his course, which had previously focused on European composers. He said: “It was about expanding the canon. So that was a really natural way to do it, and thankfully the resources were there to where it didn’t take a lot of extra effort to say, hey, you should really look at what this person has to say about this and linking it.”

Lori wrestled with commercial textbooks being perceived as the one and only voice. She said:

We’re so conditioned across years of learning to see the textbook as OK, that is the source for the “truth.” I think that when I don’t have that [textbook], I think it’s easier for students to look at more content as valuable . . . look to other places for sources of knowledge as well . . . that ties into culturally responsive teaching. You know, in terms of how we see who the knowers are and where truth lies essentially.

Peter said, “One of the questions for students was, did my content make you think differently about identity in terms of sexuality, social, ethnic, or cultural? For some of them, they had a good influence.”

Two faculty members felt challenged by the time it took to implement OER into their teaching and make it a cohesive whole. The vast majority of faculty felt that OER impacted their teaching approaches in significant ways, which may in turn have increased student learning and engagement, and passing and completion rates. Cecelia described her experience as: “So that’s what this experience trying to navigate OERs has done for me . . . I’ve had some sort of, like, reimagining the ways I present them. So, it’s been, like, a consciousness raising experience just to become aware of the wider range of experience within the job I do.” In addition to helping students with cost and as a social



justice issue, faculty indicated they were motivated to enhance student learning, to take charge of their curriculum, and to implement new teaching approaches.

Discussion

In addition to helping students with cost and as a social justice issue, faculty indicated they were motivated to enhance student learning, to take charge of their curriculum, and to implement new teaching approaches.

Academic librarians often have a role in campus and state open educational resources initiatives. Understanding the evolving impacts of OER on student outcomes is an area

of continued importance for the profession. The researcher selected the parameters of this study because her university serves many first-generation, Pell Grant eligible, and underrepresented minority students, therefore these demographics were of interest. It was important to compare the findings of this study to the results of others to add to the scholarly conversation around OER efficacy using a mixed methods approach. The researcher gathered qualitative data by interviewing students and faculty to see how the quantitative and qualitative data aligned. Finally, the author helps lead the university's OER initiative and grant program. She wanted

to see if OER courses had an impact on academic success and if it is worth spending time, effort, and resources sustaining the campus OER initiative.

The study's first question was "Does taking a course using open educational resources (OER) have a relationship to student academic outcomes of course passing rates and course completion rates?" Courses that used open educational resources benefited all students and had a 7 percent higher passing rate and a 10 percent higher course completion rate. One hundred percent of the students during the study's time frame completed the OER course sections, but 10 percent of students who took the non-OER sections failed to do so.

The study's second question was "Which student demographic populations appear to benefit most from use of OER?" All demographics gained an advantage from the use of OER. Course passing rates increased for first generation (5 percent), Pell Grant eligible (6 percent), and underrepresented minorities (5 percent). Course completion rates also rose for all demographics for students who took OER courses—first generation (9 percent), Pell Grant eligible (8 percent), and underserved minorities (10 percent).

The third question posed was "What are student and faculty perceptions of the impact of OER on student outcomes and engagement?" Students and faculty had mixed views about whether OER influenced passing and completion rates. Both students and faculty felt, however, there was more class engagement and active learning with the use of OER.

The final question asked, "Did faculty change their pedagogical approaches because of teaching with OER, if so, how?" Faculty reported OER use changed their teaching in a number of ways. They described being able to more effectively map course content to their learning objectives, to be more flexible, and to allow for culturally diverse teaching approaches in ways that were not as possible when using commercial course materials.



The quantitative data show that OER had more of an impact on passing rates than some of the qualitative data imply. It is unclear why some students and faculty failed to perceive that OER use improved student passing and completion rates, given the accessibility, quality, and engagement they described while using OER. Perhaps students who made the effort to participate in the interviews were already solidly on track to pass and complete the class, so they would have a positive outcome regardless of the course materials used. Student confidence in passing and completing the course could help explain the mixed perceptions about OER not influencing those outcomes. Perhaps faculty underestimated the influence of the teaching changes they made because of OER. COVID-19 and the abrupt switch to remote learning during 2020 may have confused perceptions as to how much OER influenced learning outcomes. The data indicate a positive impact on outcomes, and that students felt more engaged in the class and learned more, even if some did not feel OER influenced their passing or completion rates.

Although some students and most faculty did not perceive OER impacting grades or the rates at which students stayed enrolled, they strongly felt learning improved and engagement greatly increased with OER use. The mixed methods approach was intended to help understand nuances. The quantitative data are objective and indicate the positive impacts of OER and student academic success regarding passing and completion rates. The qualitative data are subjective and shed light on other positive impacts of OER. The students' qualitative data indicated that many felt more engaged, satisfied, and confident in the OER courses. These experiential benefits, along with changes in pedagogical approaches, may have led to improved course passing and completion rates. This study suggests that the benefits of OER go beyond better passing and completion rates.

This study suggests that the benefits of OER go beyond better passing and completion rates.

Limitations

This research project had methodological limitations. In gathering quantitative data, the researcher could not control for the potential variables presented by other factors that could impact passing and completion rates, such as variations in course difficulty, instructor differences, student academic aptitude, or the impacts of COVID-19. All students and faculty in this study taught and learned remotely during the spring and summer 2021 semesters. The main limitation to the qualitative portion of the study was that the author interviewed only faculty who applied for a grant to support changing to all OER materials; the perspectives from faculty who do not use OER were not included in this study. Finally, a halo bias or halo effect may have confounded student interview responses, meaning their responses may have been more positive about their experiences with OER because of the free cost.³⁹

Conclusion

The goal of this research project was to answer the overarching research question "To what extent have open educational resources contributed to student academic success?" The quantitative data indicated that OER was significantly associated with passing and



completion rates for all students in the study, as well as the demographic subsets of first-generation, Pell Grant eligible, and underrepresented minority students. This finding differs from the null hypothesis results found in some OER efficacy studies,⁴⁰ but it aligns with the findings that OER has an impact on student outcomes.⁴¹ The qualitative data from students and faculty showed OER use resulted in greater engagement of students and motivated faculty to evolve their teaching approaches. This finding aligns with other OER perception studies.⁴² When asked if they wanted to add anything to their interview comments, one student replied, "I think that more classes should offer OER as opposed to commercial textbooks, one, because of the cost effectiveness of it, and two, because of the learning impacts of it. So, I think there's a double bonus there."

There is an opportunity for further research that goes beyond the typical academic success indicators of course grades, GPA, and retention, and further examines learning and engagement impacts using mixed methods approaches to obtain more context for academic outcomes data. The results shared in this paper illustrate how pedagogical changes may have influenced better course outcomes. Another area worth further study is the impacts of OER materials on diverse course content and culturally responsive teaching. It is important to continue to identify and communicate the impacts of open educational resources so that institutional, state, and federal support continues and increases.

The principles of OER include increasing equity, keeping content relevant and high quality, empowering students and teachers, and saving money. These principles align with how these students perceived that OER impacted their learning, making them feel more engaged with the material and teaching style of their professors, and retaining and accessing this knowledge in the future. The faculty values revealed in this study, of supporting their students and evolving their teaching practices, also align with the principles of OER. Based on this study's findings, open educational resources and related pedagogical changes are an effective educational approach and deserve continued attention and leadership by librarians and others in higher education.

Acknowledgments

The author warmly thanks Daniel Edi and Angela Rockwell for their data assistance, Lori J. Terrill, who provided feedback on this manuscript, and the individuals who participated in this study.

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Appendix A

Student Interview Questions Fall 2021

Open educational resources (OER) are any type of educational materials that are in the public domain. They are published under open licenses (i.e., Creative Commons) that specify how materials can be used, reused, adapted, shared, and modified according to specific needs. They can include textbooks, lecture notes, syllabi, assignments, and tests. OER are resources that are free of cost to students.

In this study I am interested in OER impact on students and faculty.

1. What is your year in school and major? Which class used OER, and how did you know the class used open educational resources?
2. How do you define academic success?
3. What was your experience using OER in class?
4. Has the use of OER made a difference to your learning? Do you think it made a difference to your course grade? Made a difference to staying enrolled in the course? Please explain why or why not for each question.
1. Did use of OER impact your participation in class? Please explain.
2. How would you rate the quality of the OER? Compared to commercial texts and materials?
3. What were the benefits to using OER?
4. What were the challenges to using OER?
5. What would you change, if anything, about the OER used in the class?
6. How would you rate the accessibility of the OER? Compared to commercial class materials?
7. How would you rate the diversity of materials in the OER? Compared to commercial class materials?
8. How likely would you be to register for a class that uses OER in the future? Why or why not?
9. Would you like to be notified of available OER classes? How?
10. Any other comments about the class or classes you took that used OER?
11. Any other comments about open educational resources, commercial course materials, student success?

Appendix B

Faculty and Instructor Interview Questions

Open educational resources (OER) are any type of educational materials that are in the public domain. They are published under open licenses (i.e., Creative Commons) that specify how materials can be used, reused, adapted, shared, and modified according to specific needs. They can include textbooks, lecture notes, syllabi, assignments, and tests.

In this study I am interested in OER impact on faculty and instructors, and students.



1. College affiliation, how long at the University of Northern Colorado, and status (tenured, tenure track, other)?
2. What were your motivations to use open educational resources (OER) in a class or classes? What is your OER origin story?
3. Please describe your first encounter with OER to implementation.
4. How have you adapted, adopted, created OER?
5. How do you perceive the quality of the OER you selected and/or created for your OER course and why?
6. What are your thoughts on the impacts of implementing OER on your pedagogical approaches and teaching practices?
7. Perception of how OER use impacted student learning, motivation, and engagement? OER impact on learning outcomes?
8. Please share observations about whether student's final grades and persistence differed when using OER for this class, instead of commercial materials previously assigned for this class, or a comparable class?
9. What student feedback did you receive from students about using OER, if any?
10. What were the benefits and challenges to using OER?
11. Did OER impact culturally responsive teaching / EDI content? How or how not?
12. Did OER impact accessibility to the course materials? How or how not?
13. Please describe OER culture on the University of Northern Colorado's campus. If applicable, what discussions did you have about OER with colleagues, chairs, deans? How were those received?
14. How do you view institutional support for OER? What support matters? What about tenure and promotion?
15. What do you suggest campus do in order to move OER initiatives forward?
16. Any other comments about your experiences teaching with OER?

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