STUDENT SUCCESS IN OPEN NEBRASKA COURSES
NU Intercampus OER Research Committee White Paper

Julie A. Pelton, University of Nebraska Omaha

Kimberly A. Carlson, University of Nebraska Kearney

Craig Finlay, University of Nebraska Omaha

Emily J. Glenn, University of Nebraska Medical Center

Daniel N. Hawkins, University of Nebraska Omaha

Jaci Lindburg, University of Nebraska System

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ABSTRACT

The University of Nebraska's unified open educational resources (OER) program – Open Nebraska – has saved NU students over $15 million in textbook costs as of May 2023. As Open Nebraska was instituted across campuses, the NU Intercampus OER Research Committee was convened to study the effect of the Open Nebraska program on student success beyond monetary savings. This white paper represents the first systematic findings of that effort. In general, NU students are less likely to fail or withdraw and more likely to earn better grades when instructors implement open educational resources in their courses. Furthermore, in line with previous research, underrepresented students at UNO seem to benefit the most from early access to no-cost and low-cost course materials. At the very least, the implementation of OER in the NU system does not seem to harm academic success while saving students millions of dollars in textbook costs. These promising results suggest that the NU System should continue to support and promote efforts to increase the use of OER in our courses and programs. In addition, the NU Intercampus OER Research Committee should continue to gather and analyze data on student success and best practices related to OER implementation.

PURPOSE

In October of 2020, Dr. Jaci Lindburg, then Assistant Vice President of Learning Technologies and IT Strategy in University of Nebraska's Information Technology Services division, was awarded an $84,000 grant from the Women Investing in Nebraska (WIN) philanthropic organization – with a matching gift of $84,000 awarded from the NU Provost's Office – to promote OER (Open Educational Resources) across the NU System. This funding was to be distributed to the faculty at the Kearney (UNK), Lincoln (UNL), and Omaha (UNO) campuses to recognize their time and effort in redeveloping courses with OER materials. The primary goal was to save NU students $10 million by 2023, a goal that has been surpassed by over $5 million as of May 2023. A secondary goal was to write this white paper that assesses student success in courses marked as Open Nebraska – the NU System's OER program – compared to courses that do not use no-cost and low-cost materials.

To achieve the goals of the grant, Dr. Lindburg convened the NU Intercampus OER Research Committee in March of 2021. In addition to Dr. Lindburg, this committee consisted of the following faculty across the NU System: Kimberly Carlson, PhD (UNK); Julie Pelton, PhD (UNO); Nathan Wakefield, PhD (UNL); and Marquisha Frost, PhD (UNO). Drs. Wakefield and Frost subsequently left the NU System, and the following members joined the NU Intercampus OER Research Committee by Spring of 2022: Emily Glenn, MSLS (UNMC); Daniel Hawkins, PhD (UNO); and Craig Finlay, PhD (UNO). This white paper was a collective effort of the NU Intercampus OER Research Committee to inform all four NU campuses about the effect of the adoption of OER materials on student success metrics beyond monetary savings.

BACKGROUND

Open educational resources (OER) are currently defined as "teaching, learning, and research resources that reside in the public domain or have been released under an intellectual property license that permits their free use and re-purposing by others. Open educational resources include full courses, course materials, modules, textbooks, streaming videos, tests, software, and any

other tools, materials, or techniques used to support access to knowledge[1]." But open content is not a new idea. The term was first coined by David Wiley in 1998, but mainly applied to software use. It was not until 2001, with the creation of MIT's OpenCourseWare, that class materials began to be categorized as "open content." In 2002, UNESCO held a forum to explore developing a universal "open education resource" available to everyone[2]. Advocates were largely limited to making appeals to altruism, invoking ideals of equity and access to educational resources, although the emergence of open education also fits within general trend of democratic societies moving away from "elitist and exclusivist system of higher education that were based on power and privilege" (p. 25)[3].

Student financial pressures, retention, and graduation

While issues of inclusion and access remain important, simply reducing textbook costs to students has quickly become the strongest impetus for the adoption of OER. In 2014[4], the first Student Public Interest Research Groups (PIRGs) report provided statistics on textbook costs, including that 65% of students said that they had decided against buying physical or electronic textbooks because they were too expensive; that nearly half said that the cost of textbooks impacted how many or which classes they took each semester; and that 82% felt they would do significantly better in a course if the textbook was available free online and buying a hard copy was optional. The 2021[5] update to the Student PIRGs report found that self-reported rates of students who have skipped buying a textbook due to cost held steady at 65%. Further, the report found that more than 20% of students had skipped purchasing an online access code, a number that rose to 38% among food-insecure students. A striking 94% of respondents indicated that they were worried this behavior would negatively affect their grades. Meanwhile, the 2022 College Board pricing report now has the average annual expenditure on books and supplies for a public school at $1,240[6].

OER and student success

Cost savings are not the only benefit of open educational resources to students. A widely cited article by Colvard, Watson & Park (2018) looked at the impact of OER in the context of numerous student demographic factors, including ethnicity and Pell grant recipient status. Classes using OER saw improved overall grades and decreased "DFW" rates[7] among all

[1]ONE - Open Nebraska (OER). https://www.unk.edu/offices/its/instructional_technology/open-nebraska-one.php
[2]Wiley, D. Organisation for Economic Co-operation and Development. Centre for Educational Research and Innovation. Expert Meeting on Open Educational Resources. http://www.oecd.org/dataoecd/19/26/36224377.pdf
[3] Blessinger, P., & Bliss, T. J. (2016). Introduction to open education: Towards a human rights theory. *Open Education: International Perspectives in Higher Education*, 11-30.
[4] Senack, Ethan (2014). *Fixing the Broken Textbook Market.* Student PIRGs. https://studentpirgs.org/2014/01/27/fixing-broken-textbook-market/
[5] Nagle, C. & Vitez, K. (2021). *Fixing the Broken Textbook Market: Third Edition*. U.S. PIRG Education Fund. https://pirg.org/edfund/resources/fixing-the-broken-textbook-market-2/
[6] College Board (2022) *Trends in College Pricing 2022.* Trends in Higher Education Series. https://research.collegeboard.org/trends/college-pricing
[7] The DFW rate is the combined percentage of students who earned a D or F grade or withdrew from a course. The higher the DFW rate, the more students who are failing to successfully complete the course. https://uwm.edu/academicaffairs/student-success/data-of-the-week-dfw-rates

demographics[8]. Further, they found that this impact was amplified for historically underserved students. Clinton & Khan (2019) conducted a meta-analysis of 17 studies looking at the impact of OER adoption on student success and found that the withdrawal rate for OER courses was significantly lower than non-OER courses[9]. The authors hypothesize that "having access to a textbook may help a student who is behind to cover missed material and not withdraw from the class. In this way, students who are struggling in a course may be less likely to withdraw if they can access an open textbook for free as opposed to paying hundreds of dollars for a commercial textbook" (p. 10). Likewise, Grewe & Davis (2017) looked at OER adoptions at Northern Virginia Community College and found that adoptions had both a positive effect on both in-course academic performance and individual student performance relative to previous semesters[10].

Similarly, Read et. al (2020), looking at OER impact in the context of socioeconomic status and employment, found a significant improvement in self-reported motivation and confidence among socioeconomically at-risk students in OER courses[11]. Johnson et. al (2022) also found a boost in self-reported student confidence after taking OER classes[12]. This might be due to a perception on the part of students that the university was invested in taking steps to reduce student financial burden, thereby creating a deeper connection between students and their universities[13,14,15].

Even when null results are returned regarding student performance, researchers conclude that in the worst-cast scenario, OER materials offer the same learning outcomes as traditional textbooks while having the tangible benefit to students of saving them money[16][17]. Johnson et. al (2022) write that, although the first results of assessment of the OER program at two Georgia Universities showed no significant improvement in grades nor a decrease in DFW rates, students in the studied class were still relieved of the burden of purchasing a $136 textbook[18].

[8] Colvard, N. B., Watson, C. E., & Park, H. (2018). The impact of open educational resources on various student success metrics. *International Journal of Teaching and Learning in Higher Education,* 30(2), 262-276.

[9] Clinton, V., & Khan, S. (2019). Efficacy of open textbook adoption on learning performance and course withdrawal rates: A meta-analysis. *AERA Open,* 5(3).

[10] Grewe, K., & Davis, W. P. (2017). The impact of enrollment in an OER course on student learning outcomes. *The International Review of Research in Open and Distributed Learning*, 18(4).

[11] Read, K., Tang, H., Dhamija, A., & Bodily, B. (2020). Understanding the impact of OER courses in relation to student socioeconomic status and employment. *The International Journal of Open Educational Resources*, 3(1).

[12] Johnson, C., Ding, Y. Z., Dekhane, S., Jin, W., Im, T., & Park, H. (2022, April). Using an open source textbook in programming class: exploring student perception and performance. In *Proceedings of the 2022 ACM Southeast Conference* (pp. 25-30).

[13] Vojtech, G., & Grissett, J. (2017). Student perceptions of college faculty who use OER. *International Review of Research in Open and Distributed Learning*, 18(4), 155-171.

[14] Dempsey, M. (2021). The impact of free and open educational resource adoption on community college student achievement. *The International Journal of Open Educational Resources*, 4(1), 25024.

[15] Nusbaum, A. T., Cuttler, C., & Swindell, S. (2020, January). Open educational resources as a tool for educational equity: Evidence from an introductory psychology class. In *Frontiers in Education (*Vol. 4, p. 152).

[16] Jhangiani, R. S., Dastur, F. N., Le Grand, R., & Penner, K. (2018). As Good or Better than Commercial Textbooks: Students' Perceptions and Outcomes from Using Open Digital and Open Print Textbooks. *Canadian Journal for the Scholarship of Teaching and Learning*, 9(1), n1.

[17] Croteau, E. (2017). Measures of student success with textbook transformations: the Affordable Learning Georgia Initiative. *Open Praxis*, 9(1), 93-108.

[18] Johnson, C., Ding, Y. Z., Dekhane, S., Jin, W., Im, T., & Park, H. (2022, April). Using an open-source textbook in programming class: exploring student perception and performance. In *Proceedings of the 2022 ACM Southeast Conference* (pp. 25-30).

History of OER and Open Nebraska (ONE) at NU

At the January 9, 2015, meeting of the NU Board of Regents, NU Provost Dr. Susan Fritz approached the Chief Academic Officers on each NU campus about an initiative to reduce textbook costs to students, calling it Open Access Textbooks (OAT). In less than 24 hours, the inaugural OAT committee on the Kearney campus was created, consisting of Jane Petersen (IT), Dr. Joe Springer (Biology), Dr. Kimberly Carlson (Biology), and Betty Jacques (Biology). This group wrote a proposal in which they focused on converting classes that had large enrollments, high textbook costs, multiple sections, multiple teachers, and a presence across all four colleges at UNK. On January 19, the first $50,000 Kelly Funds[19] grant for OAT/OER was awarded. This proposal outlined two major intended goals: 1) decrease the cost of course materials and 2) increase learning outcomes. Four courses across three of the UNK colleges were converted to a $0 textbook cost course and they remain OER/no cost to this day. In late 2015, the UNK OAT committee added Rochelle Reeves, UNK OER librarian, to the committee, realizing the overwhelming importance of library resources in the OAT process. Since 2015, UNK has awarded 91 faculty development awards to convert their classes into OAT/OER.

In 2018, faculty and staff from UNK, UNL, and UNO formalized a group to discuss and promote open educational materials, with a name change from OAT to OER to be more consistent with national trends. Concurrently, UNL and UNO were awarded Kelly Funds grants to support their OER initiatives. In 2019, UNL and UNO offered their first grants to faculty to convert their classes to OER. Since then, Criss Library at UNO has awarded 62 Affordable Content Grants, which have funded conversions ranging in size from one or two sections to high enrollment courses such as Fundamentals of Public Speaking, which offers over 100 sections per year. Other high-impact projects have been cooperatively funded with Digital Learning and General Education and Dual Enrollment, such as all sections of Composition II and all sections of Intro to Astronomy. The Office of Digital Learning, before folding their OER initiatives into those from the library, separately awarded 57 grants as part of their development work. In 2020, UNMC offered its first courses as OER.

In 2021, the NU Student Regents unified the OER program name across the NU System to be Open Nebraska (ONE). This term identifies free or reduced textbooks costs for our university students and replaces the term OER in the NU System. There were three levels of classification: 1) No Cost Materials (NCM) – digital course materials that are incorporated into Canvas at no additional cost to the student with no book purchase required; 2) Low Cost Materials (LCM) – digital course materials that are incorporated into Canvas and cost students less than $40 with no book purchase required; and 3) Low Cost eBook (LCE) – a reduced-cost electronic book purchased through the campus bookstore that costs less than $40. In the Spring of 2022, UNK did a soft rollout of marking classes in the schedule as either ONE-NCM, ONE-LCM, or ONE-LCE. UNL and UNO have since started marking their classes with the Open Nebraska designation.

Near the end of the Spring 2023, it has been reported that the NU system OER effort has collectively saved students over $15 million dollars, which far exceeds the $10 million goal set by NU President Ted Carter. This simple measure of financial savings is a clear boon for

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[19] Kelly Funds are available to facilitate research on improving student retention by exploring new instructional approaches or supports for specific courses that are critical for student success. The call for proposals was issued by the University of Nebraska system's Office of the Provost. https://news.unl.edu/newsrooms/today/article/grants-available-to-support-research-on-improving-student-retention/

students, but might there be additional benefits of OER on student success? The goal of this white paper is to be the first systematic examination of the effects of the Open Nebraska program on academic performance across the NU System.

DATA ANALYSIS

Analytic sample

In February of 2022, campus representatives from UNO, UNL, and UNK requested information including student grades, GPA, drop/withdraw/fail (DFW) status, demographic information (including whether the student is first generation), total number of credit hours (current semester and cumulative, and course information (e.g., OER status, modality/format). These data were provided at the student-level, therefore students are the analytic cases throughout the results presented here. UNMC courses were not selected because UNMC does not offer multiple class sections and OER data for UNMC courses was not available prior to 2021.

The data was collected for five classes at UNK (BIOL 103 General Biology, BIOL 106 Biology II, ENG 102 Academic Writing and Research, TE 100 Teaching in a Democratic Society, and PSCI 110 Intro to American Politics), eight classes at UNO (CIST 2100 Organizations, Applications and Technology, CMST 1110 Public Speaking, ENGL 1160 English Comp II, MATH 1130 Quantitative Literacy, MATH 1210 Intermediate Algebra, MATH 1220 College Algebra, PSYCH 1010 Intro to Psychology I, SOC 1010 Intro Sociology), and five classes at UNL (MATH 100 A Intermediate Algebra, MATH 101 College Algebra, MATH 102 Trigonometry, MATH 103 College Algebra and Trigonometry, and MATH 106 Calculus I). These courses were identified as OER based on information from each campus about completion of an OER course development grant and were selected due to high enrollments across multiple sections offered every semester. UNK data includes courses offered between fall 2012 and Spring 2022, with the transition to OER occurring in the Fall 2015 semester. Course data for UNO is from Fall 2018 to Spring 2022, with most conversions occurring in either Spring 2021 or Fall 2021. UNL data is from Fall 2017 to Fall 2019 with OER conversion occurring in Fall 2018, except for MATH 106 which was OER beginning Fall 2019.

Descriptive statistics

Each campus was analyzed separately, with the results for UNO in Tables 1A and 1B; for UNL in Tables 2A and 2B; and for UNK in Tables 3A and 3B. Tables 1A, 2A, and 3A describe the sample characteristics for each campus, respectively. This includes the proportion of students in OER vs. non-OER sections and the modality of those sections (online vs. in-person). For UNO and UNL, proportions that include and exclude the Spring 2020, Summer 2020, Fall 2021, and Spring 2021 semesters are shown for comparison purposes. Because of the unusual nature of those semesters due to the COVID-19 pandemic, particularly regarding the quantity of remote instruction and challenge to student success, subsequent analyses focus on the data with Spring 2020 through Spring 2021 excluded. Analyses for UNK use Fall 2012 through Summer 2019 data for the same reason.

The proportion of students in OER courses ranged from about 44% at UNO to 54% at UNK to 72% at UNL (in a MATH-only sample). Just over half of the students at UNO were taking in-person classes while over 90% of their peers at UNL and UNK were in in-person

sections. For UNO and UNL, proportions for the racial/ethnic, gender, first generation, and full-time characteristics of the students are also included in Tables 1A and 2A. This information was not available for UNK. Overall, the students at UNO were substantially more likely than students at UNL to be racial or ethnic minorities, to be women, to be first generation, and to be less than full-time status. This is likely unsurprising given the overall demographics of the two campuses.

Table 1A. UNO Proportions for OER Designation, Student Characteristics, and Section Modality

	Includes SP20-SP21		Without SP20-SP21	
	Proportion	*N*	Proportion	*N*
OER	0.41	14,780	0.44	8,760
Non-OER	0.59	21,207	0.56	11,324
White	0.58	20,245	0.59	11,449
Non-White	0.42	14,357	0.41	7,930
Woman	0.56	20,562	0.56	11,428
Man	0.44	16,011	0.44	9,058
First Generation	0.45	16,478	0.45	9,207
Non-First Generation	0.55	20,050	0.55	11,428
Full-Time	0.74	25,715	0.73	14,236
Less Than Full-Time	0.26	9,226	0.27	5,310
In-Person	0.44	15,880	0.57	11,649
Hybrid/Remote	0.18	6,613	0.08	1,694
Online Asynchronous	0.38	14,014	0.35	7,083

Table 2A. UNL Proportions for OER Designation, Student Characteristics, and Section Modality

	Includes SP20-SP21		Without SP20-SP21	
	Proportion	*N*	Proportion	*N*
OER	0.78	18,743	0.72	13,061
Non-OER	0.22	5,160	0.28	5,160
White	0.76	16,771	0.76	12,859
Non-White	0.24	5,434	0.24	4,063
Woman	0.44	10,502	0.44	7,938
Man	0.56	13,397	0.56	10,279
First Generation	0.26	6,252	0.25	4,605
Non-First Generation	0.74	17,651	0.75	13,616
Full-Time	0.89	20,832	0.89	15,969
Less Than Full-Time	0.11	2,710	0.11	2,030
In-Person	0.96	22,979	0.99	18,092
Online/Hybrid/Remote	0.04	924	0.01	129

Table 3A. UNK Proportions for OER Designation and Section Modality

	Proportion	*N*
OER	0.54	10,038
Non-OER	0.46	8,510
White	--	--
Non-White	--	--
Woman	--	--
Man	--	--
First Generation	--	--
Non-First Generation	--	--
Full-Time	--	--
Less Than Full-Time	--	--
In-Person	0.92	21,295
Online	0.08	1,829

Note: Student characteristics were not available prior to Spring 2022 and are not included in the analysis.

Bivariate and multivariate analyses

Tables 1B, 2B, and 3B display the differences in proportions/means between students in OER and non-OER sections across three student success outcomes: DFW rates; the average grade earned on a traditional four-point scale; and the percentage of A's earned. For UNO and UNL, these proportions are further disaggregated by student characteristics. Because these data are not composed of random samples of sections from the three campuses, but instead represent the known population of OER courses in certain departments at a given point in time, statistical significance tests were not reported.

At UNO (Table 1B), students in OER sections had modestly but consistently more positive success metrics than students in non-OER sections: their DFW rates were 4% lower, their final grades were about 0.05 points higher, and they earned about 5% more A's. There were some notable differences in these effects across student characteristics. For example, men earned grades that were 0.15 points higher on average in OER sections, compared to just a 0.01 difference (in favor of non-OER sections) for women. First generation students earned 10% more A's in OER sections, compared to a 4% difference for non-first generation students. The DFW rate was 8% lower for less than full-time students in OER sections, compared to about 2% lower for full-time students.

Table 1B. UNO Student Success Metrics by OER Designation, Student Characteristics, and Section Modality

	DFW Rate			Average Grade		Percentage A's		
Group	OER	Non-OER	*N*	OER	Non-OER	OER	Non-OER	*N*
Overall (inc. SP20-SP21)	0.14	0.17	35,987	2.86	2.85	0.48	0.47	30,588
Overall (w/o SP20-SP21)	0.15	0.19	20,084	2.87	2.82	0.49	0.44	16,864
White	0.14	0.18	11,201	3.03	2.95	0.55	0.49	9,495
Non-White	0.16	0.19	7,822	2.63	2.58	0.42	0.37	6,487
Woman	0.16	0.18	11,234	2.87	2.88	0.51	0.47	9,396
Man	0.14	0.19	8,850	2.86	2.73	0.47	0.41	7,468
First Generation	0.16	0.19	9,056	2.73	2.67	0.49	0.39	7,479
Non-First Generation	0.14	0.18	11,005	2.98	2.93	0.52	0.48	9,365
Full-Time	0.06	0.08	13,950	2.93	2.87	0.51	0.46	13,102
Less Than Full-Time	0.24	0.32	5,196	2.68	2.62	0.45	0.39	3,762
In-Person	0.15	0.17	11,386	2.89	2.78	0.49	0.42	9,680
Hybrid/Remote	0.14	0.13	1,690	2.59	2.51	0.37	0.33	1,455
Online Asynchronous	0.16	0.22	6,961	2.93	2.95	0.54	0.52	5,687

Note: All group comparisons use semesters that do not include Spring 2020 through Spring 2021.

The overall results for UNL (Table 2B) are more mixed than those at UNO: students in OER sections had 4% higher DFW rates than those in non-OER sections, but they did earn final grades that were 0.03 points higher on average and were 1% more likely to be A's. The benefits of OER may have accrued more strongly to White and non-first generation students at UNL. When taking OER sections, White students had average grades that were 0.08 points higher and earned 3% more A's, compared to slightly lower grades and earned A's for racial/ethnic minority students. Likewise, non-first generation students earned grades that are about 0.10 points higher with 3% more A's in OER sections, compared to essentially the opposite pattern for first generation students. Although based on a small sample, it appears that less than full-time

students at UNL may have benefitted more from OER sections than full-time students, with 4% lower DFW rates, grades that were 0.05 points higher on average, and 4% more earned A's.

Table 2B. UNL Student Success Metrics by OER Designation, Student Characteristics, and Section Modality

	DFW Rate			Average Grade		Percentage A's		
Group	OER	Non-OER	*N*	OER	Non-OER	OER	Non-OER	*N*
Overall (inc. SP20-SP21)	0.10	0.07	23,903	2.68	2.63	0.36	0.34	14,968
Overall (w/o SP20-SP21)	0.11	0.07	18,221	2.66	2.63	0.35	0.34	11,514
White	0.10	0.07	12,859	2.77	2.69	0.38	0.35	8,230
Non-White	0.13	0.08	4,063	2.31	2.34	0.24	0.25	2,561
Woman	0.10	0.06	7,938	2.82	2.82	0.40	0.39	5,341
Man	0.11	0.08	10,279	2.50	2.50	0.31	0.30	6,172
First Generation	0.14	0.08	4,605	2.33	2.44	0.25	0.27	2,965
Non-First Generation	0.10	0.07	13,616	2.79	2.69	0.39	0.36	8,549
Full-Time	0.06	0.03	15,969	2.71	2.68	0.36	0.35	10,576
Less Than Full-Time	0.34	0.38	2,030	2.13	2.08	0.22	0.18	937
In-Person	0.11	0.07	18,092	2.66	2.63	0.35	0.34	11,431
Online/Hybrid/Remote	0.08		129	2.99		0.36		83

Note: All group comparisons use semesters that do not include Spring 2020 through Spring 2021.

The positive effects of taking OER sections on student success metrics were modest but consistent at UNK (Table 3B) as well: students in OER sections had 1% lower DFW rates, 0.09 points higher average grades, and 5% more earned A's. The benefits of OER did not seem as consistent or positive in online asynchronous sections, but these findings were based on a relatively small sample size compared to the in-person sections. Supplemental multivariate tests were performed on data from all three campuses to control for potential spurious effects due to academic discipline or instructor characteristics. Multiple regression revealed that the results shown in Tables 1B, 2B, and 3B are substantively unchanged with the addition of these control variables, so we retained the more parsimonious findings presented here. These supplemental analyses are available from the authors upon request.

Table 3B. UNK Student Success Metrics by OER Designation and Section Modality

	DFW Rate			Average Grade		Percentage A's		
Group	OER	Non-OER	*N*	OER	Non-OER	OER	Non-OER	*N*
Overall	0.08	0.09	16,862	3.06	2.97	0.49	0.44	15,305
In-Person	0.07	0.09	16,324	3.07	2.97	0.49	0.44	14,883
Online Asynchronous	0.19	0.17	538	2.96	3.01	0.45	0.39	422

Note: These analyses include only data from Fall 2012 to Summer 2019 to avoid any potential pandemic effects.

CONCLUSIONS

The results reported in this white paper are a promising first look at the effect of the Open Nebraska program on student success. In general, our students across three NU campuses seem less likely to fail or withdraw and more likely to earn better grades when instructors implement open educational resources in their courses. Furthermore, in line with previous research,

underrepresented students at UNO seem to benefit the most from early access to no-cost and low-cost course materials. At the very least, the implementation of OER in the NU system does not seem to harm academic success while saving students millions of dollars in textbook costs.

Still, further research is needed to understand the full extent and reliability of the relationship between using open educational materials and student outcomes. Extending the timeline of research beyond the data available in this study is important for multiple reasons. First, while UNK was an early adopter of a version of the Open Nebraska course marking system, it is a newer process that has yet to be fully institutionalized at the other three NU campuses. Significant post-hoc work was done on the data set used in this study to ensure that the OER variable was as accurate and reliable as possible, yet some course sections that were utilizing no-cost or low-cost materials were almost certainly missed. This would likely result in an *underestimate* of the positive effects of Open Nebraska courses on student success. Second, we need to analyze data that is further removed from the COVID-19 pandemic, when extreme disruption to education caused by shutdowns and sudden shifts to online education added a variable that made it impossible to conduct direct, one-to-one comparisons of OER and non-OER courses. Third, there may be a longitudinal component at play, given that any instructor is bound to experience a learning curve when implementing OER. Assessing the effectiveness of Open Nebraska over time by instructor may yield interesting and helpful results. In general, additional data would allow for more complex analyses that can disentangle student and instructor effects from the implementation of OER itself.

Our data set would benefit from additional information on student characteristics, such as age and socioeconomic status (which could be measured by proxy through Pell Grant receipt). For example, looking at nontraditional students, Clinton-Lissell (2022) found that while grade performance improved for traditionally aged students in OER courses but not for nontraditional students, indicating a possible generational divide in comfortability with e-texts[20]. Likewise, we would expect that students from lower SES families would benefit the most from access to no-cost and low-cost materials. Still, there are cases in prior studies[21] and in our data where more privileged students seem to benefit more from OER, and additional student variables would help us dig into that finding. A smaller study that includes a quantitative or qualitative exploration of additional student outcomes such as engagement, confidence, motivation, and belonging may be warranted as well. Additional instructor-level variables could be added to the data set, including their years of experience teaching college-level courses, various assessments of their general teaching effectiveness, and their comfort in implementing OER. For example, Wiley & Hilton (2018) propose a new term, "OER-enabled pedagogy," to describe the still-emerging field of study looking at best practices for implementation as opposed to simply tracking existing use.

There seems to be significant faculty interest and buy-in around adoption of OER materials, but continued support from university leadership will be necessary to sustain this momentum. A recent study by Sergadis & Smith, for example, evaluating a university awards program found that the greatest concern moving forward was not advocacy but addressing faculty concerns regarding implementation and pedagogical considerations[22]. A common faculty

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[20] Clinton-Lisell, V. (2022). How does OER efficacy vary based on student age and course modality? A multi-institutional analysis. *American Journal of Distance Education*, 1-17.

[21] Dempsey, M. (2021). The impact of free and open educational resource adoption on community college student achievement. *The International Journal of Open Educational Resources*, 4(1), 25024.

[22] Sergiadis, A., & Smith, P. (2022). Is it worth it? Evaluating an open educational resources awards program. *Tennessee Libraries*, 72(1).

anxiety when approaching OER implementation is the impact of moving away from a standard textbook to accommodate an entirely online text. As Salem (2017) points out, the growth in both faculty incentive programs and library centered OER programs means that OER are going to continue to be a component of higher education, meaning assessment strategies are essential for guiding maintenance and continued growth[23]. OER education, already an established and permanent component of the higher education ecosystem, is transitioning into a fourth phase of OER implementation, centered around discussion and research focused on broader set of Open Educational Practices, of which OER and open pedagogy are components[24]. Thus, both financial support and informational campaigns will be critical to increasing the use of the Open Nebraska system among instructors across the University of Nebraska. Furthermore, annual review and promotion/tenure processes could explicitly value OER course conversions will give faculty added confidence that their efforts in this arena will be rewarded.

   The Open Nebraska program appears to be off to a successful start, championed by NU instructional faculty and academic leaders alike. Additional investments in converting courses to OER and in monitoring the success of these conversions for faculty and students is warranted. Telling this story to the wider state and regional community is a promising avenue to show prospective students, families, and stakeholders that the NU system continues to take innovative steps to provide a high-quality and affordable education.

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[23] Salem Jr, J. A. (2017). Open pathways to student success: Academic library partnerships for open educational resource and affordable course content creation and adoption. *The Journal of Academic Librarianship*, 43(1), 34-38.
[24] Lambert, S. R. (2018). Changing our (dis) course: A distinctive social justice aligned definition of open education. *Journal of Learning for Development*, 5(3), 225-244.