No-Cost/Low-Cost and OER Impact on Time-to-Credential

An Event History Modeling Study

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Abstract

The study explores the efficacy of no-cost/low-cost (NCLC) programs on student credential completion and persistence. The study looked at student-level data between the fall 2014 and 2021 academic year at a community college in the West. A retrospective cohort design with multivariate logistic regression and survival analysis was used to investigate the influence of attempted NCLC on student completion. Findings indicate that students, across all demographic categories, who attempt NCLC credits increase their likelihood of graduation with a large impact for older students. Our findings also indicate that student NCLC credits do not decrease time-to-completion compared to students who do not participate in NCLC credits. Students who participated in NCLC programs, however, graduated at a higher rate than those who did not participate. In this article, we provide recommendations for policy, practice, and research on the use of NCLC and its impact on student outcomes.

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Introduction

The increasingly unaffordable cost of higher education, including the fluctuating costs of instructional materials, has been a growing concern among university students, faculty, and the public. Reports critiquing the rising costs of course materials date back at least 20 years (see Fairchild, 2004). The College Board's *Trends in College Pricing* report highlighted a more than 33% increase between 2006 and 2016 in required allowances for books and supplies (Ma & Pender, 2022). The price tag of textbooks and other course materials remains one of the largest costs for students outside of tuition and fees. Students are increasingly forgoing this cost amid rising costs in other areas such as food and housing (Nagle & Vitez, 2021; Senack, 2014). A report by Student PIRGS (Nagle & Vitez, 2021) reported that 65% of student respondents reported forgoing the purchase of required course textbooks. Scholars recommended lowering the cost of textbooks as a strategy for supporting students (Dubick et al., 2016). In response, institutions are opting to adopt a variety of no-cost resources such as open educational resources (OER) and other low-cost options.

OER are "teaching, learning, and research materials that reside in (a) the public domain or (b) licensed in a manner that provide everyone with free and perpetual permission to engage in the 5R activities—retaining, remixing, revising and redistributing the resources" (William and Flora Hewlett Foundation, n.d.). OER gained traction globally when introduced as part of the Cape Town Open Education Declaration (2007), which urged publishers and governments to make publicly funded educational materials available via the internet and at no charge. In 2015, the United States (U.S.) 114th Congress (2015-2016) introduced H.R. 3721 – Affordable College Textbook Act to "expand the use of open textbooks to achieve savings for students" (Summary section, para. 3) by making openly available digital copies of educational resources developed using federal dollars. While OER are relatively new, in higher education, research continues to explore the efficacy of OER as a method for both supporting students amid increasing college costs and positively affecting student outcomes.

The original purpose of this study was to explore the impact on time-to-credential for students participating in courses using OER, however, several challenges emerged that shifted our research direction and design. We originally recruited three institutions that demonstrated interest in this study and had course marking practices in place; of the three, only one institution was able to participate. One institution's dataset was too small to allow for statistical analysis and provide generalizable results. In addition, such a small amount of data could not provide student anonymity. The second institution found too many discrepancies between their manually tracked courses using OER and data pulled from their student information system by their Institutional Research (IR) office. Although the final institution participated in this study, they highlighted a main issue faced by open education practitioners: student- and course-level data on OER adoption and usage are not readily available or marked in ways that allow for researchers and practitioners to better understand OER impact on student outcomes such as time-to-credential.

The participating institution nested courses using OER under a no-cost/low-cost (NCLC) course designation. This meant that a no-cost course could include not only OER but library licensed materials or other no-cost materials. OER could also be used and incorporated as part of a low-cost course. Course

markings are:

> also called attributes, designations, tags, flags, [and] labels are specific, searchable attributes or designations that are applied to courses, allowing students to quickly identify important information to aid in their decision making and allow them to efficiently plan their academic careers" (Johnson et al., 2024, p. v).

Several states have created policies that support course marking for OER, no-cost, and low-cost (see Texas Senate Bill 810, 2017 or Oregon House Bill 2871, 2015). How OER is course marked, however, can vary by institution and can sometimes be found embedded under a NCLC course designation. Due to the extenuating factors found in our participating site, we shifted the research direction of the study to explore the impact of NCLC courses on student time-to-credential. Although we explore NCLC on time-to-credential, the study provides a framework for how this study can be replicated in the future at institutions that have implemented course marking specifically for OER.

To advance the empirical evidence on the impact of NCLC on student success, the Western Interstate Commission for Higher Education (WICHE) conducted the study to understand whether NCLC influences a student's progression toward credential completion. Additionally, we were interested in understanding if NCLC could be utilized as a retention and persistence strategy and whether there are disparate effects on completion for historically underrepresented student populations (e.g., students of color, veteran students, and Pell Grant eligible students). The three research questions orienting this study were:

1. Does participation in a no-cost/low-cost course impact a student's time-to-credential completion?

2. Are there disparate completion effects for underrepresented and historically marginalized student populations who have participated in a no-cost/low-cost course?

3. Can no-cost/low-cost courses be used as a retention and persistence strategy?

Literature Review

The ability to save students money has driven support for OER among practitioners and policymakers alike, evidenced by the long list of legislation across states (Seaman & Seaman, 2017; SPARC, 2024). Students are making choices about whether they can forgo course materials, such as college textbooks and ancillary materials, amid rising postsecondary education costs and increased basic needs such as food and housing (Nagle & Vitez, 2021; Payne-Sturges, 2017). In response to public pressure, practitioner advocacy, and student needs, state legislatures are appropriating funds and creating policies to make course materials more affordable and accessible (SPARC, 2024). Institutions are increasingly expanding their NCLC options by offering courses using OER and other affordable materials.

While the American public calls for making postsecondary education more affordable (Baker, 2024), postsecondary institutions are simultaneously held accountable for student outcomes such as

persistence, retention, and completion rates (Felix & Garcia, 2023; Le et al., 2019; DeAngelo et al., 2011). Credential completion is at the center of the nation's quest to fill workforce demands across industry sectors. Under the Obama administration, the U.S. Department of Education's call included an increase in associate degree production to 60% among 25 to 34 year olds by 2020 (Fry, 2017). The goal remains unchanged years later as the U.S. experiences continued workforce shortages (Ferguson, 2023).

Researchers have found positive impacts on student academic performance for those that participate in a course using OER. Impacts include increased course grades and lower withdrawal rates, including positive outcomes for students from low-income and Pell Grant eligible backgrounds (Watson & Rush-Marlowe, 2023; Colvard et al., 2018; Robinson, 2015). Research conducted at Yavapai College, a college serving rural students in Arizona, found no negative impact on retention and completion for students who participated in courses with OER. Researchers did, however, find a slight positive impact on underrepresented students who experienced a 6% increase in retention and completion from fall to spring (Crossfield & Ryan, 2022).

OER has promising impacts on students, but the way in which institutions collect data on OER is complex and fragmented. In 2023, the Midwestern Higher Education Compact (MHEC) conducted a landscape analysis in which they collected 30 different terms and 41 unique definitions for course marking OER. OER was found "mixed in with other types of course designations" (Johnson et al., 2023, p. 3). This variation makes it difficult to study the impact of OER exclusively (Johnson et al., 2023). For example, one respondent reported embedding OER in their NCLC course designation when a primary source used OER (Johnson et al., 2023). Currently, the only study on NCLC is by McNulty et al. (2023) who looked at student enrollment behaviors across institutions at Oregon community colleges and public universities that provided students access to courses with NCLC options. McNulty et al. (2023) found that students sought and filled NCLC course sections at higher rates than non-NCLC options.

Theoretical Framework

We utilized Amaury Nora's Model of Student Engagement (MSE) as our theoretical framework. Nora's (2003) exploration of factors affecting college completion and degree completion was relevant to our research questions. We found Nora's model applicable to our research, although the MSE was originally developed to explore college persistence and degree attainment among Hispanic students. By answering our research questions, we sought to further our understanding of the impact of NCLC course participation as a possible intervention to drive student completion. We maintain that the availability of NCLC options for students can be a driver for student selection of a postsecondary institution as part of what Nora calls "precollege factors and pull-factors" (Nora, 2003, p. 56). The cost of postsecondary education is a major factor in institutional selection, and offering NCLC course options can serve as a deciding factor in a student's postsecondary selection. NCLC approaches can create "institutional allegiance" (Nora, 2003, p. 56) if an institution makes itself more affordable.

Nora's (2003) MSE considers students' "academic and social experiences" (p. 64) and the validating, mentoring, and social experiences that support student persistence. In our study, we did not explore the function of NCLC courses and the materials used for student learning; however, the use of

an approach such as open pedagogy in an NCLC course can provide what Nora (2003) presents as important to student persistence. Students require validating experiences, mentorship opportunities, and the ability to engage with learning in curricular and co-curricular environments. Open pedagogy can serve these functions. Elder (2019) defines open pedagogy as "the set of pedagogical practices that include engaging students in content creation and making learning accessible" (Open Pedagogy section, para 1). DeRosa and Robison (2017) regard open pedagogy use in OER "as a jumping-off point for remaking our courses so that they become not just repositories for content, but platforms for learning, collaboration, and engagement with the world outside the classroom" (p. 17). The use of open pedagogy and OER in an NCLC course could provide students with the academic and social experiences that lead to higher persistence. Important to student persistence is students' institutional allegiance, which can increase through institutional commitments to provide students with a sense of belonging and provide students with a worthwhile educational experience (Nora, 2003). Institutions that provide NCLC course opportunities for students can provide students with worthwhile experiences at a free or lower cost and help them attain their educational goals. Combined, these factors can drive student persistence.

Methods

Recruitment and Sample

A flyer was developed and shared electronically through WICHE's networks and those of the OERwest Network to find postsecondary institutions interested in participating in this study. The OERwest Network is a community of practice composed of practitioners (faculty, librarians, instructional designers, chief academic officers, state and institution OER coordinators) working together to advance and scale OER across the western United States and from the U.S. Pacific Territories and Affiliated States. Institutions who demonstrated interest in participating were invited to an initial meeting to discuss the types of data they collect for courses using OER. It was during these initial meetings that challenges regarding the types of available data arose. Institutions were not tracking data for courses exclusively using OER; instead, they embedded OER use under their NCLC designation. Prospective institutions used a $40 course materials cost threshold for NCLC designations. One institution had too small of a sample size, making statistical analysis and student anonymity impossible. The second institution found data discrepancies between their IR department and the individual tracking courses using OER.

Only one institution of the original three that expressed interest was able to participate in this study. The participating institution in this study was a community college in the Rocky Mountain region which offered more than 2,000 OER course sections per year in more than eight subject areas serving more than 19,000 students across multiple campuses and online. We worked specifically with this institution's IR department to gather the appropriate data for analysis. We provided the IR department a codebook with definitions of the variables to be collected and the method in which the data should be organized and sent back to WICHE through a secure data environment that adhered to federal and state data privacy requirements. The institution's lead for this project and their IR liaison participated in a secondary meeting with the methodologists to answer any data related questions.

Our cohort for this study included undergraduate students enrolled in an associate degree program at the participating institution who matriculated in the 2014-2015 academic year. Specifically, the cohort included students who matriculated between fall semester 2014 and June 30, 2015, and students who enrolled on or after July 1, 2014, and continued enrollment in the fall of 2014. All enrollment and graduation data for this cohort was included throughout 2021. We excluded dual/concurrent enrollment students from the sample, as they are considered high school students. We did not limit the population to "first-time, full- time" students but rather requested data from any student matriculating for the first time at the participating institution, including: first time, transfer, part-time, and full-time students. De-identified data were acquired from the National Student Clearinghouse, which resulted in a sample of 8,268 unique students meeting our inclusion criteria. We took appropriate steps to limit analysis and reporting of results to groupings of sufficient size to preclude identification of any individuals.

Data Collection

We chose our modeling approaches based on our research questions. First, we sought to determine whether attempting NCLC credits increase a student's odds of completing a credential. Second, we employed a data sharing agreement with the participating institution for the collection of de-identified student-level data. We received Institutional Review Board (IRB) approval for this study through the State Higher Education Policy Center (IRB 00011222). We also established a secure process for transmitting the data into WICHE's data environment using industry-standard tools with appropriate mechanisms to ensure data encryption. We prepared the data received from the participating institution and other data, such as school and postsecondary institution characteristics, and made it available to the researchers conducting the analysis.

One potential risk was the disclosure of data that could be reidentified. Steps to mitigate reidentification of data included a data sharing agreement outlining WICHE's secure data environment; the agreement exceeded all state and federal requirements for handlining identifiable student-level data. Additionally, we used a non-disclosure agreement. We developed a template for the codebook that was shared with the participating institution. The codebook delineated the data variables we sought and the variables that should be omitted from inclusion. We did not collect any identifying information. We asked the participating institution to assign each student a unique six digit proxyID. Additionally, we did not report disaggregated data with small cell sizes that could lead to reidentification, a widely accepted practice among researchers.

Study Design

We employed a retrospective cohort design (Capili & Anastasi, 2021) with multivariate logistic regression (Alexopoulos, 2010) and survival analysis (Schober & Vetter, 2018) to investigate the influence of attempted NCLC credits on both associate degree completion and time-to-credential.

Variable Selection

Outcome Variable. Models used one of two outcome or dependent variables: graduation status and time-to-credential. The first outcome variable (graduation status) is a binary indicator status with two categories: *graduated* and *did not graduate* within the given time period (each semester). The second outcome variable (time-to-credential) is the number of semesters a student took to graduate. We calculated this variable by counting semesters during which a student took at least one credit so as to exclude semesters in which a student was not actively moving towards credential completion. In our study, we did not explore the total number of NCLC credits, however, we suggest exploring this as a variable for future studies.

Exposure Variable. The exposure or key independent variable was whether students attempted NCLC credits and was coded "0" for students who attempted zero NCLC credits and "1" for students who attempted more than zero NCLC credits. We also tested models with a continuous variable for the number of NCLC credits attempted, but the distribution of the variable was too right-skewed (due to so many students attempting no NCLC credits) to be reliable without further transformation.

Covariates. In addition to the exposure variable, we investigated the partial influence of multiple covariates in all models. These covariates included student enrollment status, like part-time (n = 6,524) and full-time (n = 1,744). It also included genders, like male (n = 4,090), female (n = 4,139), and unknown (n = 39). Race and ethnicity was another covariant represented by Asian (n = 298), Black/African American (n = 287), Hawaiian/Pacific Islander (n = 201), White (n = 6,417), and unknown (n = 909). Additionally, veteran status such as never served (n = 7,867), prior served (n = 4,524), and age was included. The last covariant was whether the individual was a Pell Grant recipient, either yes (n= 3,744) or no (n= 4,524). To determine student enrollment status, we calculated the average number of credits taken per semester. If the average exceeded eleven credits, the student was classified as a full-time student, whereas an average below 12 credits indicated part-time student status. By incorporating this measure into our analysis, we aimed to capture the potential influence of student workload on the observed outcomes.

Data Analysis

We were interested in modelling the effects of covariates on these relationships. We modeled these covariates as interactive effects to see if the influence of NCLC credits varied across the different combinations of demographic characteristics. While we controlled for non-interaction terms for each covariate in the model, these main effects were not of interest to our research question. Instead, we report on the interaction terms between NCLC and each demographic covariate.

Probability of Credential Completion

We ran logistic regression models to model relationships between the binary predictor NCLC credits attempted and the probability of graduating using Equation 1.

Equation 1

$$\log log \left(\frac{\pi}{1-\pi} \right) = \beta_0 + \beta_1 X_1$$

In the equation, $\log(\pi/(1-\pi))$ is the estimated log odds of an event occurring, and $Y=1=\pi$, where Y is the outcome variable of having graduated or not. B_0 is the intercept term, or log odds of graduating when not attempting NCLC credits, and B_1 is the model coefficient associated with the predictor X_1 (set to 1 if students attempted NCLC credits). We transformed log odds to odds ratios for interpretation by exponentiating the log odds $(\exp(\log(\pi/(1-\pi))))$. The results of odds ratio can be interpreted as the odds that a given event (in this case, credential completion during the time period) is more or less likely to occur for students in one group (in this case, students who attempted NCLC credits) over another.

We ran another set of logistic regression models to look at the interactive effect of each demographic covariate with the binary predictor of NCLC credits attempted, as well as the main effect of the demographic covariate using Equation 2.

Equation 2

$$\log \log \left(\frac{\pi}{1-\pi}\right) = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2,$$

In Equation 2, $\beta_3 X_1 X_2$ estimates the interaction effect between attempting NCLC credits (X_1), and the co-variate (X_2) used in the model.

Time-to-completion analysis

We tested for differences in time-to-completion for students attempting NCLC courses and those that did not by using a survival function and log-rank testing. For these analyses, we created a coded variable to represent graduation status, where a zero represented a censored observation (did not complete), and a one represented an observation where the event occurred (completion). The survival function estimated the probability that an individual survives (does not complete) up to and including time t and was calculated using Equation 3.

Equation 3

$$S(t) = Pr(T > t),$$

In equation 3, T is the time of graduation, and $Pr(T > t)$ is the probability that the time of graduation is greater than some time t. We plotted the survival function as Kaplan-Meier curves to visualize differences in median survival time between groups.

To estimate the size of the difference between groups and test for interaction effects between covariates and attempting NCLC credits, we calculated cox proportional hazards using Equation 4.

Equation 4

$$h(t) = h_0(t) * exp(b_1 x_1 + b_2 x_2 \dots b_n x_n),$$

In Equation 4, *t* represents the survival time (semesters to graduation), and *h(t)* is the hazard function determined by n covariates (x_1, x_2, x_n). Hazard ratios represent the ratio of hazard between a baseline group and a treatment group (e.g., did not attempt NCLC, attempted NCLC). Given the results of our logistic regression modelling, we chose to model how attempting NCLC credits affects the hazard of graduating at any given time and how student age interacts with this hazard. All statistical analyses were performed using the R statistical software version 4.1.2 (R Core Team, 2021).

Results

Our simple model with a single predictor (NCLC credits) revealed a significant difference in the odds of completing a credential between those that attempted NCLC credits and those that did not (OR = 2.012, 95% CI [1.74, 2.33]), where the estimated odds ratio of 2.012 suggests that students attempting NCLC credits were more than two times likely to complete their credential over those that did not. (See Figure 1).

Figure 1

Predicted Probabilities of Graduation for Students Who Did and Did Not Attempt NCLC Credits
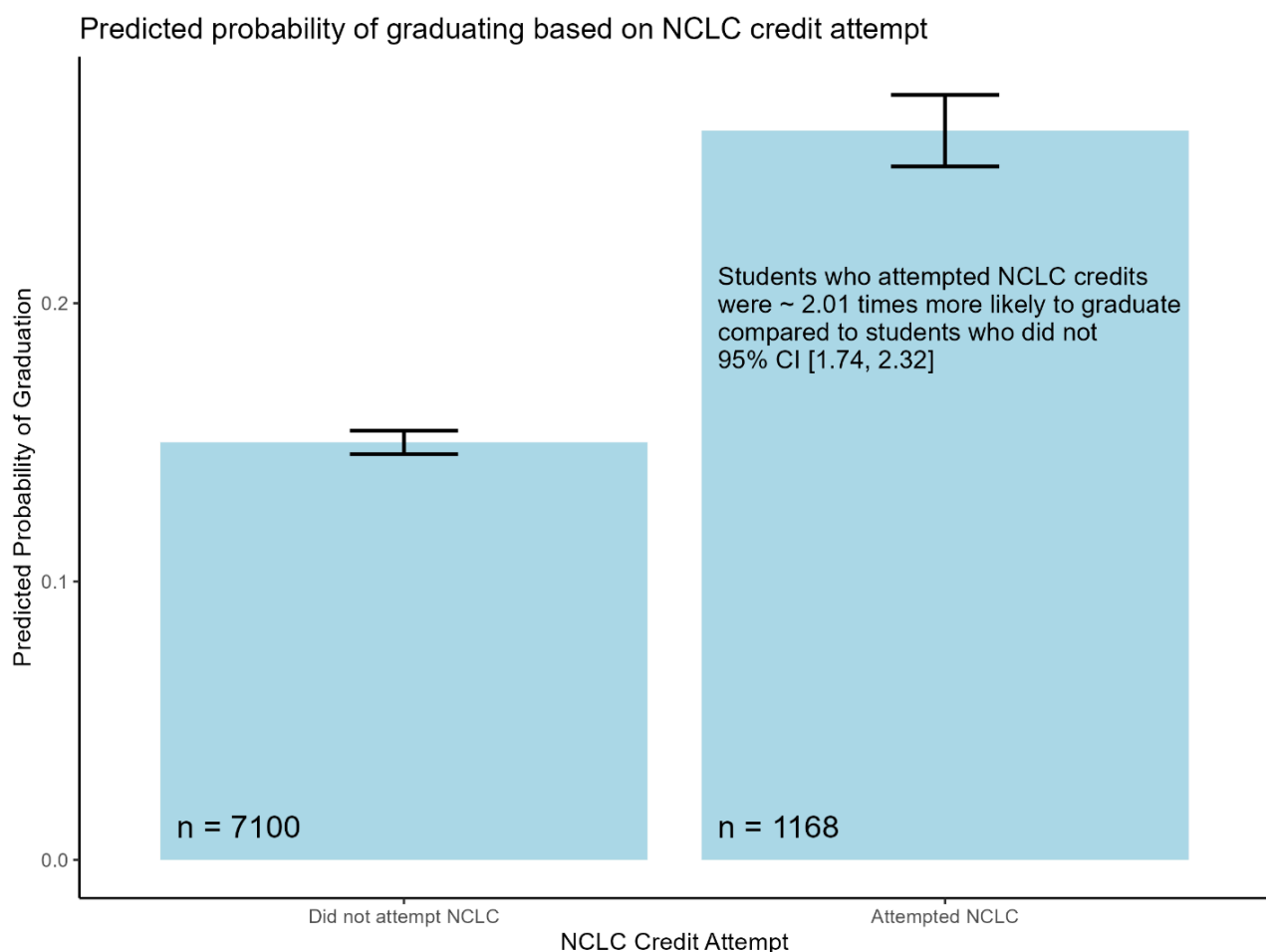

Note. Annotated with odds ratio showing estimated difference between groups.

We also found that age modified the effect that attempting NCLC credits had on the odds of completing a credential. For a one-year increase in age, the odds of completing a credential increased slightly (OR = 1.03, 95% CI [1.01,1.06]) for those attempting NCLC credits compared to those who did not. (See Figure 2). In other words, the older the student who attempted NCLC credits, the higher likelihood they had of completing a credential at any given time compared to those who did not attempt NCLC.

Figure 2

Probability of Credential Completion Dependent on Age and NCLC Credits Attempted

Probability of graduating depends on age and NCLC credit attempt
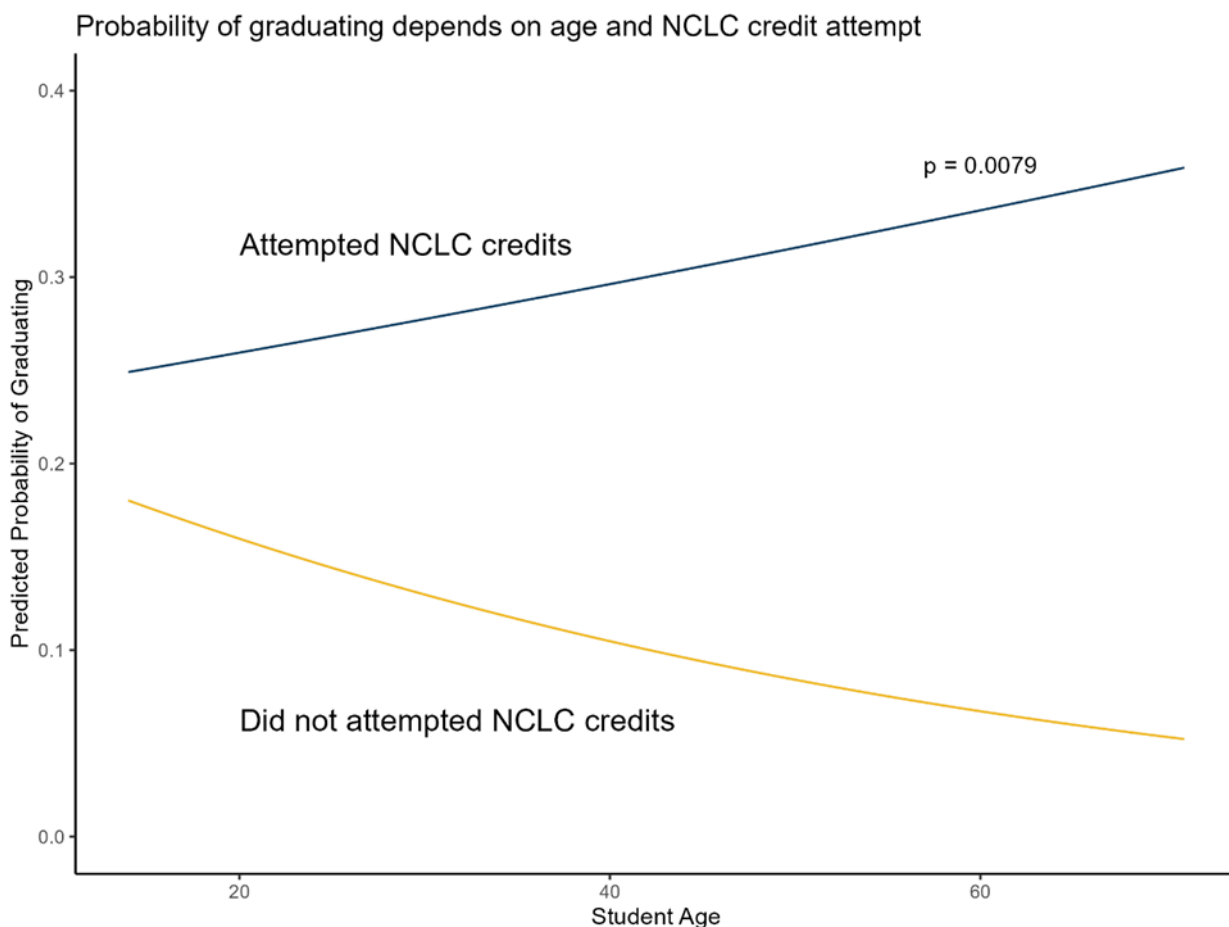
Note. Predicted probability of credential completion as a function of NCLC credit attempt, and age, with p-value shown for the interaction between NCLC attempt * age.

The logistic regression analysis also revealed that odds of credential completion were dependent upon whether student enrollment status was full-time (> 11 credits per semester average) or part-time (<= 11 credits per semester average; see Table 1). A significant difference exists between part-time students attempting NCLC credits and part-time students who did not (p < 0.0001). Part-time students attempting NCLC credits were approximately 2.4 times more likely to complete a credential than part-time students not attempting NCLC credits (OR = 2.4, 95% CI [2.08, 2.85]; see Figure 3). No

differences exist between part-time students attempting NCLC credits and full-time students in either group.

**Table 1**

Logistic Regression Models

Model	Independent variable	b	se	z	p
graduated ~nclc attempt					
	Intercept(No attempt NCLC)	-1.735	0.033	-52.19	<0.0001
	Attempt NCLC	0.699	0.074	9.396	<0.0001
graduated ~nclc attempt*age					
	Intercept(No attempt NCLC)	-1.175	0.123	-9.569	<0.0001
	Attempt NCLC	-0.057	0.283	-0.201	0.8409
	age	-0.025	0.005	-4.65	<0.0001
	Attempt NCLC*age	0.033	0.013	2.657	0.0079
graduated~nclc attempt*enrollment_status					
	Intercept(No attempt NCLC part-time)	-1.925	0.041	-47.313	<0.0001
	Attempt NCLC	0.891	0.08	11.123	<0.0001
	Full-time	0.684	0.072	9.573	<0.0001
	Attempt NCLC*full-time	0.875	0.257	3.409	<0.0001
graduated~nclc attempt*race					
	Intercept (White, No Attempt NCLC)	-1.65	0.037	-45.107	<0.0001
	Attempt NCLC	0.0731	0.083	8.824	<0.0001
	Asian	-0.132	0.186	-0.71	0.478
	Black	-0.924	0.254	-3.634	<0.0001
	Hawaiian/Pacific Islander	-1.528	0.387	-3.945	<0.0001
	American Indian	-0.278	0.27	-1.1029	0.303
	Unknown	-0.287	0.114	-2.53	0.011
	Attempt NCLC*Asian	-0.024	0.369	-0.064	0.949
	Attempt NCLC*Black	0.1	0.489	0.204	0.838
	Attempt NCLC*Hawaiian/Pacific Islander	-0.772	1.093	-0.706	0.48
	Attempt NCLC*Asian	-0.675	0.606	-1.115	0.265
	Attempt NCLC*Unknown	-0.063	0.257	-0.244	0.807
graduated~nclc attempt*pell grant recipient					
	Intercept (No Pell, No Attempt NCLC)	-1.833	0.046	-39.831	<0.0001
	Attempt NCLC	0.717	0.109	6.578	<0.0001
	Pell recipient	0.214	0.066	3.206	0.001
	Attempt NCLC*Pell	-0.065	0.149	-0.433	0.665
graduated~nclc attempt*gender					
	Intercept (Male, No Attempt NCLC)	-1.995	0.052	-38.683	<0.0001
	Attempt NCLC	0.718	0.118	6.092	<0.0001
	Female	0.484	0.068	7.139	<0.0001
	Unknown	0.386	0.45	0.857	0.392
	Attempt NCLC*Female	-0.065	0.152	-0.429	0.668
	Attempt NCLC*Unknown	0.199	1.309	0.152	0.879
graduated~nclc attempt*veteran					
	Intercept (Non-vet, No Attempt NCLC)	-1.724	0.034	-50.738	<0.0001
	Attempt NCLC	0.692	0.076	9.12	<0.0001
	Veteran	-0.235	0.165	-1.429	0.153
	Attempt NCLC*Veteran	0.139	0.39	0.356	0.722

The log-rank test showed there was a significant difference in the time-to-credential between students attempting NCLC credits and those that did not ($\chi 2 = 412$, df = 1, p < 0.0001). Students attempting NCLC credits have a significantly lower hazard or likelihood of credential completion at any given time compared to students who did not attempt NCLC. However, when controlling for the main effects of age, there was evidence that the likelihood of credential completion at any given time depended on age (p = 0.038). The hazard ratio for students attempting NCLC credits was 1.02 (95% CI [1.00, 1.04]), indicating a multiplicative increase in the likelihood of credential completion for each

one-unit increase in age among individuals attempting NCLC credits compared to those that did not. Median survival times differed between the two groups: 50% of students who did not attempt NCLC credits completed a credential by semester eight, while 50% of students who did attempt NCLC credits completed by semester 12. (See Figure 3).

Figure 3

Students Attempting NCLC Credits Take Longer to Graduate
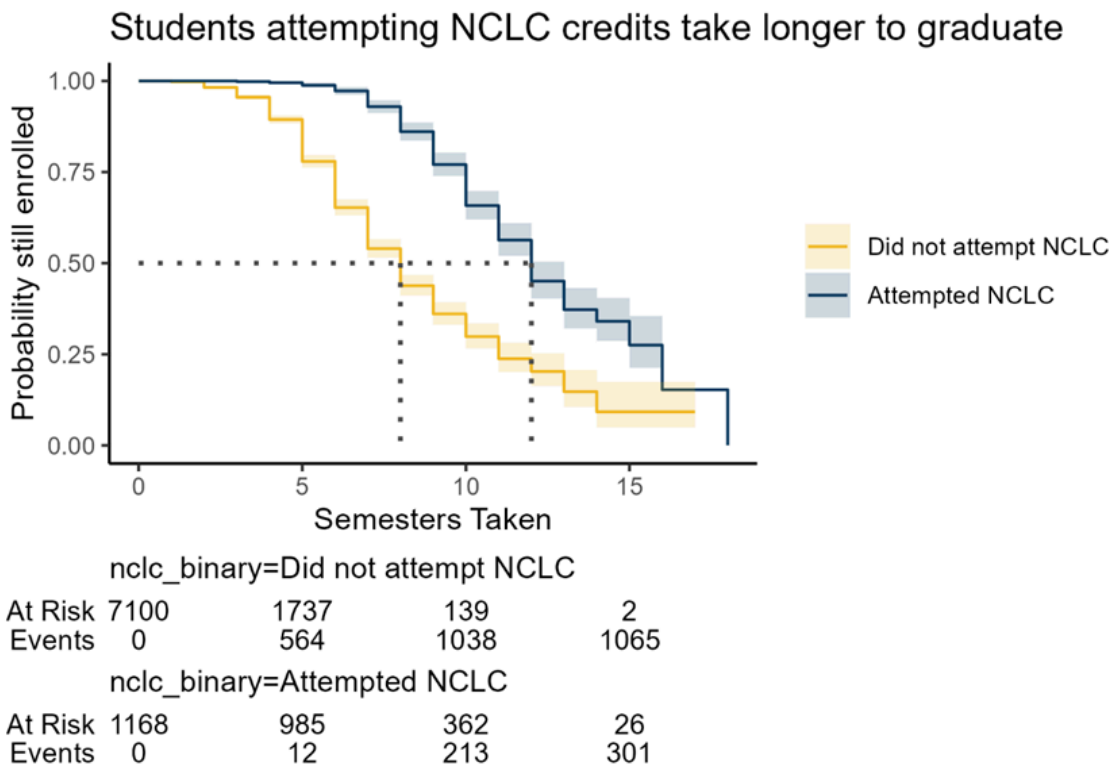
Note. Kaplan-Meier curves showing the influence of NCLC credits on time to graduation for students who did not and did attempt NCLC credits. Dashed lines indicate median survival times, i.e., when 50 % of students have graduated.

Discussion

Our findings indicate that students who participated in NCLC credits increased their likelihood of completing their credential. We did not find statistically significant impacts across demographic categories; however, of particular importance in our findings was the impact of NCLC on the credential completion of adult students—a student population that is a large and growing demographic at postsecondary institutions (Taliaferro & Duke-Benfield, 2016). The older the age of the student who participated in NCLC credits, the higher the likelihood of that student completing a credential. Secondly,

we found that NCLC credits do not decrease time-to-credential when compared to students who did not participate in NCLC credits; however, 50% of students who participated in NCLC credits graduated within six years compared to the national average of 28% in four years (Chen, 2022; Yano & Myers, 2018). Students who participated in NCLC took longer to complete their credential, however, their completion rates were higher than students who did not participate in NCLC credits. Our findings indicate that there are positive impacts on students participating in NCLC credits—increased completion rates and positive impact for older students.

Limitations and Delimitations

The lack of a course marker in the dataset for courses using OER exclusively posed a challenge in our ability to understand the impact of OER on student success outcomes. The inability to differentiate between OER and NCLC credits reflects broader challenges within the open education movement, including the lack of standardized definitions for how postsecondary institutions define and categorize OER. In 2022, the Midwestern Higher Education Compact (MHEC) released their report, *Toward Convergence,* presenting a series of recommendations for developing a consistent method for measuring cost savings and a return on investment when using OER. The report's framework could be utilized as a model for developing a standard for course marking OER.

Instructors across the western United States utilize a combination of educational materials in their classrooms which include materials like OER or materials that may be free but are not openly licensed, library licensed materials, or may include low-cost materials. A $40 cost threshold was predominately used across institutions in the West; however, this is not a standard threshold, and there are disparities. For example, Idaho uses a $30 threshold for very low-cost and a $50 threshold for low-cost designations (Idaho State Board of Education, 2021). Our initial interest was to only analyze the impact of OER on credential completion; however, the limited number of institutions that have clear definitions and classifications for what constitutes a course that uses OER versus a course that uses a combination of materials under an NCLC designation proved a limitation.

Conclusion

Our study has implications for policy, research, and practice. Institutions, by and large, are unable to quantitatively assess the impact of OER on student success outcomes if they do not have a mechanism by which to pull such data, especially if OER is embedded within other course designations such as NCLC. Implementation of a course designation for OER or no-cost would facilitate the ability of IR departments, faculty/staff, and administrators to examine how course materials impact student outcomes. Practitioners interested in better understanding the relationship between course materials and student outcomes should implement or revisit their institution's course marking policies. Course marking policies should account and differentiate between course material categories (e.g., OER, library licensed, no materials needed, low-cost). Practitioners interested in learning more about course marking should explore resources such as MHEC's 2024 report, *A Course Marking Roadmap,* which serves as a guide for the development and implementation of Open and affordable course marking, or they should review the book *Marking Open and Affordable Courses: Best Practices and Case Studies* (Ainsworth et

al., 2020) to learn how to implement course marking.

Similarly, stakeholders such as policymakers are often supportive of OER/NCLC for their affordability, accessibility, and impact both have on student cost savings. State appropriations and institutional/system funding for OER has occurred in many states (see SPARC Policy Tracker), however, accountability measures have primarily relied on how much money it saved students. There is an appetite within the open education community for moving the conversation among policymakers and institutional leaders past cost savings and onto the teaching and learning benefits of using OER. Although there is ample research on student learning outcomes when using OER and the impacts on faculty teaching practices, these topics do not necessarily align with interests among policymakers or institutional administrators that are accountable for differing outcomes (e.g., completion, retention, persistence).

Currently, the type of course marking that distinguishes OER in more nuanced detail from an NCLC course marker does not offer enough detail for effectively understanding or communicating the impact of these types of course offerings on student outcomes in a way that is of interest to policymakers. We recommend OER proponents work collaboratively with policymakers and institutional administrators to bring transparency and clarity to the issue of course marking to better track data, specifically on OER. Practitioners can look at existing state-level course marking policies such as the Texas Senate Bill 810 (2017) which established protocols for course marking OER in registration systems, course catalogs, and schedules across institutions in the state or at Idaho's (2021) Instructional Material Access and Affordability policy.

Recommendations for future research include studying institutions with Z-degree pathways. Z-degree pathways, also known as Zero Textbook Cost Degrees, offer students degree tracks with no textbook costs (Minnesota State Community and Technical College, n.d.). We also encourage studies that investigate other impacts of the use of NCLC and OER in courses; impacts such as student learning, applicability in curricular and co-curricular spaces, and faculty engagement and retention. Secondly, we encourage additional research to better understand why students who participate in NCLC credits take longer to complete their credential. Based on our findings, NCLC can be used as a persistence tool, however, more research should be conducted to understand the phenomena.

Acknowledgements

Conflict of Interest Statement

The authors report no conflicts of interest.

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Open Peer Review

Keating, M. (2024, May). [No-Cost/Low-Cost and OER Impact on Time-to-Credential: An Event History Modeling Study, by L. D. Solodukhin, M. MacDonald, C. Falkenstern, P. Lane, & K. Jones]. *Journal of Open Educational Resources in Higher Education, 3*(1), 130-148. doi: 10.31274/joerhe.17772

Reviewer: Michaela Keating

Recommendation: Reject

Scope, Objectives, Content

Is the article in scope for Journal of Open Educational Resources in Higher Education? Does the topic discuss an element related to open education, open data, open access, or other open topics? Is the topic an important one, or is it trivial or of low priority?

The article is not entirely within the journal's scope, as it cannot separate between the categories of OER, zero-cost, and low-cost materials and their impact on student success. Since some of the courses considered for this study may entail a cost for course materials, placing them within the context of open education is difficult. This limitation is addressed within the manuscript, but this may not be appropriate for a journal focusing on topics related to open education. The authors are correct in pointing out that there is not currently much literature on the role of low-cost resources in student persistence, success, and retention. Still, this particular research may not have a place in a journal dedicated to OER.

Organization

Does the article proceed logically? As applicable, does the article adhere to a recommended structure and the section guideline?

The article proceeds logically and follows the recommended structure of the journal. The manuscript does include more figures/tables than recommended; some may need to be moved to an appendix if accepted.

Methodology, Approach, Conclusions

The methodology for data gathering and analysis should be appropriate for the problem addressed. Inferences from data should be sound--the author should not reach unsupported conclusions. Not all papers will use a scientific research methodology, but all should employ sound reasoning and an adequate balance between description and critical analysis.

Consider: Is the article factually accurate? Is it clear the author knows, or has investigated, previous work on the subject of the article? Has the author failed to reference recent or seminal work on the subject?

The methodology and results sections of the paper are difficult to read. While in-depth descriptions of their analytical tools and equations are appreciated, the additional information is not particularly helpful for the average researcher. Few readers will use this resource to replicate the study using this information, so perhaps some of this information would be better suited to an appendix than the main text. The data collected, and its conclusions, are interesting and important, but some of that gets lost in reporting on the details of how the data was collected.

Writing Style, References

Please indicate whether there are problems with expression or flow, but do not comment about grammar or basic edits. Do NOT take the time to do copy editing - that will be handled later in the process. However, general comments pointing out problems with style or format are useful.

The literature review section does not feel fully connected to the rest of the study. Two ideas are introduced–affordability and accountability–but most of the original research presented here does not comment on either of those aspects in the discussion or the conclusion. It seems like those things serve as more the impetus for conducting the study than the place in which the research should be situated. The idea of accountability especially is of interest, but the authors have not made connections to how their research is connected to this previous research.

Application:

Does the article contribute knowledge or practical examples that will inform/improve others' practice or education?

It's unclear how this research might inform the practice of others. It's helpful to know the connections established in their study, but again, the inability to know the difference between open, zero-cost, and low-cost does not add any nuance to the discussion.

What are the stronger points/qualities of the article?

It's clear the researchers have spent significant time collecting this data and working through their analyses. The rigor of their research design is commendable.

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What are the weaker points/qualities of the article? How could they be strengthened?

Overall, it's difficult to wade through the technical aspects of the study and get to the heart of the data. The difficulty in describing the research and its findings limits its use for other researchers. It could be improved by streamlining some of these sections to focus on more clear and concise ideas derived from the data.

Peer Review Ranking: Scope

Does the topic discuss an element related to open education, open data, open access, or other open topics?

Not Relevant

Peer Review Ranking: Clarity

Clarity of expression and flow? Does the article proceed logically?

Clear

Peer Review Ranking: Contribution

Contribution to higher education research and/or practice

Contributes

Peer Review Ranking: Methodology

If this is a research paper, is the methodology appropriate?

Appropriate

Peer Review Ranking: Conclusion

If this is a research paper, are the conclusions sound? Does the article contribute knowledge or practical examples that will inform//improve others' practice or education?

Not Sound

Overall Evaluation

Reject

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Open Peer Review

Reviewer: James Paradiso

Recommendation: Minor Revisions Required

Scope, Objectives, Content

Is the article in scope for Journal of Open Educational Resources in Higher Education? Does the topic discuss an element related to open education, open data, open access, or other open topics? Is the topic an important one, or is it trivial or of low priority?

The authors do a good job of explaining how this study was intended to look solely at the impact of OER, but because interested institutions were generally rolling OER into their NCLC designation (rather than having a marker specifically for OER), the researchers had to pivot. I think the article still fits within the scope of this journal because, as was mentioned in the study, the model and their findings will prove helpful for further studies that look at similar questions in the context of "only" OER. Any work looking at the impact LCNC (including OER) has on student success (e.g., time-to-graduation) is extremely important to the progress of this field.

Organization

Does the article proceed logically? As applicable, does the article adhere to a recommended structure and the section guideline?

The article proceeds logically and follows the section guidelines in all areas except for "Figures and Supporting Information." The Section Guidelines state: "Up to four (4) figures, tables, graphs, diagrams, supporting information, and appendices may be supplied and should be embedded in the main body of the text. Additional items can be uploaded as supplementary electronic files e.g. survey instruments, data, etc." I counted 4 figures and 3 tables in the body of the text.

If only 4 must remain, I'd recommend keeping the figures and possibly covering the main points of the data in paragraph form and referencing the location of the full table for readers to view if desired.

Methodology, Approach, Conclusions

The methodology for data gathering and analysis should be appropriate for the problem addressed. Inferences from data should be sound--the author should not reach unsupported conclusions. Not all papers will use a scientific research methodology, but all should employ sound reasoning and an adequate balance between description and critical analysis. Consider: Is the article factually accurate? Is it clear the author knows, or has investigated, previous work on the subject of the article? Has the author failed to reference recent or seminal work on the subject?

The methodology is sound (well-chosen, considering the research questions), and the inclusion of covariates allows for a more nuanced discussion of the findings.

Writing Style, References

Please indicate whether there are problems with expression or flow, but do not comment about grammar or basic edits. Do NOT take the time to do copy editing - that will be handled later in the process. However, general comments pointing out problems with style or format are useful.

The article is grammatically sound and concise with very well-developed ideas.

I was a little thrown off when reading the Influence of Attempting NCLC Credits on Time-to-Credential Completion sub-section, though.

The first paragraph states the "Students attempting NCLC credits have a significantly lower 'hazard' or likelihood of graduating at any given time...." but when controlling for "age," the likelihood of graduating at any given time was higher compared to those who didn't attempt NCLC credits. Maybe a transition like "however" placed before "Our cox proportional hazards models...." might help signal to the reader that there is a juxtaposition.

I had to spend a bit of time re-reading this section to make sure I was understanding it as intended. I think some of the confusion was due to a lack of idea coherence (which could be helped with transition words or clearer separation between similar / different results), but the phrase "at any given time" was also something I had to stop and think about, as I wasn't immediately sure how to interpret it. I'd consider rewording that phrase and possibly reworking the section slightly to make the ideas flow more naturally for someone who hasn't spent hours thinking about the data.

Application:

Does the article contribute knowledge or practical examples that will inform/improve others' practice or education?

The article discusses graduation rates and time-to-graduation—two very important metrics for higher education institutions (and their funding). I am not sure how easy or practical it will be to replicate the study (for the general reader-base), but that does not take away from the importance of this work in the broader sense. The key will be to share the findings with the right audiences (post-publication).

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The authors might include a practical step-by-step guide, diagram, or tips sheet on how to investigate any of the recommended items mentioned in the Conclusion. This would greatly facilitate "next steps" for the many readers who are practitioners by trade.

What are the stronger points/qualities of the article?

This study has a clever research design and adds to an under-researched area in the field. It also provides solid guidance, especially for those working at the system–or institutional–level. The findings are compelling and will hopefully encourage others to continue investigating these and related research questions that add to the efficacy of OER (and affordability initiatives) as it relates to student success.

What are the weaker points/qualities of the article? How could they be strengthened?

The article could have brought the message home more closely for non-administrative practitioners (e.g., teachers, instructional designers, librarians, et al.), as these are often the ones on the ground making the work happen. A single article can't (and arguably shouldn't) be all things for all people, but having an "applied" or "in action" component could go a long way—even for the readers who work as administrators (for awareness if nothing more).

For example, faculty often discuss course materials options with librarians, so how might they support this effort, considering the evidence shown? Similarly, for instructors and instructional designers, an NCLC course (especially one using OER) does not run successfully simply because a new ISBN was submitted to the bookstore. A course redesign often accompanies materials changes like these— involving a considerable amount of (invisible) labor—that is not factored into administrators' or policymakers' top-down plan to operationalize NCLC or OER programs at state or institutional levels.

Peer Review Ranking: Scope

Does the topic discuss an element related to open education, open data, open access, or other open topics?

Relevant

Peer Review Ranking: Clarity

Clarity of expression and flow? Does the article proceed logically?

Clear

Peer Review Ranking: Contribution

Contribution to Higher Education research and/or practice

Contributes

Peer Review Ranking: Research Assessment

If this is a research paper, is the methodology appropriate?

Appropriate

Peer Review Ranking: Research Assessment

If this is a research paper, is the methodology appropriate? Does the article contribute knowledge or practical examples that will inform/improve others' practice or education?

Sound

Overall Evaluation

Minor Revisions Required

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