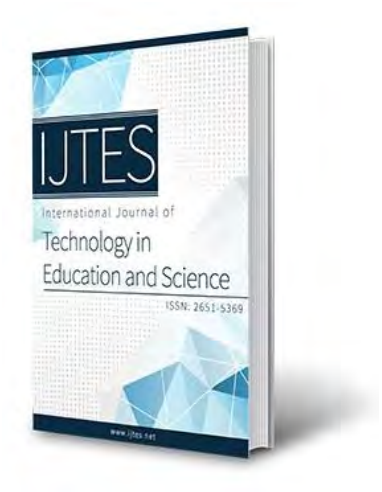

www.ijtes.net

The Cost of Doing Homework: Online Homework Systems with Access Codes from a Social Justice Perspective

Virginia Clinton-Lisell
University of North Dakota, United States

Alison E. Kelly
University of North Dakota, United States

To cite this article:

Clinton-Lisell, V. & Kelly, A. E. (2024). The cost of doing homework: Online homework systems with access codes from a social justice perspective. *International Journal of Technology in Education and Science (IJTES), 8*(2), 296-310. https://doi.org/10.46328/ijtes.547

International Journal of Technology in Education and Science
2024, Vol. 8, No. 2, 296-310 https://doi.org/10.46328/ijtes.547

The Cost of Doing Homework: Online Homework Systems with Access Codes from a Social Justice Perspective

Virginia Clinton-Lisell, Alison E. Kelly

Article Info

Article History

Received:
05 January 2024
Accepted:
05 April 2024

Keywords

Online homework systems
Commercial courseware
Postsecondary students

Abstract

The use of online homework systems that require the purchase of an access code has become widespread. The purpose of this study is to examine student experiences with and perceptions of online homework systems with access codes. Postsecondary students (N = 966) completed a survey about the financial costs, perceptions of quality, engagement with, and learning with online homework systems. Most students (79.5%) indicated that they had been required to purchase an access code for an online homework system. Of those who had been required to purchase an access code, 29.4% reported their grade was hurt because they could not afford an access code. Students reported online homework systems were moderately helpful for learning. When considering students who have been historically underserved by higher education, Black students reported more courses with required access codes for homework and reported that online homework systems were more helpful than other students. Latino/a/x students were more likely to report their grades were hurt by not affording access codes (47.9%) than other students. First-generation students reported they avoided courses with online homework systems (36.9%) more than continuing-generation students (23.9%). Overall, the findings indicate that the cost of online homework systems is a barrier to education, and alternatives should be further developed and promoted.

Introduction

Most postsecondary faculty (72%) in the United States require or recommend that students in at least one of their courses use online homework systems to complete coursework (Seaman & Seaman, 2022). Also referred to as courseware, these systems are often developed by commercial textbook publishers (e.g., Pearson, Cengage, Macmillan) and usually require an access fee. Online homework systems are also used globally in countries such as South Africa (Mafunda & Swart, 2020; Wiggins & van der Hoff, 2021), Australia (Benzie & Harper, 2020), Canada (Elias et al., 2017), and Saudi Arabia (Yushau & Ali Khan, 2014). Despite their widespread use, there is little evidence about student perceptions of these systems, as well as how the cost may affect students (Hughes & Taylor, 2022). Furthermore, it is important to consider how students traditionally underserved in higher education are experiencing online homework systems. The purpose of this study is to examine student experiences with online homework systems that require purchasing access codes. In particular, we are interested in how online

homework systems affect students in terms of financial cost, emotional cost, and academic outcomes. We also consider student perceptions of the helpfulness of online homework systems and how they relate to engagement with the content. In pursuing these purposes, we examine how these experiences may differ for two groups of students traditionally underserved in higher education: racially and ethnically minoritized students and first-generation students.

Social Justice and Cost

Open educational resources (OER), which are teaching and learning materials available without online access fees due to their licensing (UNESCO, 2021), have been a means to address the rising costs of commercial textbooks (Thomas & Bernhardt, 2018). Over the past several years, commercial publishers have marketed online homework systems that are on proprietary platforms (Lalonde, 2020). Commercial homework systems rapidly became commonplace after the need to transition to virtual learning in March 2020 due to the COVID-19 pandemic, presumably because many publishers had these systems temporarily available without cost (Nagle & Vitez, 2021). There are some open-source or low-cost online homework systems that incorporate OER (see BC Campus, 2023, for examples), but there do not seem to be similar patterns of rapid adoption of these systems by instructors (Seaman & Seaman, 2022). To understand if there is a need in open education to further develop and advocate for the use of open homework systems, there first needs to be an understanding of student experiences with commercial homework systems. If commercial homework systems are financially burdensome, but also viewed as helpful for learning, that would be evidence supporting the development and promotion of open homework systems.

Our inquiry into online homework systems is grounded in the SCOPE framework (Clinton-Lisell et al., 2023). In the SCOPE framework, research in open education is organized in terms of its relevance to Social justice, Cost, Outcomes, Perceptions, and Engagement. Our primary focus in the current study is on social justice and cost, as the purchase of access codes could interfere with removing barriers to resources, particularly for students more likely to encounter barriers. This aspect of social justice, known redistributive justice (Lambert, 2018), reflects financial barriers preventing students from completing their course assignments and taking full advantage of learning opportunities. Fundamental to this concern is that students who already have more barriers in pursuing postsecondary education may have an additional barrier in the form of the financial cost of an access code.

Very little research has examined student experiences with online homework systems, but research about student perceptions of the financial impact of commercial textbooks may offer potential insights. Generally speaking, students resent the cost of commercial textbooks and report negative academic repercussions due to not purchasing textbooks (Nusbaum et al., 2020). These issues are often amplified for students historically underserved in higher education. For example, in a study by Jenkins and colleagues (2020), compared to their white peers, Latinx students reported more stress from commercial textbook costs and were more likely to forgo purchasing textbooks and have it hurt their course performance. Similar patterns were noted when first-generation students were compared to their continuing-generation peers. It should also be noted that with textbooks, students often engage in cost-saving measures, such as sharing a textbook with a friend, buying used or previous editions, finding pirated

versions online, or simply not having the textbook. However, access codes are unique to students and the cost-saving approaches with textbooks do not apply. Therefore, access codes could have more deleterious effects on students than textbooks. It is important to examine this possibility, given cost is considered the most significant barrier to postsecondary education (Gallup & Lumina Foundation, 2023).

Outcomes, Perceptions, and Engagement

Online homework systems typically include quizzes, videos, problems, and visuals that are intended to provide students with opportunities to practice skills and master course concepts. However, the limited existing research shows students earn similar grades in courses with and without commercial online homework systems (Boozer & Simon, 2020; Mafunda & Swart, 2020; Welch, 2019). Relatedly, students performed better when an instructor-developed online homework system was used compared to a commercially prepared system that required the purchase of an access code (Elias et al., 2017). Despite this, students typically perceive that online homework systems help their learning and encourage engagement with the content (O'Sullivan et al., 2020; Raines, 2016; Wiggins & van der Hoff, 2021). Given the widespread use of online homework systems, further inquiry into students' perceptions of these systems is needed, especially from students who historically have not had their voices heard.

Research Questions

1. What are the overall experiences of postsecondary students with online homework systems? These experiences include cost, frequency of use, perceived helpfulness, and consequences due to cost of access codes.
2. How do experiences with online homework systems vary for students traditionally underserved by higher education? In the current study, we focus on racially minoritized students and first-generation students.

Method

Positionality Statements

Following recommendations from Castillo and Babb (2024), the authors wrote positionality statements about their identities and potential biases. The first author is a white, cisgender woman who was a continuing-generation college student. She works to be mindful of the biases inherent in these identities in her research in education. The second author is a white, cisgender woman and was a continuing-generation college student. She is also a non-tenure-track professor at a public university enrolling a predominantly white student body. In her teaching and research, she actively works to identify and minimize the potential biases inherent in her privileged identities.

Participants

In the current study, postsecondary students (N = 966 completed at least some items for analyses) in the United

States were recruited to complete a survey on their perceptions of online homework systems requiring the purchase of access codes. Participants were recruited from the Prolific online research platform. According to participants reporting demographic background and identities (n = 872), 43.9% were men, 5.5% were nonbinary/gender fluid, and 50% were women, with four participants indicating another gender identity/identities. In terms of race, 9.9% reported being Asian or Pacific Islander, 12.0% were Black or African American, 49.9% were white, 8.9% were Latino/a/x or Hispanic, and three reported other racial identities. The average age was 27.60 years (SD = 9.76 years). In terms of college generation status, 35.4% reported they were the first person in their family who would graduate with a college degree.

Survey Instrument

For the survey, items from Jenkins and colleagues' (2020) survey about textbook costs were adapted to be relevant to online homework systems. Additional items were created by the study authors to address the research purpose and questions. Specifically, students reported the cost of online homework system access code fees during the most recent semester, how frequently they used online homework systems, the perceived helpfulness of online homework systems, and their perceptions of stress or anxiety due to online homework system costs.

For academic performance, students reported whether they engaged more with course content and performed better in courses requiring online homework systems, as well as whether they had avoided, dropped, withdrew, or failed a course because of online homework system costs. Students were also asked to indicate what they perceived to be a fair price for an example online homework system, as well as recommend a fair price for the system. Finally, two open-ended items asked about the advantages and disadvantages of online homework systems.

Analysis

QuantCrit (Quantitative Critical Race Theory) was considered when conducting the analyses in this study. One of the major tenets of the QuantCrit approach is that numbers are not neutral. Therefore, including variables in statistical models that are dependent on racism may distort findings due to race. For this reason, race and college generation status were examined separately to avoid hiding the effects of racism that are conflated with college generation status (Rondini, 2023; Street et al., 2022). In the interest of research transparency, which is a recommendation of QuantCrit (Young & Young, 2022), the survey instrument and de-identified data from this study are openly available on Open Science Framework (Clinton-Lisell & Kelly, 2023).

Results

Overall responses from all participants are reported in Table 1 and 2. As noted in Table 1, the requirement to purchase access codes was a common experience. Only participants who indicated that they were required to purchase an online homework system access code for at least one course answered the specific questions about their experiences with access codes. Their responses are in Table 3 and 4.

Table 1. Dichotomous Measures from All Participants

Item	Percent indicated "yes" response
Required to purchase access codes	79.5%
Avoided class that required access codes	28.0%

Table 2. Interval Measures from All Participants

Item	M(SD)	Range (minimum to maximum)
Number of courses with access codes	1.27(1.21)	0-5+
Cost of access codes this semester	$115.87($132.33)	$0-$800
Average cost per course with access code	$92.56($66.24)	$0-$567
Example homework system access code cost is reasonable (1 = extremely unreasonable and 11 = extremely reasonable)	3.36 (2.27)	1-11
Fair price of example online homework system access code (actual price is $159.99)	$56.52($48.53)	$0-$850

Table 3. Dichotomous Measures from Participants Required to Purchase Access Codes for Online Homework System

Item	Percent indicated "yes" response
The cost of access codes is stressful	77.9%
Did not pay for an access code	28.3%
Grade was hurt because of not having access codes	29.4%
Dropped a class because of access code costs	16.1%
Failed a class because did not have access code	6.2%

Table 4. Interval Measures from Participants Required to Purchase Access Codes for Online Homework System

Item	M(SD)	Range (minimum to maximum)
Level of stress or anxiety because of online homework system prices (1 = no stress and 10 = extreme stress)	5.82(2.49)	1-10
How helpful for learning are online homework systems? (1 = not at all helpful and 10 = extremely helpful)	4.91(2.42)	1-10
How frequently do you use online homework systems? (1 = never and 10 = daily)	5.88(2.45)	1-10
How often do you engage with course content when required to purchase an online homework system? (1 = much less often and 10 is much more often)	5.41(2.21)	1-10
Do you perform better or worse in class when required to purchase an online homework system? (1 = much worse and 10 is much better)	5.57(1.86)	1-10

Experiences Based on Racial/Ethnic Identity

We were particularly interested in how students historically underserved in higher education reported their experiences. We considered race based on the four most common racial and ethnic identities reported by participants. Descriptive results from all participants in these racial and ethnic identities are reported in Tables 5 and 6. Only participants who indicated they had at least one class that required an access code were included in the descriptives in Table 7. To determine if the findings in Table 5 differed across racial and ethnic identities, we conducted chi-square tests. There were no reliable differences in the likelihood of being required to purchase an access code, but Latino/a/x students were more likely to have to purchase an access code compared to their peers from other races.

Table 5. Dichotomous Measures from Participants Disaggregated by Racial/Ethnic Group

Item	Asian or Pacific Islander	Black/African American	Latino/a/x or Hispanic	White	χ^2 and p value
Required to purchase access codes	88.3%	81.7%	82.8%	76.9%	7.41, .06
Avoided class that required access codes	29.8%	29.6%	44.8%	25.8%	13.10*, .004

We further conducted a multivariate analysis of variance with the items listed in Table 6 as the dependent variables and race/ethnicity as the independent variable. Bonferroni corrections were used for post-hoc comparisons when there were significant omnibus results. Due to space limitations, only significant post-hoc results are reported. As can be seen in the right column, there were differences across racial/ethnic groups for the number of courses with access codes, the perceived reasonableness of the example online homework system cost, and the fair price of the example online homework system.

Table 6. Interval Measures from Participants Disaggregated by Racial/Ethnic Group

Item	Asian or Pacific Islander M(SD)	Black/African American M(SD)	Latino/a/x or Hispanic M(SD)	White M(SD)	F statistic and p value
Number of courses with access codes this semester	1.71(.84)	2.31(1.15)	1.88(.99)	1.75(.94)	8.07*, $p < .001$
Cost of access codes this semester	$165.85 ($138.43)	$178.72 ($129.46)	$170.05 ($138.79)	$154.24 ($125.89)	.92, .43
Average cost per course with access code	$100.77 ($69.96)	$83.82 ($59.54)	$93.65 ($64.01)	$92.82 ($67.64)	.85, .47
Example of OHS reasonable	3.00(2.01)	4.77(2.71)	3.54(2.23)	3.15(1.99)	13.39*, <.001
Fair price of example OHS	$56.47 ($28.76)	$92.22 ($107.53)	$55.65 ($31.68)	$53.16 ($33.23)	13.18*, <.001

Note: OHS = online homework system. Longer item descriptions in Table 2

Based on post-hoc analyses, Black students have more courses with access codes than Asian ($p < .001$), Latino/a/x ($p = .04$), or white students ($p < .001$). In addition, Black students were more likely to indicate that the example online homework system access code cost was reasonable than Asian ($p < .001$), Latino/a/x ($p = .003$), or white students ($p < .001$), and indicate a higher fair price for an online homework system access code than Asian ($p < .001$), Latino/a/x ($p < .001$), or white students ($p < .001$).

Based on chi-squared test results, there were disproportionate responses across racial/ethnic groups for access code costs being perceived as stressful, harmfulness towards grades due to not purchasing an access code, and failing a course due to not having an access code (see Table 7). Black students were less likely to indicate the cost of access codes was stressful compared to students from other racial/ethnic groups. Latino/a/x students were more likely to indicate that their grades were hurt from not having an access code, as well as that they had failed a course because of the price of access codes compared to students from other groups. A multivariate analysis of variance was used to calculate the *F* statistics and *p* values reported in Table 8.

Table 7. Dichotomous Measures from Participants Who Had Been Required to Purchase an Access Code for an Online Homework System Disaggregated by Racial/Ethnic Group

Item	Asian or Pacific Islander	Black/African American	Latino/a/x or Hispanic	White	χ^2 and *p* value
Cost of access codes is stressful	75.9%	61.1%	84.5%	81.5%	21.36*, < .001
Did not pay for an access code	22.0%	29.8%	33.3%	29.2%	2.67, .45
Grade was hurt because of not purchasing access code	18.5%	37.6%	47.9%	28.2%	18.79, < .001
Dropped a class because of access code costs	12.0%	21.3%	25.0%	15.5%	6.47, .09
Failed a class because of the price of the access code	0.0%	6.4%	11.1%	6.5%	8.62*, .04

Table 8. Interval Measures from Participants Who Had Been Required to Purchase an Access Code for an Online Homework System Disaggregated by Racial/Ethnic Group

Item	Asian or Pacific Islander M(SD)	Black/African American M(SD)	Latino/a/x or Hispanic M(SD)	White M(SD)	*F* statistic and *p* value
Level of stress or anxiety because of OHS prices	5.71(2.37)	5.63(2.80)	6.28(2.27)	5.88(2.40)	1.07, .36
Helpfulness of OHS	4.77(2.21)	5.97(2.56)	5.32(2.41)	4.67(2.34)	8.26*, < .001
Frequency of OHS use	6.05(2.38)	6.66(2.18)	5.92(2.48)	5.67(2.51)	4.19*, .01
Engagement with OHS	5.34(2.01)	6.08(2.33)	5.30(2.14)	5.44(2.18)	3.24*, .02
Performance with OHS	5.66(1.63)	6.29(2.20)	5.47(1.98)	5.39(1.72)	6.28*, < .001

Note: OHS = online homework system. Longer item descriptions in Table 4

Based on post-hoc analyses, Black students reported that online learning systems were more helpful than did Asian (p = .01) and white students (p < .001). In addition, Black students reported they more frequently use assigned online homework systems than did white students (p = .003). Black students further reported that online homework systems help them better engage with the course content more than white (p < .001) and Latina/o/x students (p = .03). Finally, Black students indicated that online homework systems help their course performance more than white (p < .001) and Latina/o/x (p = .03) students.

Experiences Based on Generation Status

Based on chi-squared test results, there were no reliable differences in generation status for being required to purchase access codes (see Table 9). However, first-generation students were more likely to report that they had avoided a course because of the cost of the required online homework system access code.

Table 9. Dichotomous Measures from Participants Disaggregated by Generation Status

Item	First-Generation Students	Continuing-Generation Students	χ^2 and p value
Required to purchase access codes	80.2%	79.2%	.15, .70
Avoided a class that required access codes	36.9%	23.9%	16.85*, < .001

Based on the results of the MANOVA, first-generation students had higher access code costs in the current semester than continuing-generation students (see Table 10).

Table 10. Interval Measures from Participants Disaggregated by Generation Status

Item	First-Generation Students M(SD)	Continuing-Generation Students M(SD)	F statistic and p value
Number of courses with access codes this semester	1.92(1.02)	1.79(.92)	2.65, .10
Cost of access codes this semester	$180.69($145.13)	$151.58($122.33)	6.70*, .01
Average cost per course with access code	$99.34($73.90)	$91.28($66.15)	1.86, .17
Example OHS access code cost is reasonable	3.48(2.37)	3.35(2.09)	.48, .49
Fair price of example OHS access code	$61.05($42.21)	$59.62($55.75)	.10, .75

Note: OHS = online homework system. Longer item descriptions in Table 2

Based on chi-squared test results of students who were required to purchase an access code for online homework, first-generation students were more likely to indicate that they had not paid for an access code due to cost, that their grades were hurt due to not having an access code, that they had dropped a course because of access code

cost, and that they failed a course due to not having an access code. See Table 11 for all item comparisons.

Table 11. Dichotomous Measures from Participants Required to Purchase an Access Code for Online Homework Systems Disaggregated by Generation Status

Item	First-Generation Students	Continuing-Generation Students	χ^2 and p value
Cost of access codes is stressful	22.8%	21.3%	.24, .62
Did not pay for an access code	33.1%	25.7%	4.45*, .04
Grade was hurt because of not having OHS access code	35.8%	25.6%	8.16, .004
Dropped a class because of access code costs	22.1%	13.6%	8.30, .004
Failed a class because did not have an access code	11.0%	2.9%	19.11, <.001

Based on the results of a MANOVA, there were no reliable differences in perceived stress or anxiety due to online homework system prices based on generation status. Additionally, first-generation students reported that online homework systems were more helpful for their learning and that they used online homework systems more frequently than did continuing-generation students (see Table 12).

Table 12. Interval Measures from Participants Disaggregated by Generation Status

Item	First-Generation Students M(SD)	Continuing-Generation students M(SD)	F statistic and p value
Level of stress or anxiety because of OHS prices	6.00(2.64)	5.71(2.35)	2.29, .13
Helpfulness of OHS	5.16(2.42)	4.78(2.39)	4.14, .04
Frequency of OHS use	6.18(2.51)	5.74(2.39)	5.46, .02
Engagement with OHS	5.41(2.23)	5.37(2.20)	.04, .84
Performance with OHS	5.58(2.00)	5.53(1.77)	.12, .73

Note: Note: OHS = online homework system. Longer item descriptions in Table 4

Perceptions of Online Homework Systems

We selected examples of open-ended responses that indicate student perceptions of online homework systems that required access codes. For advantages, students appreciated immediate feedback on performance, the integration and alignment with course textbooks, opportunities for additional practice and examples, and digital access. For disadvantages, students said they were too expensive, often had technological problems, it was tempting to cheat, and that they needed internet access to use. Quotes from students are in Table 13.

Table 13. Examples of Student Responses to Open-ended Questions

Examples of student responses to advantages to online homework systems	Examples of student responses to disadvantages to online homework systems
"I think the main advantages of online homework systems are the immediate feedback and the multitude of examples to help comprehend coursework content."	"They're expensive and buggy/glitchy"
"I think the advantages of online homework student systems is that the coursework and homework is integrated with the textbook, which I think is advantageous for students."	"If you do not have wifi, then you will not be able to access it. Some people that are not good with technology might have trouble with it."
"I think it provides access to more customized and immersive learning tools. Such as for my biochem class there were videos we could watch as we answered questions to help reinforce pathways and mechanisms."	"The disadvantage of online homework systems is that you are not allowed to buy it secondhand. A lot of people buy used textbooks as it is cheaper and you cannot do that with online homework systems."
"You don't have to send in papers like the old-fashioned way, and some systems allow you to retake for a better score."	"The cost is exorbitant. The programs tend to not run well. Some programs run on a limited number of browsers/operating systems."
"I think some of the advantages are getting immediate feedback for quizzes, being able to access assignments and the textbook in the same place, and grade progress tracking."	"it is expensive, doesn't teach much, leads to a lot of cheating. It is a way of discrimination because some won't have access to these things or technology to use them"
"They usually come with a ton of resources (videos, examples, etc.) in case you need extra help with a certain subject. The first time algebra and other math concepts finally clicked for me was due to the extra assistance from a Pearson homework platform. (I have Dyscalculia)."	"paying even more unnecessary fees when the professors could just assign their own homework, encourages cheating because the answers are almost certainly on Chegg"

Discussion

The purpose of this study was to examine student experiences with online homework systems requiring the purchase of access codes. Despite the widespread use of these homework systems, little data reports on students' experiences, particularly students historically underserved by higher education. Overall, our findings indicate that paying for access to course homework is a relatively common experience among higher education students in the United States. Further, a concerning number of students (28%) indicated their course selection process is driven by the cost of doing online homework, and that their grades have been hurt due to not being able to afford these systems. However, students perceived the systems to be moderately helpful and reported using them somewhat

frequently, which is consistent with the findings from previous studies on online homework systems (O'Sullivan et al., 2020; Raines, 2016; Wiggins & van der Hoff, 2021). However, students perceived the cost of an example online homework system to be somewhat unreasonable. Similarly, students reported an average fair price for an online homework system that was approximately one-third the actual cost. This would indicate that, similar to student perceptions of fair pricing for textbooks (Clinton, 2018), students view online homework systems as overpriced.

When examining findings by race, Black and Latinx/Hispanic students reported different experiences than students of other races. In particular, Black students paid the most for access codes, had the lowest stress levels related to the cost of access codes, and had the highest reported fair price of an example online homework system. This may be because Black students are more accustomed to purchasing access codes for their courses. Additionally, Black students used online homework systems more frequently, found them to be more helpful, and reported more course content engagement due to online homework systems compared to students of other races. By contrast, Latinx/Hispanic students reported higher levels of stress and anxiety and more undesirable academic outcomes due to the cost of online homework systems, which is similar to findings on expensive commercial textbooks (Jenkins et al., 2020).

When examining findings by generation status, first-generation students paid more for online homework system access codes during the most recent semester compared to their continuing-generation peers. First-generation students were also more likely to have negative academic outcomes due to not being able to afford access codes. This could be due to first-generation students typically experiencing higher cost burdens and coming from lower-income backgrounds compared to continuing-generation students (Kyaw, 2023). Importantly, these findings are similar to those involving the financial burden of commercial textbooks (Jenkins et al., 2020). Despite these cost burdens, first-generation students appeared to have more positive perceptions of the helpfulness of online homework systems and reported using them more frequently. However, it should be noted that commercial homework systems have shown no benefits to student learning when compared to online homework systems that do not require purchase to access (Boozer & Simon, 2020; Mafunda & Swart, 2020; Welch, 2019). Indeed, one study found that students had higher grades with homework prepared by their instructor than when they used commercial homework systems (Elias et al., 2017). Therefore, additional inquiry is needed to determine if student perceptions of learning are aligned with actual benefits in grades.

An alarming pattern of findings suggests that students traditionally underserved by higher education appear to not only have more courses with required access codes but also disproportionately experience negative academic outcomes due to access code costs. The number of students of color and first-generation students who have failed a course because they cannot afford to do online homework is particularly noteworthy. These findings highlight how online homework system costs are a barrier to redistributive justice (Lambert, 2018) and contribute to inequitable education for students. Despite these barriers, Black students and first-generation students noted more perceived value and course content engagement due to online homework systems. These findings emphasize the need to develop more open homework systems that allow students to benefit from interactive content and feedback without the steep financial access barriers. Moreover, there should be efficacy studies comparing open and

commercial homework systems to infer whether learning benefits, if indeed there are benefits to having online learning systems, are similar despite different financial costs to students. If online homework systems function similarly across prices as textbooks, there would likely be similarities in learning and perceptions with less cost to the student for open systems (Clinton & Khan, 2019; Hilton, 2016, 2020; Tlili et al., 2023).

Importantly, there may be systematic factors that explain the current study's findings regarding historically underserved groups in higher education. In particular, materials that are required for purchase at the course level may be influenced by the institution--individual students within a course are very rarely required to purchase different materials. Therefore, it can be inferred that courses and institutions that have higher enrollments of racially minoritized or first-generation students are more likely to require online homework systems. This may be due to targeted marketing from commercial publishers to these institutions. Another possibility is that online homework systems are viewed as a means to overcome a lack of institutional resources (e.g., tutoring is not available, so students purchase online homework systems to receive additional academic support). This assumption is based on longstanding inequities for institutions that primarily serve students historically underserved in higher education (Jones & Kunkle, 2022). However, these possibilities are merely conjectures without any supporting data. Future studies should investigate why particular groups of students are more likely to be required to purchase access codes for online homework systems.

There are limitations to this study that need to be mentioned. First, we did not ask students about internet access. Given that approximately 10% of college students do not have reliable access to the internet, this creates an additional barrier to completing homework using online systems (Nagle & Vitez, 2021). In the open-ended comments, the need for internet to do homework was named as a disadvantage. It may be valuable to develop online homework platforms that would be downloadable for offline use. However, this is an issue for any online homework, including most of what is posted on learning management systems, not only systems that require purchase of access codes (Chen et al., 2023). Further, our sample only included students from one country (the United States). Additional research in more countries is needed to make claims about the global generalizability of our findings.

Conclusion

Online homework systems have the potential to provide students with opportunities for interaction with course content and immediate feedback. However, the findings from this study indicate that the financial costs of these systems are barriers to desirable academic outcomes, especially for students traditionally underserved by higher education. Students traditionally underserved in higher education perceived the online homework systems as beneficial for their learning and regularly used them when purchased. Should future research indicate online homework systems have benefits for student learning, the development and expansion of open-access online homework systems without expensive access codes may be necessary. Finally, faculty should reflect on these findings and consider the financial and academic consequences reported by students when making decisions about homework platforms for their courses.

Acknowledgements

We thank the William and Flora Hewlett Foundation for financially supporting this study.

References

BCcampus. (2023). *The Open Homework Systems Project*. https://bccampus.ca/projects/archives/the-open-homework-systems-project/

Benzie, H. J., & Harper, R. (2020). Developing student writing in higher education: Digital third-party products in distributed learning environments. *Teaching in Higher Education*, *25*(5), 633–647. https://doi.org/10.1080/13562517.2019.1590327

Boozer, B. B., & Simon, A. A. (2020). Teaching effectiveness and digital learning platforms: A focus on mediated outcomes. *Journal of Instructional Pedagogies*, *24*. https://eric.ed.gov/?id=EJ1263918.

Castillo, W., & Babb, N. (2024). Transforming the future of quantitative educational research: a systematic review of enacting quantCrit. *Race Ethnicity and Education, 27*(1), 1-21. https://doi.org/10.1080/13613324.2023.2248911

Chen, L., Wong, S. L., & How, S. P. (2023). A systematic review of factors influencing student interest in online homework. *Research and Practice in Technology Enhanced Learning*, *18*, 1-21. https://doi.org/10.58459/rptel.2023.18039

Clinton, V., & Khan, S. (2019). Efficacy of open textbook adoption on learning performance and course withdrawal rates: A meta-analysis. *AERA Open, 5*(3), 1-20. https://doi.org/10.1177/2332858419872212

Clinton, V. (2018). Savings without sacrifices: A case study of open-source textbook adoption. *Open Learning*, 33(3), 177–189. https://doi.org/10.1080/02680513.2018.1486184

Clinton-Lisell, V., & Kelly, A. E. (2023). Online homework systems survey. Retrieved from http://osf.io/tdu97

Clinton-Lisell, V. E., Roberts-Crews, J., & Gwozdz, L. (2023). SCOPE of open education: A new framework for research. *The International Review of Research in Open and Distributed Learning*, *24*(4), 135–153. https://doi.org/10.19173/irrodl.v24i4.7356

Elias, A. L., Elliott, D. G., & Elliott, J. A. W. (2017). Student perceptions and instructor experiences in implementing an online homework system in a large second-year engineering course. *Education for Chemical Engineers*, *21*, 40–49. https://doi.org/10.1016/j.ece.2017.07.005

Gallup & Lumina Foundation. (2023). The state of higher education. https://www.luminafoundation.org/resource/the-state-of-higher-education-2023-report/

Gillborn, D., Warmington, P., & Demack, S. (2018). QuantCrit: Education, policy, 'Big Data' and principles for a critical race theory of statistics. *Race Ethnicity and Education*, *21*(2), 158–179. https://doi.org/10.1080/13613324.2017.1377417

Hilton, J. (2016). Open educational resources and college textbook choices: A review of research on efficacy and perceptions. *Educational technology research and development*, *64*, 573-590. https://doi.org/10.1007/s11423-016-9434-9

Hilton, J. (2020). Open educational resources, student efficacy, and user perceptions: A synthesis of research published between 2015 and 2018. *Educational Technology Research and Development*, *68*(3), 853-876.

https://doi.org /10.1007/s11423-019-09700-4

Hughes, J., & Taylor, J. (2022). Textbooks 101: What you really need to know about textbook access codes, inclusive access, open access, and more! Paper presented at the Annual Meeting of the Association Supporting Computer Users in Education (ASCUE). https://eric.ed.gov/?id=ED622612.

Jenkins, J. J., Sánchez, L. A., Schraedley, M. A. K., Hannans, J., Navick, N., & Young, J. (2020). Textbook broke: Textbook affordability as a social justice issue. *Journal of Interactive Media in Education*, *2020*(1), 1–13. http://doi.org/10.5334/jime.549

Jones, V. A., & Kunkle, K. (2022). Unmarked privilege and marked oppression: Analyzing predominantly white and minority serving institutions as racialized organizations. *Innovative Higher Education*, *47*(5), 755–774. https://doi.org/10.1007/s10755-022-09610-z

Kyaw, A. (2023, July 3) [Report]. More than half of all U.S. college students are first-generation. https://www.diverseeducation.com/reports-data/article/15541596/report-more-than-half-of-all-us-college-students-in-the-us-are-firstgeneration. *Diverse Issues in Higher Education*.

Lalonde, C. (2020, May 7). The cost of homework. *B. Ccampus News*. https://bccampus.ca/2020/05/07/the-cost-of-homework/

Lambert, S. R. (2018). Changing our (dis)course: A distinctive social justice aligned definition of open education. *Journal of Learning for Development*, *5*(3). https://doi.org/10.56059/jl4d.v5i3.290

Mafunda, B., & Swart, A. J. (2020). The impact of mind tap on the academic achievement of first-year software application students. *World Transactions on Engineering and Technology Education*, *18*(1), 63–67.

Nagle, C., & Vitez, K. (2021). Fixing the broken textbook market. *Us PIRG*. https://uspirg.org/sites/pirg/files/reports/Fixing%20the%20Broken%20Textbook%20Market%2C%203e%20February%202021.pdf

Nusbaum, A. T., Cuttler, C., & Swindell, S. (2020). Open educational resources as a tool for educational equity: Evidence from an introductory psychology class. *Frontiers in Education*, *4*(152). https://doi.org/10.3389/feduc.2019.00152

O'Sullivan, P., Forgette, C., Monroe, S., & England, M. T. (2020). Student perceptions of the effectiveness of adaptive courseware for learning. *Current Issues in Emerging eLearning*, *7*(1), Art. 5. https://scholarworks.umb.edu/ciee/vol7/iss1/5

Raines, J. (2016). Student perceptions on using MyMathLab to complete homework online. *Journal of Student Success and Retention*, *3*(1). https://www.jossr.org/wp-content/uploads/2014/04/STUDENT-PERCEPTIONS-ON-USING-MYMATHLAB_article.pdf.

Rondini, A. C. (2023). 'Dream like the Whites': Disjunctures in racial experiences and interpretations of low-income first-generation students of color and their parents. *Social Problems*, *70*(3), 616–634. https://doi.org/10.1093/socpro/spab061

Seaman, J. E., & Seaman, J. (2022). Turning point for digital curricula: Educational resources in U.S. higher education. https://www.bayviewanalytics.com/reports/turningpointdigitalcurricula_infographic.pdf

Street, C., Guenther, J., Smith, J., Robertson, K., Ludwig, W., Motlap, S., Woodroffe, T., Ober, R., Gillan, K., & Larkin, S. (2022). Do numbers speak for themselves? Exploring the use of quantitative data to measure policy "success" in historical Indigenous higher education in the Northern Territory, Australia. *Race Ethnicity and Education*, *25*(3), 309–330. https://doi.org/10.1080/13613324.2021.2019003

Tlili, A., Garzón, J., Salha, S., Huang, R., Xu, L., Burgos, D., ... & Wiley, D. (2023). Are open educational resources (OER) and practices (OEP) effective in improving learning achievement? A meta-analysis and research synthesis. *International Journal of Educational Technology in Higher Education*, *20*(1), 54. https://doi.org/10.1186/s41239-023-00424-3

Thomas, W. J., & Bernhardt, B. R. (2018). Helping keep the costs of textbooks for students down: Two approaches. *Technical Services Quarterly*, *35*(3), 257–268. https://doi.org/10.1080/07317131.2018.1456844

United Nations Educational, Scientific and Cultural Organization. (2021). Paris OER declaration. https://unesdoc-unesco.org/ark:/48223/pf0000246687. Programme and meeting document for the World Open Educational Resources Congress in Paris, *2012*.

Welch, S. (2019). An evaluation of Macmillan Education's *LaunchPad* as a textbook technology supplement when teaching introductory psychology. *Scholarship of Teaching and Learning in Psychology, 5*(3), 236–246. https://doi-org.ezproxy.library.und.edu/10.1037/stl0000162

Wiggins, H., & van der Hoff, Q. (2021). Using an online homework system for fostering self-directed learning. *International Journal of Technology in Education and Science*, *5*(3), 323–335. https://doi.org/10.46328/ijtes.199Young, J., & Young, J. (2022). Decoding the data dichotomy: Applying QuantCrit to understand racially conscience intersectional meta-analytic research. *International Journal of Research and Method in Education*, *45*(4), 381–396. https://doi.org/10.1080/1743727X.2022.2093847

Yushau, B., & Ali Khan, M. A. (2014). Student perceptions of online homework in preparatory year precalculus course. *International Journal of Mathematics Trends and Technology*, *8*(1), 12–17. https://doi.org/10.14445/22315373/IJMTT-V8P503

Author Information

Virginia Clinton-Lisell
https://orcid.org/0000-0002-4705-2217
University of North Dakota
231 Centennial Dr.
Grand Forks, ND, 58202
United States
Contact e-mail: *virginia.clinton@und.edu*

Alison E. Kelly
https://orcid.org/0000-0003-3626-8634
University of North Dakota
501 N Columbia Rd.
Grand Forks, ND, 58202
United States