



Motivating Factors among University Faculty for Adopting Open Educational Resources: Incentives Matter

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ABSTRACT

Despite an increasing need for integrating Open Educational Resources (OER) into teaching at higher education institutions in North America, advocates could better understand how faculty are motivated to adopt OER. In particular, there is a lack of knowledge about how added incentives can help motivate faculty to adopt OER. Given reported barriers affecting OER adoption, evaluating what additional incentives might encourage faculty to try using OER will help higher education institutions understand what strategies would likely be effective in promoting OER use. This paper examines motivating factors regarding OER adoption using a case study in the University System of Georgia; for the study, we conducted an instructor survey with 77 respondents. The results showed that faculty were motivated not only by factors reported in prior literature such as the lowered costs and improved student learning but also by additional incentives provided by the University System of Georgia, including a monetary incentive and recognition for using OER. We also found that faculty experienced a variety of benefits and challenges associated with the adoption of OER. The study contributes to the understanding of what university faculty perceive and experience in adopting OER. In particular, we offer practical knowledge regarding additional incentives that higher education institutions could consider to motivate faculty to adopt OER and help them realize the benefits of using OER in their teaching.

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There is a growing interest in, and need for, broadening access to quality and affordable educational materials and improving student learning in North America (Coleman-Prisco 2017). As one approach towards that goal, researchers and educators have sought ways to effectively leverage Open Educational Resources (OER). OER are defined as “teaching, learning, and research materials in any medium – digital or otherwise – that reside in the public domain or have been released under an open license that permits no-cost access, use, adaptation, and redistribution by others with no or limited restrictions” (UNESCO n.d.).¹ In recent years, especially in the North American countries, the high cost of college textbooks has been one of the main drivers of the open education movement (Carrns 2015; Ozdemir & Hendricks 2017; United States Public Interest Research Group 2017). The high price of textbooks not only increases the overall costs of education for students but also negatively impacts how they study in college. According to Florida Virtual Campus (2019), which conducted an online survey with 21,430 students from different universities and colleges in the state of Florida in the United States in 2018, students took fewer courses (42.8%), earned a poor grade (35.6%), dropped a course (22.9%), and failed a course (17.2%) because of the high price of textbooks.

To mitigate the expense posed by traditional textbooks, many higher education faculty members in North America have created and adopted open textbooks, a type of low-cost OER. Studies have shown that open textbooks are positively perceived both by faculty and students; faculty and students consider the quality of open textbooks as good as or better than traditional textbooks (California Open Educational Resources Council 2016; Cooney 2017; Hilton 2016; Jung, Bauer, & Heaps 2017; Watson, Domizi, & Clouser 2017). For instance, a study by the California Open Educational Resources Council (2016) held five focus groups with faculty members from California Community Colleges, California State University, and the University of California. They found that 12 out of 16 faculty involved in the use of open textbooks rated the resources they used either as superior or equal to the traditional textbooks (California Open Educational Resources Council 2016). Importantly, studies have also shown that the adoption of OER and open textbooks does not negatively impact student learning. When comparing the learning outcomes of students who used open textbooks and those with traditional textbooks, many studies found no significant difference between those groups, arguing that open textbooks are a better option due to the cost benefit (Allen et al. 2015; Chiorescu 2017; Croteau 2017; Hilton 2016; Winitzky-Stephens & Pickavance 2017).

If mainstreaming OER is a promising direction, *how could we motivate faculty to try, and even better, continue using OER for their teaching?* Seaman and Seaman’s (2017) survey with 2,700 faculty members at higher education institutions in the United States shows that a majority of faculty members (56%) are not yet aware of OER. This indicates that too many faculty in the United States do not reap the benefits of using OER, which most faculty appreciate once they adopt OER in their teaching (Jhangiani et al. 2016; Pitt 2015). For instance, Pitt (2015) found that educators, once they were exposed to open textbooks, were likely to explore other OER and contribute to OER repositories through remixing. To help more faculty realize the benefits of OER and thus contribute to increased access and student learning, it is essential to first understand what helps faculty become motivated to make a transition from *traditional* resources to OER. In addition to motivating factors that are attached to OER themselves (e.g., cost benefit, unrestricted access to materials) (Chae & Jenkins 2015; Petrides et al. 2011), it is also important to understand what additional incentives could help faculty try adopting OER. It is vital to investigate what roles contextual factors might play in influencing OER adoption, since merely offering OER as an instructional alternative does not guarantee behavioral changes among faculty who may perceive challenges such as a lack of time to evaluate and incorporate new materials in their courses (Belikov & Bodily 2016).

The present paper reports findings of a survey that investigated university faculty’s motivating factors for adopting OER, conducted in the context of a Textbook Transformation Grant program offered by Affordable Learning Georgia (ALG). ALG began in 2013 as a pilot program of the University System of Georgia libraries to help faculty discover and adopt low- and no-cost

¹ Among several definitions of OER that are available, we chose this definition by UNESCO because it covers core characteristics of OER (e.g., the requirement of open licensing) that other definitions do not necessary cover (Creative Commons 2020).

teaching materials. Now in its twenty-first round, the grant program is featured in the University Systems of Georgia's 2024 strategic plan to ensure educational affordability in the state. Our work contributes to the understanding of faculty attitudes towards OER and how they are and can be motivated and incentivized to use OER. Practically, such an understanding will inform OER designers and university administrators of ways to encourage faculty to make a transition to an instructional option that is more open, accessible, and potentially more effective.

REVIEW OF LITERATURE

Several prior studies provide common motivating factors that influence OER adoption. For example, Seaman and Seaman (2017) examined faculty's motivating factors for adopting digital resources in general. They found that the most important factors in selecting required educational materials among 2,700 U.S. faculty were "comprehensive content" (89%) and "cost to the student" (89%), followed by "easy to find" (82%) (Seaman & Seaman 2017: 9). A few studies specifically focused on OER and open textbooks also show a similar set of motivating factors for adoption. Petrides et al. (2011) conducted a qualitative study in which 36 U.S. instructors were interviewed about their experiences of using open textbooks through the Community College Open Textbook Project. The findings show that cost, perceived content quality, and ease of use were among the three major factors that the faculty regarded as important in adopting open textbooks (Petrides et al. 2011). Another qualitative study by Chae and Jenkins (2015), which interviewed faculty in Washington's community and technical colleges in the U.S., lists increased accessibility of educational resources and "pedagogical freedom" as their motivating factors for using OER (Chae & Jenkins 2015: 13). Further, Ozdemir and Hendricks (2017) examined university faculty's experiences of using open textbooks by analyzing faculty's e-portfolio reflections on adopting open textbooks. Most of the faculty members (80%) mentioned "cost savings" as an important motivating factor for their transition from traditional textbooks to open textbooks, while several of them indicated that "content" (44%), "repurposing" (24%), and "accessibility" (20%) were also important (Ozdemir & Hendricks 2017: 104).

These past studies show several common motivating factors that affect OER adoption positively, including cost savings, instructional benefits (e.g., flexibility, quality of content), and unrestricted access to materials. However, it is also important to consider *contextual factors* such as institutional policies and institutional support because such incentives could encourage faculty to explore the benefits of using OER (Jhangiani et al. 2016). To that end, the present study aims to add knowledge about faculty's motivating factors for using OER. In particular, we are interested in understanding how institutional incentives (e.g., monetary awards) can help motivate faculty to adopt and realize the importance of making a transition from traditional course materials to OER. Such an understanding will provide pragmatic knowledge regarding how institutions can strategically nudge faculty to become successful adopters of OER, and to overcome obstacles, including lack of time and difficulty in finding appropriate OER (Belikov & Bodily 2016).

Further, we are also interested in finding unanticipated benefits and challenges that involve the use of OER. Past work including Chae and Jenkins (2015), Belikov and Bodily (2016), and Ozdemir and Hendricks (2017) found that faculty see benefits of OER such as cost savings, instructional benefit, quality, increased student engagement, whereas they identify as challenges a "lack of time," "lack of technology," an unwelcoming environment, and difficulty of finding specific content (Belikov & Bodily 2016: 242; Chae & Jenkins, 2015: 26). Our study adds to the body of knowledge on benefits and challenges regarding the use of OER as perceived by university faculty. In our research, we asked the following research questions in the context of the Textbook Transformation Grant program at the University System of Georgia: 1) *what are faculty's motivating factors, especially those related to additional incentives provided by the grant program, for adopting OER?* and 2) *what kinds of benefits and challenges do faculty perceive in adopting OER?*

STUDY CONTEXT: TEXTBOOK TRANSFORMATION GRANT BY AFFORDABLE LEARNING GEORGIA

The present study was conducted to focus on the Textbook Transformation Grant initiative by Affordable Learning Georgia (<https://www.affordablelearninggeorgia.org/>). Launched in support of a statewide initiative for the University System of Georgia, ALG provides a one-stop shop

for University System of Georgia faculty to search for open materials, and includes search portals for a number of other OER providers and databases, such as OASIS from SUNY-Geneseo (<https://oasis.geneseo.edu/>) and OpenStax (<https://openstax.org/>). Textbook Transformation Grants, recently renamed as Affordable Materials Grants, are ALG's major faculty outreach initiative, providing direct support for the University System of Georgia faculty to adopt, modify, create, and implement OER. Grants are awarded to faculty, librarians, and instructional designers who apply as partners or teams for Transformation Grants (new OER creation or adoption) or for Continuation Grants (updates or ancillary OER development). The amount of funding allows a maximum of USD \$5,000 per team member to be used toward salary, course release, or professional development, and a maximum amount of USD \$30,000 per project. To date, 450 projects have been funded, representing all 26 institutions within the University Systems of Georgia (reports and detailed data related to the initiative are accessible through the ALG website, above).

METHODS

PARTICIPANTS

In 2016, researchers invited all prior applicants for the grant to participate in a survey, whether or not their application proposals had been selected for grant funding. While the majority of contacted applicants were instructional faculty, the list also included librarians and instructional designers who serve as partners for grant proposals but do not have primary responsibility for selecting course materials. Respondents were asked to identify their role as eligible instructional faculty before beginning the survey. Of the 458 applicants on ALG's list, 77 responses were received, reaching close to a 17% return rate.

The demographics of participants reflected a diverse and representative range among all institutional sectors in the University Systems of Georgia, all instructional ranks, and various levels of experience of teaching the course for which they intended to adopt OER. Among the four sectors of the University System of Georgia, respondents identified themselves as teaching at Research Universities (16.9%), Comprehensive Universities (23.9%), State Universities (40.8%), and State Colleges (18.3%). Instructional ranks included Full Professor (22.5%), Associate Professor (25.4%), Assistant Professor (32.4%), and Lecturer (15.5%). Respondents were almost equally male and female (50.7% and 49.3%, respectively) and the majority fell into expected age ranges for faculty in prime working years: 35–44 (38.2%); 45–54 (30.9%); and 55–64 (19.1%).

MATERIAL

The survey was developed using a Google Form, including an informed consent acknowledgment and an initial question asking if the respondent's role was as instructional faculty with the responsibility to select course materials, rather than as librarian or as instructional designer. (These roles, as grant applicant partners, were included in the email contact list that formed the basis for the survey invitation, but as support personnel, they were less appropriate respondents for this survey). The survey consisted of 28 questions, 23 of which asked about factors that would motivate faculty to use OER, their benefits, and the challenges associated with OER adoption. Questions used both a multiple-response format (e.g., "Which factors related to ALG's Textbook Transformation Grant motivated you to consider adopting OER? Check all that apply") and an open-ended question format (e.g., "What were some of the unanticipated challenges you faced in adopting OER? How did you overcome them?"). The remaining five questions asked about the responder's demographic information.

PROCEDURE

The survey was conducted in an electronic format (i.e., Google Form), with an initial invitation and two subsequent reminders via email. No incentive was provided to participate, but the invitation emails indicated that respondents' feedback would be used to help guide ALG in future planning.

CODING

The responses to the open-ended questions were first coded by the two researchers independently, producing 87 separate codes. In the next phase, the researchers met multiple times to discuss all of the generated codes and to determine common categories and themes. The initial set of codes were grouped into 12 mid-level themes. Then the researchers categorized the mid-level themes into three high-level themes: motivating factors for adopting OER, benefits in adopting OER, and challenges in adopting OER.

RESULTS

MOTIVATING FACTORS

The survey results revealed several motivating factors among faculty in adopting OER for their instruction. As the study was conducted in the context of ALG’s Textbook Transformation Grant, we were interested in how important the grant opportunity was in motivating the adoption of open textbooks among the studied faculty members, as well as motivating factors reported in prior studies (Chae & Jenkins 2015; Ozdemir & Hendricks 2017). **Table 1** shows factors related to the grant opportunity collected from multiple-response survey questions. Most of the faculty (73.2%) considered the monetary award as an important motivating factor. The collaboration opportunity provided by the grant (33.8%), support and resources (29.6%), and the grant application timing (23.9%) were also considered as motivating, though not as strongly as the monetary incentive attached to the grant.

MOTIVATING FACTORS	N	%
The monetary award attached to the grant	52	73.2%
The collaboration opportunity provided by the grant	24	33.8%
The support and resources available to grantees	21	29.6%
The timing of the call for proposals	17	23.9%
Other	28	39.4%
Total	142	

Table 1 Motivating Factors Related to ALG’s Grant for Faculty to Adopt OER.

Regarding the motivating factors *unrelated* to the ALG’s grant opportunity (i.e., those typically reported in prior studies), as **Table 2** summarizes, the top two factors were the dissatisfaction with the availability or expense of current course materials (73.2%) and desire for improved student learning (70.2%), followed by the dissatisfaction with content of current course materials (39.4%) and change to course design or delivery also taking place (26.8%). Familiarity with open licensing (19.7%) and other colleagues’ experiences with OER (11.3%) were also chosen as motivating factors by a few of the faculty.

MOTIVATING FACTORS	N	%
Dissatisfaction with availability or expense of current course materials	52	73.2%
Desire for improved student learning	50	70.4%
Dissatisfaction with content of current course materials	28	39.4%
Change to course design or delivery also taking place	19	26.8%
Familiarity with Creative Commons and/or open licensing of intellectual property	14	19.7%
Familiarity with colleagues’ experiences with open materials	8	11.3%
Other	8	11.3%
Total	179	

Table 2 Motivating Factors Unrelated to ALG’s Grant for Faculty to Adopt OER.

The open-ended questions about faculty’s experiences with OER adoption provided further details on these factors as well as those that could not be captured through the questions above. We grouped open-ended responses into four themes based on the analysis: *monetary incentive, cost to students, recognition, and student learning*. First, we found that many of

the responses mentioned the importance of the monetary incentive attached to the grant in motivating them to use OER, consistent with the finding shown in [Table 1](#). One instructor commented, “salary in the state of Georgia is inadequate to support faculty year-round,” indicating the powerful impact that the monetary incentive can have in their particular context. Faculty also care about the cost to students as an important motivating factor for OER adoption. For example, we found that faculty said they “got tired of smart, motivated students dropping or failing my class because they couldn’t afford the textbook.” One theme that stood out from the open-ended responses, which we did not find in the quantitative responses ([Tables 1 & 2](#)), was that the faculty highly valued their recognition for adopting OER, as seen in these responses: “the format, that is, a grant, is good to show on the vita,” and “[I am] being seen to support the campus drive towards the use of OER.” Finally, consistent with the finding above ([Table 2](#)), student learning was another factor that many instructors shared as important in the open-ended responses.

PERCEIVED BENEFITS OF USING OER

Through analyzing survey responses for the open-ended question regarding the perceived benefits of using OER, we identified four mid-level themes that the faculty commonly reported: *pedagogical improvements, collaboration, discoverability of materials, and students’ access to learning materials*. Each of these themes is discussed in detail below.

Pedagogical improvements

A great number of respondents appreciated that the adoption had improved their pedagogy in various ways and attributed the improvement to an opportunity to explore OER. Many responses indicated that the adoption and creation of OER encouraged them to revisit and improve their instructional strategies and materials. For example, instructors shared improvements in their teaching strategies: “I feel that my online course delivery has improved significantly due to the redesign prompted by the adoption of OER” and “adopting an OER was part of an overall total redo of my course, so I also changed from a primarily lecture-based style to a primarily ‘flipped’ classroom.” Another instructor pointed out the increased course control of the teaching materials made possible due to the affordance of open licensing: “[I] have more control and customization on the materials.” There are also responses made on the increased perceived quality: “The online component of my class has changed significantly, is much more comprehensive, up to date, and individualized due to the resources I have compiled.” In sum, these responses illustrate that the adoption of OER helped faculty see benefits in pedagogical improvements.

Collaboration

Faculty also saw increased collaboration opportunities through the adoption of OER. For example, one faculty member wrote, “It caused me to get back into the literature and to communicate with my colleagues about what they wanted in a classroom text.” The participating faculty also collaborated with librarians, one of the key stakeholders in adopting OER at universities (Braddlee & VanScoy 2019), as one mentioned “the assistance of the librarian” being a benefit they had perceived in the OER adoption process.

Discoverability of materials

Several faculty members commented on their experiences of exploring OER online. One respondent wrote that “the ease of finding quality information” was a benefit, and others expressed their surprise at the amount of resources available, as one instructor said, “I have discovered material that I didn’t know was available.”

Students’ access to learning materials

The participating faculty also perceived benefits related to students’ access to materials. Instructors considered it important that students always have access to the materials, as represented by this comment: “[I think it is important that] students had access to the text material the first day of class.” In addition to the increased access, the use of OER also made faculty notice “increased student engagement and preparation.” One instructor mentioned

that the ability to customize OER to their teaching context helped them make their materials engaging: “because we developed our OER specifically for our course, students found the materials totally relevant. [Students] could also provide feedback to suggest improvements.”

PERCEIVED CHALLENGES OF USING OER

Despite the above-mentioned benefits, surveyed faculty also reported a variety of challenges associated with the adoption of OER. We found four main categories of challenges that the faculty experienced: *low levels of discoverability and content quality, lack of time, collaboration, and unfamiliarity with technology and copyright.*

Discoverability and content quality

The most common issue reported was the issue of discoverability. Although the discoverability was mentioned as a benefit by some faculty, many others responded that it was hard to find appropriate and/or quality resources on the web. Challenges identified in these comments included:

- “Discovering that there was not suitable content through MERLOT or OpenStax, requir[ed] us to independently locate suitable OER materials or create nearly all content from scratch”; and
- We found “exceptionally poor quality of OER relative to the content available from publishers, especially in digital content support and professor resources.”

Lack of time

Another issue that many of the faculty members pointed out was the lack of time to locate, customize, and create teaching materials with OER. Finding and adopting OER requires of faculty additional, significant time (e.g., Ozdemir & Hendricks 2017), which they may underestimate. While grant funds can be applied toward a course release, grantees commonly accept funds as overload pay, which does not accommodate the need for extra time. We found many responses that indicate the faculty’s frustration about the amount of time required to engage with OER adoption. Comments such as, “[t]he biggest issue is the time commitment. I wanted to transform our courses but lack the time to do it properly,” and “[t]he time involved in redesign of a course was a biggest factor,” represent this concern about the lack of time. Although we categorized lack of time separately from discoverability and content quality, it also appears that these two problems are closely related:

- “Our OER text was really very inadequate, well below standards for college instruction. We had to add a lot to it to make it appropriate. We still need to add much more material. It was much more work than I expected. I will not be adopting more OER materials because it is way too time-consuming.”
- “Finding the best available resources, keeping the resources current, [and] the time to look at all the available resources [was a challenge].”

Collaboration

Grants are awarded for team projects; while some two-member projects with one faculty member and one support professional (librarian or instructional designer) propose to transform a single course, other projects consist of 3–5 members charged with transforming a shared course that faculty teach in individual sections. Larger team projects present more complex issues for collaboration. Although it was beneficial to some of our respondents, collaborative work was one thing that several faculty members felt made the task difficult and more time-consuming:

- “We did not appreciate how having different authors write different sections of our open source website ‘textbook’ would lead to student frustration with different writing styles and changes in ‘voice’ between the different topics. We are currently editing all website material to create consistency in writing style and voice.”
- “Team buy-in. [It was difficult to explain] how each professor could modify the product to reach his/her objectives.”

Unfamiliarity with technology and copyright issues

Some faculty members expressed their frustration on the technical aspects of OER integration, namely, issues around learning technologies and copyright. Many types of OER adoption involved the use of digital texts and homework tools, which was a problem for some of the faculty: “students [did] not hav[e] the proper software to run some programs. They worked to resolve issues with my local IT department.” Others indicated that they had “concerns regarding copyright infringement.”

DISCUSSION

Our study aimed to investigate faculty’s motivating factors for adopting OER and associated benefits and challenges that faculty perceived. Both our quantitative and qualitative results provided insightful implications on how faculty are motivated to use OER, what benefits and challenges they perceive, and how we might design OER initiatives at higher education institutions.

As for the motivating factors for adopting OER, we were particularly interested in the impact that the ALG grant program had on faculty’s motivation because we acknowledged that such contextual factors could play a key role in motivating faculty to adopt OER (Coleman-Prisco 2017). The main motivating factors we found included additional incentives provided by the program, including *the monetary incentive, collaboration opportunities, and recognition*. The finding that such incentives can have a strong impact on faculty’s motivation is important because it implies that initiatives and policies at institutions aspiring to promote OER can play a significant role in motivating faculty to adopt OER. In other words, simply encouraging faculty to adopt OER without any added incentives might fail, as we have seen that faculty are faced with a number of challenges including the lack of time and the difficulty of finding appropriate content, also reported elsewhere (Belikov & Bodily 2016; Chae & Jenkins 2015). Although it might be the case that our findings are specific only to the ALG’s grant program, it is important to recognize the potential impact that such factors could have in motivating faculty. As many instructors are still unaware of OER (Seaman & Seaman 2017) and perceive obstacles even when they become aware of OER, it is a promising strategy to provide additional incentives to the faculty who adopt OER, rather than only stressing the expense and availability of educational materials that students struggle with.

Such incentives could bring a significant change to actual teaching and learning practices because once faculty members experience OER, they will likely find unanticipated benefits, as we and others have found (Pitt 2015). In our study, the types of benefits for using OER that faculty perceived varied, many of which had not necessarily been expected before they started to use OER. Among others, it was found that many faculty experienced benefits of using OER for improving their pedagogical practices, including re-designing course materials and increased course control through customization. These experiences led to a faculty shift from serving as *deliverers* of publisher-designed content to embracing their own authority as *curators* of open content that they have discovered, organized, and/or created with specific needs in mind. The faculty also appreciated the benefits for students’ experiences. They felt that the use of OER not only allowed students to get accessible materials but also brought improved student engagement and improved satisfaction.

Despite these benefits, there are several challenges that faculty perceived, such as the difficulty of finding appropriate materials and the lack of time. This result showed that the adoption of OER is a time-consuming task and suggests that higher education institutions might need a better model to support faculty in their endeavor. For instance, ALG has continually updated and expanded their central repository for OER searches to better facilitate efficient OER discovery. Higher education institutions may need more OER-focused librarians and instructional designers who can provide support for instructors. Institutions can target the need for a temporary reduction in faculty workload when they adopt OER or hold a series of workshops to help them get started on OER adoption easily (Belikov & Bodily 2016). Another important finding is the different perceptions that the faculty had about existing OER: for example, some mentioned the discoverability of materials and collaboration as benefits while others complained about those as negative aspects of OER use. This finding suggests an uneven availability of OER among

disciplinary fields. Institutions may need to offer appropriate disciplinary support, ideally for discovering new material and also for navigating course redesigns that often accompany OER adoption.

While our findings show new insights into how faculty use OER and are motivated to use OER, we acknowledge the limitations of our study. First, our study was conducted around a specific grant program for faculty in one state's public institutions. The results might not generalize to other contexts. Thus, the same incentives may not be effective in motivating faculty in adopting OER; we rather argue for the importance of providing incentives that best match faculty resource needs (money, time, recognition, and/or support). Another limitation of our study is the voluntary participation of survey respondents. It is possible that instructors who responded to the survey had more sharply positive or negative feelings about their experiences.

CONCLUSION

In our study, we investigated motivational factors among university faculty within the University System of Georgia for adopting OER as well as perceived benefits and challenges in the adoption process. We found that faculty were motivated not only by generally reported factors such as accessibility and improving student learning but also by incentives including a monetary award and an opportunity for recognition. With regard to benefits and challenges, the faculty commented that they realized many pedagogical benefits as well as benefits related to student learning. However, some also experienced difficulty with finding appropriate and/or quality materials, and a lack of time prevented them from satisfactorily integrating OER into their teaching. The findings provide new knowledge on how incentives and support could motivate more faculty to adopt OER. More studies are needed to further evaluate institutional incentives and what pedagogical changes those incentives could bring to educators in a variety of contexts.

COMPETING INTERESTS


The authors have no competing interests to declare.

AUTHOR CONTRIBUTIONS

The first author contributed to the analysis of the data and led the writing. The second author contributed to data collection, analysis, and writing.

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