Empowering Future Educators: Leveraging Openness by Design when Integrating Technology in Teacher Education Programs

Empoderando a los futuros educadores: aprovechando la apertura por diseño al integrar la tecnología en los programas de formación del profesorado

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Abstract

Teacher educators who design and teach educational technology courses have an important role to play in developing thoughtful approaches to using educational technology in teaching and learning through the development of digital literacies that make use of accessible, meaningful, and pedagogically appropriate technology. Several researchers have argued that K-12 teachers are well suited to both adopt and develop aspects of open education by growing awareness of open educational resources and practices. This paper aims to articulate the potential, gaps, and opportunities for teacher educator programs to bring aspects of open education into teacher training. Based upon a small survey with students in a teacher education program in British Columbia Canada, gaps in knowledge among teacher candidates are identified and reflections from participants provides motivation to consider how open educational resources and practices might be further integrated into teacher education programs. Kahle's (2008) design philosophy approach is recommended and discussed based on the results with a focus on using technology to prioritize openness that aligns well to prominent themes in teacher education programs.

Keywords: open education practices, open educational resources, teacher education, digital literacy, philosophy of educational technology

Resumen

Los formadores de docentes que diseñan e imparten cursos de tecnología educativa tienen un importante papel en el desarrollo de enfoques reflexivos sobre el uso de la tecnología educativa en la enseñanza y el aprendizaje mediante el desarrollo de alfabetizaciones digitales que hagan uso de una tecnología accesible, significativa y pedagógicamente apropiada. Varios investigadores han argumentado que los docentes de educación primaria son idóneos para adoptar y desarrollar aspectos de la educación abierta mediante la concienciación sobre los recursos y las prácticas educativas abiertas. Este artículo pretende articular el potencial, las lagunas y las oportunidades de los programas de formación docente para incorporar esos aspectos. A partir de una pequeña encuesta realizada a estudiantes de un programa de formación docente en la Columbia Británica de Canadá, se identifican sus lagunas de conocimiento y sus reflexiones proporcionan motivación para considerar cómo los recursos y las prácticas educativas abiertas podrían integrarse más en estos programas. Se recomienda el enfoque de la filosofía de diseño de Kahle (2008) y se discute en base a los resultados centrándose en el uso de la tecnología para priorizar la apertura que se alinea bien con los temas prominentes en los programas de formación docente.

Palabras clave: *prácticas educativas abiertas, recursos educativos abiertos, formación docente, alfabetización digital, filosofía de la tecnología educativa*

1. INTRODUCTION

The rhetoric around technology use in K-12 learning contexts has, for several years, spoken to the importance of developing digital literacies in young people through the appropriate and meaningful use of educational technology in classrooms (Gruszczynska & Pountney, 2013; Kimmons, 2014; List, 2019; Marcus-Quinn & Hourigan, 2017). This requires that teachers themselves be well versed and critically selective about the use of technology to support learning and the implications in directing young people towards their usage. Teachers may use technology for teaching and learning for a variety of reasons including supporting in class learning, creating blended learning environments, intentionally creating fully online learning experiences, or while offering fully online education in a crisis, as was the case during the Covid-19 pandemic. In all cases, careful decisions must be made about what and how to use technology to best support learners. Importantly, the tools and technologies teachers use in the process of teaching and learning may impact young people's beliefs what tools for personal knowledge management are valued and worthy for use in their daily lives.

As a result, courses that introduce technology integration concepts as part of teacher education programs must be carefully designed to develop critical and intentional uses of technology. Within teacher education programs, teacher candidates are engaged with thinking about pedagogical choices and have chances to practice their approaches to teaching in learning the process of teacher education, all while receiving feedback along the way from teacher educators. As such, teacher education programs are in an excellent position to develop innovative approaches based on developments in learning science and technology, to meet the needs of society.

Increasingly, flexibility and access are becoming a component of educational offerings. Dede (2022) describes the future as "irreversibly hybrid" and thus teacher education programs must adapt to prepare teachers for supporting learning in technology mediated environments that enables personalization to individual learner needs and preferences. Developing digital literacies with future teachers can help prepare them for unpredictable futures in which flexibility and digital learning environments shall feature prominently. This increases the scope and challenge for teacher educators designing technology integration courses, by necessitating the development of approaches to technology enhanced face-to-face teaching while also leveraging knowledge about teaching and learning strategies that work in classrooms and how these may be applied online where appropriate. Thus, teacher candidates must understand what types of teaching are best suited to the various levels of technology infrastructure and the modality being used (Dede, 2022).

Teacher candidates are both student and teacher during their programs of study. While developing the understanding of teaching and learning in their specific areas of specialization, they are also given opportunities to take on the role of teacher as they engage in practicum experiences within school settings and during their coursework (Thompson et al., 2019). This creates an opportunity for candidates to experiment, practice, and receive feedback on their teaching as well

as, experience, from a learner perspective, various pedagogical strategies as they engage in study. This puts greater onus on teacher educators to model effective and intentional practices as part of their learning design efforts, as researcher has shown that educators often end up teaching in similar ways to how they were themselves taught (Oleson & Hora, 2014).

Complicating the landscape is the dominance of big educational technology vendors who appear to be perceived as the default environments for learning. From big tech companies such as Google and Microsoft, to more focused vendors pushing technology solutions in schools, questions about platform capitalism, datafication, vendor lock in, and privacy remain largely unchecked. Many of these platforms have been adopted by schools in an uncritical way historically, and this was advanced even further during the Covid-19 pandemic (Czerniewicz & Feldman, 2023; Stockman & Nottingham, 2022). A growing number of scholars are raising concerns about these issues and have offered critical analysis of big technology firms pervasive and uncritiqued usage in education (Castañeda & Villar-Onrubia, 2023; Krutka et al., 2021; Pangrazio et al., 2022).

With that in mind, teacher education programs have a key role to play in developing education literacies during teacher training that foreground openness, flexibility, and personalization. Scholars have argued that open education might present the opportunities for context-centric learning approaches, support more productive teachers in their early years of teaching, promote flexible and dynamic pedagogy, and provides a low-cost and low barrier way to develop and share teaching and learning materials in teacher education programs (Karunanayaka & Naidu, 2017; Petrides, 2017). As such, several scholars who have conducted research into open education practices within teacher education programs have found it to be a useful and welcomed addition to their programs (Kelly, 2014; Tang et al., 2020). Taking an expansive view of open education, this may include developing competencies around pedagogical approaches, resource selection, assessment design, and technology use that is driven by openness. There appear to be similar themes shared in teacher education programs such as accessibility, community engagement, inquiry-driven learning, multimodality, collaboration, mindfulness, and multiculturalism that align well to the philosophies underpinning open education.

The purpose of this paper is to investigate the levels of awareness, current practices, and understanding of open education concepts among teacher candidates at a University in British Columbia, Canada. The paper begins with a literature review of studies involving open education in K-12 settings, describes the theoretical framework for the study in relation to development of digital literacy for teachers, and presents the results from an exploratory survey to better understand knowledge about open education among teacher candidates.

2. OPEN EDUCATION RESEARCH IN K-12 SETTINGS

This paper argues for developing educational technology competencies within teacher education programs that leverage open educational resources (OER) and open education practices (OEP) to meet these emerging demands and variabilities for future teaching practice. Several researchers have argued that K-12 teachers are well suited to both adopt and develop aspects of open

education. DeBarger (2019) suggests that OER, specifically, may be an effective alternative to traditional resources to enhance both student and teacher agency. Marcus-Quinn and Hourigan (2017) acknowledge OER in the development and improvement of teaching effectiveness through more open sharing and development of pedagogy. Similarly, Allen and Katz (2019) posit that teachers are excellent candidates to evolve OEP and saw that increasing their opportunities to engage openly in a safe environment impacted their self-efficacy and willingness to share openly in the future (J. V. Allen & Katz, 2022).

The use of open education among teachers can involve many elements of their practice. Educators may consider aspects of openness when designing learning outcomes, selecting teaching and learning resources, and when planning activities and assessment (Paskevicius, 2017). With regard to locating resources and ideas for teaching, scholars have cited the challenges expressed by teachers in locating relevant, high quality, and topical resources in their subject area as a significant barrier and that integrating these resources into their curriculum is a time-consuming task (Allen & Seaman, 2016; De Los Arcos et al., 2014; Petrides et al., 2011). OER and the affordances they offer in relation to designing teaching activities and assessment, represent new and largely optional technologies for busy educators to integrate into their practice. Educators need a chance to practice and experiment with these new approaches, and therefore could benefit from intentional strategies that involve awareness raising as well as of capacity building in order to integrate open teaching and learning practices (Nascimbeni & Burgos, 2016). Researchers have explored technology integration with educators at length, most notably finding that perceptions around usefulness and ease of use contribute most to the ongoing usage of new technologies (Davis, 1989). Allocating time to develop literacies in working with OER, as well as time to work with colleagues to share these practices and approaches with their colleagues, are cited as significantly important considerations for fostering more open practices (Kimmons, 2016).

With regard to flexibility and autonomy, Kimmons (2015) study found that the use of open education can contribute to greater flexibility and autonomy for teachers, enabling them to be more involved with resource evaluation, adoption, and modification, where needed, to better meet the learning context and enable differentiated instruction. Similarly, Roberts (2022) found that open education lends itself to supporting personal and inquiry learning pathways for learners as well. Their research found that open education was well suited to support teachers in being more responsive to learner needs, differentiating learning, and bridging both formal and informal learning contexts (Roberts, 2022).

Yoon and Gilpin (2022) investigated the use of open education in a teacher education program, where teacher candidates worked collaboratively to create digital resources and build open websites. The findings suggest that working collaboratively and openly helped the students establish and reflect on their sense of identity from their current perspective as a learner, as well as considering their future role and practice as teachers. The researchers suggest that open education promoted equity-focused teaching and learning practices and also empowered new teachers to build confidence in the face of opposing feelings of control over curriculum choices from school boards and districts in their research context. Yoon and Gilpin (2022) conclude with the recommendation that in order for open education to find its way into K-12 classrooms, these

approaches to teaching and learning must be woven into teacher education programs in an intentional way so that teachers can experience being a student engaged with these practices, have chances to practice, in order to build confidence towards their future practice as a teacher.

Despite the emerging body of literature around open education in K-12 settings, scholars have argued that the research and practice of open education in K-12 is underdeveloped, lacks policy direction, and thus awareness largely remains quite low (Blomgren, 2018; Blomgren & MacPherson, 2018). Without knowledge of the opportunities made available through open education, teacher candidates have been shown to turn to other online marketplaces such as Teacher Pay Teachers to locate content and learning design ideas for their teaching (Thompson et al., 2019). These resources are often problematic and have been shown to include works that are offered without proper adherence to copyright and offered in formats that do not always allow for customization (Schwartz, 2019). Despite these issues, Teacher Pay Teachers resources have proven to be very popular amongst educators in North America. They remain problematic in that they are popular, highly discoverable, and yet come at, often, a personal cost to teachers. Without knowledge of other opportunities for sourcing learning resources, activities, and assessment tools, these sites remain attractive to teachers while being of dubious quality and without suitable peer review (Brown et al., 2023).

In the currently landscape, a significant opportunity exists for teachers to make use of OER for creative and educational activities. Knowledge about the appropriate use of these resources also constitutes ethical practice for working with and reusing digital media and can serve teachers well as they begin developing their practice and resource base. Furthermore, it has been argued that more open practices and the use of open resources may challenge economic and structural inequities embedded within our education systems (Cox et al., 2020). As well Bali et al. (2020) provide several examples of how open education learning design and approaches, when thoughtfully applied, can support pedagogical approaches that contribute to social justice and equity. With the increased availability of openly licensed digital textbooks around the world, more learners are being exposed to and can access a growing and diverse range of OER. Yet the extent to which learners are recognizing what is now possible with these resources or engaging with the digital literacies associated with open education are largely unknown.

3.   THEORETICAL FRAMEWORK

While fears of a "digital divide" between those with and without access emerged as the internet first became popular (Hoffman & Novak, 1998), scholars now warn of a "participation divide" which may result in the underrepresentation of certain perspectives (Hargittai & Jennrich, 2016). The participation divide represents a rift between those who actively contribute to knowledge by creating information on the web and those who choose to only use the internet to consume information (Hargittai & Walejko, 2008). Divides have been shown to exist between those in different geographical locations, of varying socioeconomic status, and among racial and ethnic differences (Hargittai & Jennrich, 2016). Despite nearly ubiquitous access for many, the effective and efficient use of the internet for sharing resources and creative outputs are limited (Blank,

2013; Correa, 2010; Hargittai & Walejko, 2008; Schradie, 2015). Teacher education is a practical context in which we can invite learners to take a more active role in creating knowledge, critiquing traditional and emergent knowledge sources, and remixing multimedia on the web in ways that are legal, participatory, and social. These literacies form the basis OEP that could enable a teacher to provide great personalization to meet individual learner needs and preferences. Through the development of these digital literacies' teachers are also in a better position to support their learners with similar knowledge generation activities. Creating opportunities for individuals to practice working openly with digital media has been offered as a means to enhance digital literacies and reduce the online participation divide (Hargittai & Jennrich, 2016).

Educators may consider using design approaches that draw from the values and principles of open education as they both design and deliver educational experiences that make use of educational technologies. A good starting point may include considering openness by design, as a teacher begins sourcing and creating the resources used to support teaching and learning. Openness by design guides practice by ensuring educators build resources using openly licensed content, use open standards, and maintain attribution for remixed works. Kahle's (2008) recommendations for designing with openness in mind using educational technology appears to account for several important additional values and principles, namely: designing for access, designing for agency, designing for ownership, designing for participation, and designing for experience. Kahle's vision was for an approach to learning design that "would raise an additional set of questions (problems) based on the values of open education that are best addressed (resolved) during the design process" (Kahle, 2008, p. 30). At the time of writing, Kahle (2008, p. 27) described the importance of an open design approach as:

> Highlighting the core values of open technology and defining these as principles of design practice is an important first step toward accelerating the production and ultimately the adoption of innovative educational software that honors the complex needs and interests of educators and learners alike.

Considering Kahle's (2008) principles in the context of learning design, some examples of how these design elements map to practice are articulated as follows. When designing for access, teaching and learning resources are available freely and openly to educators and learners whenever possible in formats that promote accessibility principles, are multi-modal, and allow for remix and customization. Designing for agency involves educators and learners being invited to participate in knowledge communities that allow for the generation of knowledge that leverage personalized and contextual areas of interest. When designing for ownership, educators and learners retain learning materials and resources and can personalize them through modification, format shifting, remix, annotation, or archival. Designing for participation means educators and learners can actively participate in contributing to knowledge where applicable, collaborate with others, and engage in peer-review. Finally, designing for experience involves educators drawing from open resources to create teaching and learning materials that prioritize human-centred learning design principles to ensure they are interesting, relevant, and useful for learners to engage with and learn from.

4. METHOD

As teacher educators are trained in the process of pedagogy and spend a significant amount of time studying the design and delivery of educational experiences, there exists a unique opportunity to bring in OEP as a core competency for design when considering the use of educational technology. To better understand prospective teachers' current awareness of open education, an exploratory online survey was conducted with a group of teacher candidates at the University of Victoria in British Columbia, Canada. The objective of this research was to investigate the levels of awareness, current practices, and understanding of open education concepts among teacher candidates.

A survey that contained 35 questions was designed, including demographic information, about participants experience and awareness of open education concepts. The survey was piloted with graduate students and colleagues prior to launch. The survey was estimated to take approximately six to eight minutes to answer and was made available via the web. Participants who provided an email address were entered into a draw for one of five $50 Amazon gift cards. The survey was shared with 399 learners in the Fall of 2020 and 2021 and 83 participants completed the survey resulting in a 21% response rate. The study was reviewed by the institutional ethics committee and approved in prior to data collection.

5. RESULTS

Most respondents were aged 20-29 (65%), 23% were under 20, 8% were 30-39, and 4% over 40. Of the respondents, 48 were enrolled as part of the four-year Bachelor of Education program and 33 were part of post-degree professional program. The latter group would have already completed a four-year degree before starting in the teacher education professional program. Most respondents identified as female (80%), 17% male, 2% non-binary, and 1% who chose not to answer.

Participants were asked about their current approaches to finding resources when creating digital resources for school curriculum. Participants were able to select multiple strategies and the majority (55) selected one or more of the following strategies listed in

Table 1.

Table 1

Approaches to finding resources for digital resources or curriculum.

Strategy Used	Percentage of Respondents
I use a basic web search	73%
I use an advanced web search (e.g., filtering by source, content, date, etc.)	45%
I use a web search to locate resources that have open licenses (e.g., Creative Commons, Public Domain)	37%
I go to openly licensed databases (e.g., Creative Commons Search, Wikimedia, OER Commons)	36%
I find things on social media (e.g., Instagram, GIPHY, Twitter, Facebook)	19%
I purchase resources from content providers	8%
Other (included access through public or university library, ask classmates/peers)	14%

Once resources were identified, in many cases through a basic or advanced web search, participants were asked if they were aware of the default copyright and terms of use on internet resources.

Figure 1

Are you familiar with copyright and terms of use on internet resources?
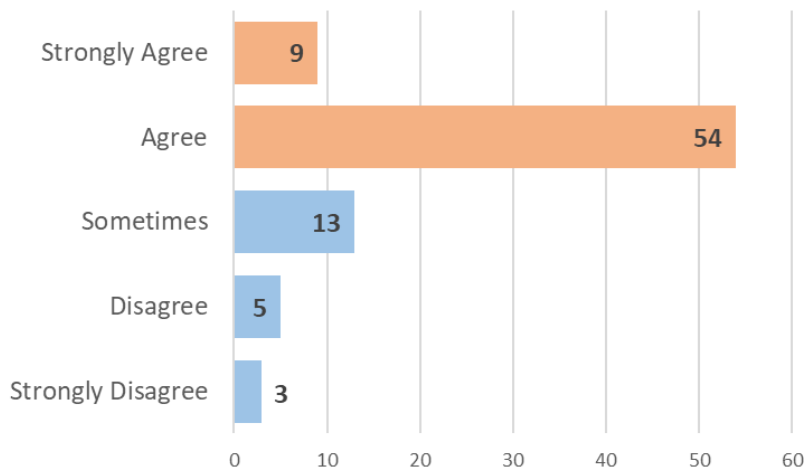

Figure 1

displays the responses to the question, are you familiar with copyright and terms of use on internet resources. Most respondents (54) agreed to this statement, with 9 strongly agreeing, 13 neither agreed or disagreed, and 5 indicating they disagree, and 3 strongly disagreed. Participants were also asked if they believed the copyright and terms of use on internet resources was clear and understandable. Figure 2 displays responses to this question. Statements provided qualitatively in respect to this question included, "I realize I haven't been very 'web' cautious in terms of

ensuring resources are 'open' to me" [TC52]. Such statements indicate a need for greater awareness about online copyright and how it might be navigated for creating teaching resources for future teachers.

Figure 2

Do you find the copyright and terms of use on internet resources to be clear and understandable?
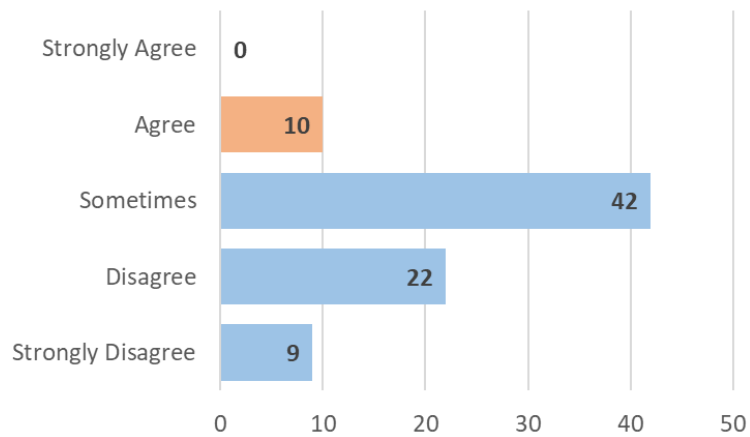
Participants largely reported that the copyright and terms of use on internet resources was not clear and understandable or that they were unable to recognize and feel confident in interpreting them, with only 10 agreeing to this statement, 42 indicating sometimes, 22 disagreeing, and 9 strongly disagreeing. Qualitative comments in relation to this question included:

> *I definitely feel as though I should be more familiar with copyright licenses. I think that plagiarism is often discussed and different ways to cite are as well, but students don't actually understand why they are doing these things. [TC16]*

In this case the participant references the idea of plagiarism and citation, common and important topics within academic programs in relation to open copyright. The relationship between these concepts is important, as the idea of plagiarism and citing sources extends to open copyright models where one might be legally granted permission to use a digital resource through an open licence, then provide attribution and have freedom to create derivative and creative copies of the source material.

In relation to participants' practices in sourcing and using internet resources, participants were asked if they would review the copyright and terms of use of internet resources before using them. **Figure 3** displays responses to this question.

Figure 3

Do you review the copyright and terms of use of internet resources before using them?
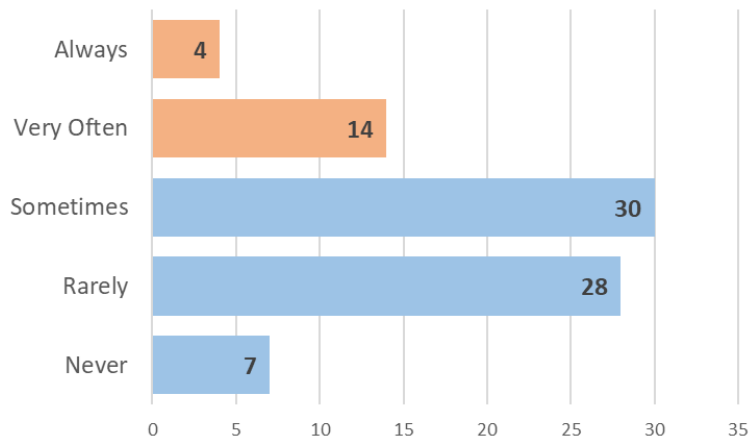

Participants largely reported that they did not necessarily review copyright and terms of use on internet resources before using them, with only 4 indicating always, 14 reporting very often, 30 indicating sometimes, 28 rarely, and 9 never. It is notable here that in the context of Canada, fair use/dealing allowances create opportunities for students and educators to use copyright works for the purpose of education with a limited group of learners but not share openly online.

Whether or not teacher candidates had started to consider the design of learning materials for teaching one could assume they were consuming and producing social media on popular websites. When considering the use of social media for content creation, participants were asked about their current access, consumption, and creation using popular social media tools. **Figure 4** displays responses to this question.

Figure 4

*How do you engage with the following social media services?*
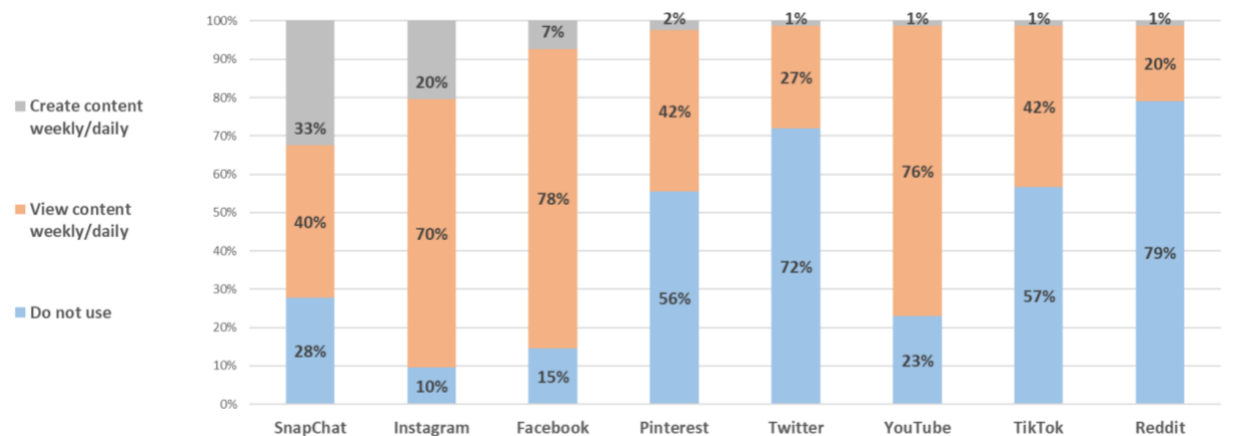
It is interesting to note that content creation activities in social media spaces was reported to low or negligible with only minor increases in content creation on Snapchat, Instagram, and Facebook. Many reported moderate levels of access to viewing content in social media, without content creation across all social media platforms.

Finally, when reporting on their awareness and understanding of open education concepts specifically related to resource access and creation, participants shared their levels of understanding among concepts like open textbooks, open educational resources, open access research, open copyright licenses, open-source software, massive open online courses, and open data. **Figure 5** displays responses to this question.

Figure 5

Awareness and understanding of open concepts.
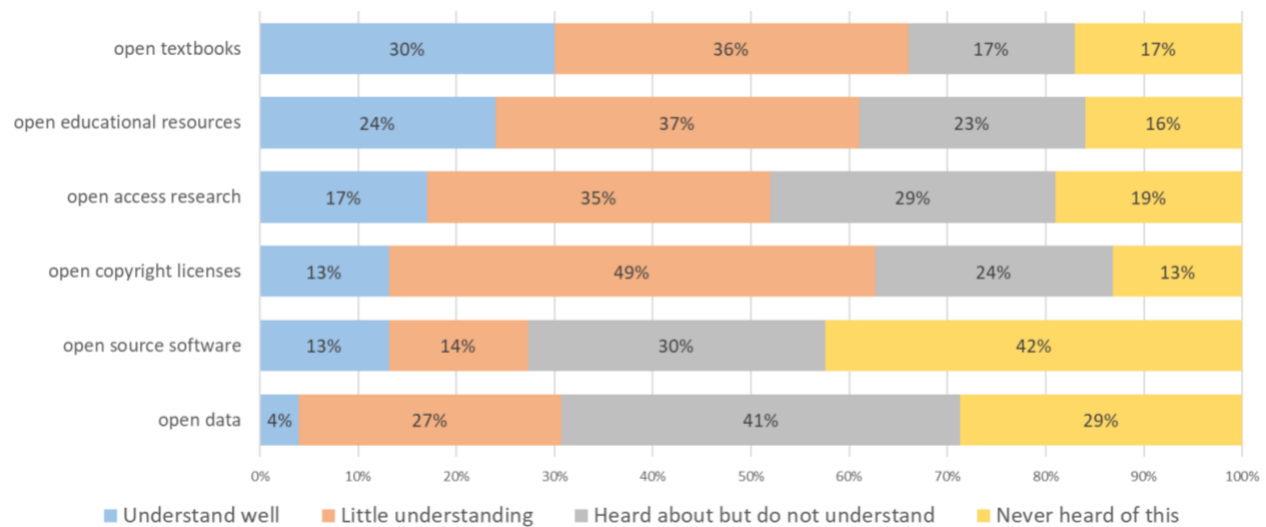
Participants reported limited understanding of most of the concepts with the greatest awareness being around open textbooks, open educational resources, open access research, and open copyright licenses. Many participants commented on this question in many cases recognizing their relevance but limited understanding of how to use them in developing their teaching practice. Two participants commented that they needed more information on these topics to develop competence in their use while recognizing their potential impact on digital literacies and access:

I think it is super important to learn about them, use them, and promote them within educational spaces. They are intimidating, but offer a lot of important learning, including greater digital literacy, and offer an alternative to privatized educational resources. [TC2]

The issue of access and cost was further echoed by another respondent, "open access is fantastic for students. The high cost of textbooks and other materials is often prohibitive to our education" [TC24]. One other respondent noted that "as future teachers, we should be aware of all these terms" [TC3]. One respondent commented specifically on recognizing the value of OER for

supporting teaching in the early part of their career, "open educational resources, [...] will be great resources for when I begin teaching" [TC73].

Another participant shared their hesitation to use open resources in the absence of a solid foundation of their usage rights:

> *As a future educator, I would really love to learn how to properly utilize these resources in a classroom but until I feel comfortable knowing the limits to their use, I will not. I am scared of accidentally doing something illegal in my use. [TC62]*

This passage draws particular attention to the need for training around how open education can be used in teaching and learning. Without developing confidence in their usage, this student is reluctant to try for fear or making a mistake. As a result, teachers may miss opportunities for sourcing, remixing, and contributing to open education.

6. LIMITATIONS

There are several limitations inherent in this study, most notable the small sample size of respondents to the survey. As well, respondents have self-reported their awareness and understanding of concepts in this study. One could argue that the terms and concepts may sound familiar in that they include clearly defined words, but respondents may lack a more in-depth understanding of their meaning and thus their potential impacts on teaching and learning. Further studies could look closer at the practices and approaches to using open education among teacher candidates and early career teachers following educational experiences that involve the development of OEP.

7. DISCUSSION AND CONCLUSIONS

Growing the awareness and adoption of OEP by teacher candidates may be an effective way to promote alternatives to traditional resources used within K-12 contexts with a goal of enhancing both student and teacher agency (DeBarger, 2019). Engagement in these approaches to teaching and learning enable flexibility that could better support learners' agency, autonomy, participation, and responsibility. Based on the findings from this study, learners need and have expressed an interest in being more informed about open education as a design approach (Kahle, 2008). This requires the development of open education literacies that focus on how to recognize and use resources that are made available with open copyright licenses such as Creative Commons. Additionally, teacher candidates need to know where to locate and assess educational resources that are free from copyright that they can adopt or adapt for use in developing their teaching and learning resources and how enables new learning designs.

Similar to the findings of Thompson et al. (2019), this study found that awareness of open education concepts and tools remains low among educators. Participants reported low levels of

understanding when asked about concepts including open textbooks, OER, open access publishing, open copyright licensing, open-source software, and open access data. These open education tools and resources can provide significant opportunities for the sourcing and design of teaching and learning materials, especially in the early years of ones' career. This speaks to the need for a greater awareness of OER and OEP among K-12 teachers and an important role for teacher education programs to address these needs and work to develop open education literacies. With the right amount of support, scholars have argued that "teacher educators are well-positioned to evolve future use of open practices within the K-12 curriculum" in the dynamic and active learning spaces often found in K-12 settings (Allen & Katz, 2019, p. 318). These practices may involve pedagogical approaches, assessment design, and technology use that is driven by openness in teaching and learning.

This need for literacy development to enable innovative teaching and learning in a more open world also provides an underpinning philosophy for the integration of technology in education. The importance of learning design is critical, not only in determining the intended outcome of an educational experience, but also in selecting resources, identifying activities, and developing assessment tools that provide friction free access, allow teachers to make modifications to meet contextual needs, and enable learners to have agency throughout teaching and learning processes. Teachers who take up technology in education may apply OEP as a design philosophy to make best use of the open internet. In doing so they can change the ways in which they source, remix, and create educational resources, find ideas for learning activities, and develop methods of assessment that prioritize learner agency and personalization. The alignment between learning outcomes, teaching activities, and assessment provides a framework to guide impactful instructional design and practice and has been recommended as one possible approach to designing learning that draws upon OEP (Paskevicius, 2017).

In thinking about the selection of technologies in the context of learning design it is useful to delineate between 'delivery technologies,' those that influence the cost and access to education, and 'design technologies,' which include the resources and tools that enhance learning (Clark, 1994). Examples of delivery technologies might include the learning management systems and learning portals, while design technologies are the resources, activities, and assessment tools teachers design to use with learners. Both design and delivery technologies play a role in supporting resources, activities, and assessment tools and increasingly are merging as tools and software advance. For example, an educator can design an online course experience using a tool such as a learning management system (LMS) or Google Classroom with that tool providing both the design of learning activities, resources, and assessment tools, while also providing the delivery of the learning experience online. This creates some tensions for both educators and learners; for educators, they may find themselves using or creating OER within closed delivery platforms. This may be at odds with the license depending on how it has been applied and limit the potential for the OER to continue evolving and remain accessible. Consider the use of the share-alike clause as part of the commonly used Creative Commons model which does require any OER used be shared openly as it was originally shared. For students, they may find their engagements and the artifacts they create as part of their educational experience become part of the closed system and in some

cases can be hard to detangle from online platforms. Again, digital literacies are necessary to both recognize and respond to these entanglements to ensure sustained and open access.

Openness by design provides teacher candidates with a starting point for considering how they might frame their use and application of education technology in their early years of teaching. While they are bound to be inundated with institutional systems, processes and pre-selected technologies once situated in their place of employment, a design approach that prioritizes openness can align well to those prominent themes in teacher education programs such as accessibility, community engagement, inquiry-driven learning, multimodality, fostering collaboration, mindfulness, and multiculturalism. Further research is needed on how best to model the elements of access, agency, ownership, participation, and experience within educational technology curriculum that is unwed to specific types of technologies and can be established as a design approach for the use of technology in education.

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