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Viewing open education within the Technological, Pedagogical, Content Framework: illustrating educator knowledge, skills and dispositions

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Without interrogation, educators may reproduce hegemonic materials and learning opportunities that are simply easier to access in open educational practices (OEP). Thus, we argue that to effectively engage in OEP, educators must not only possess knowledge, skills and dispositions related to their discipline, but also related to open education, CC licensing, open pedagogy, digital tools that facilitate OEP, and intentionality and care in negotiating openness with students. While there are various frameworks for open education, none have been applied to explain what knowledge, skills and dispositions are needed to engage in OEP. In this manuscript, we seek to conceptualise and provide examples of OEP within the Technological, Pedagogical, Content Knowledge Framework (TPACK) through the intersections of content, technology, and pedagogy with equity, intentionality, and care at the forefront.

Keywords: open educational practices; open pedagogy; TPACK

Introduction

Empowered by a desire for more equitable and inclusive access to knowledge, the open education movement is gaining momentum (William and Flora Hewlett Foundation 2020). In 2015, the United Nations (UN) released Sustainable Development Goals calling for a global partnership of all countries to achieve a better future for people worldwide by 2030 (UN 2015). Key among these goals is a commitment to 'ensure inclusive and equitable quality education and promote lifelong learning for all' (UN 2015, p. 17). The open education movement is driven by the belief that learning materials and experiences should be available to everyone; however, this belief goes beyond just access. In constructing an open education ecosystem, skilled individuals must develop teaching and learning materials and educational opportunities that they are willing to proactively share beyond restrictions imposed by copyright and other barriers to access (Hegarty 2015). Sharing and participation undergird openness, as 'open'

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1

is an umbrella term applied to resources, instructional practices, institutional policies and educational technology applications. Thus, openness is viewed as a community practice that values knowledge and resource sharing (Wiley and Green 2012).

Open educational practices (OEP) embody teaching and learning approaches that draw on collaborative and flexible learning environments, social and participatory learning, knowledge creation and sharing, learner activity and agency and open sharing (Cronin and MacLaren 2018). Open Educational Resources (OER), learning objects that are shared openly with a Creative Commons (CC) license, are often, but not always, central to OEP (Cronin and MacLaren 2018). The permissions provided by CC licensing permit all users to use, adapt, and remix OER, and reshare the resources within a global community, which is prohibited under traditional copyright. While OER is content-centred, OEP is process-centred, encouraging teachers to enhance equitable teaching and learning practices through openness (Bali, Cronin, and Jhangiani 2020). Accordingly, teaching and learning materials and educational opportunities are created that can continually grow and be updated for accessibility, cultural relevance, inclusivity and timeliness.

Although frameworks discussing the continuum of openness (Hilton *et al.* 2010), attributes of open pedagogy (Hegarty 2015), and social justice implications of OEP (Bali, Cronin, and Jhangiani 2020) exist, none have been applied to explain what knowledge, skills and dispositions are needed to engage in OEP. Widely used in educational technology, the Technological, Pedagogical, Content Knowledge Framework (TPACK) provides educators with a map for understanding how to successfully integrate technology into curriculum and instruction (Koehler and Mishra 2009). OEP may be conceived through TPACK since the creation, adaptation and remixing of resources require educators to purposefully integrate technology as a teaching tool. In this manuscript, we seek to conceptualise and provide examples of OEP within the TPACK framework through the intersections of content, technology, and pedagogy with equity, intentionality, and care at the forefront. We first frame our work in conversations of TPACK, open education, social justice and critical digital pedagogy. Then, we parse the intersections of open and TPACK to show educators the knowledge, skills and dispositions needed to teach effectively, as well as the decisions educators make, as they teach openly. These connections are supported by examples and suggested tools and practices to encourage educators to teach with OEP with considerations for an equitable learning environment.

Framing perspectives

In order to engage in a discussion of OEP through the TPACK framework, we review the tenets of each guiding perspective. These next sections describe the elements of the TPACK framework and frame the need for intentionality and criticality in current conversations of open education and digital pedagogy.

TPACK framework

Building on Shulman's (1986) notions of content and pedagogical knowledge, Mishra and Koehler (2006) proposed the TPACK framework which added technological knowledge. Arguing that simply adding technology to teaching is not enough, they examine specific knowledge needed to meaningfully integrate technology into

educational processes by first considering content and then merging effective instructional methods for teaching that content with technology. Thus, three interrelated bases of knowledge are blended in complex, and often nuanced, ways. Content knowledge is expertise in the subject matter one is teaching, such as facts, concepts, theories and procedures, how these ideas are connected, and evidence that supports this disciplinary knowledge. Pedagogical knowledge refers to a deep understanding of how individuals learn, knowledge of various teaching methods and practices, and overall aims, purposes, and values of education. Technological knowledge specifies knowledge of various tools, devices, software, applications, etc., along with the necessary skills to utilise these technologies and adapt to an ever-changing technological landscape. Although many today narrowly view technological knowledge as 21st-century digital technologies and tools, Mishra and Koehler (2006) originally defined the term more broadly to include any tool that can be used in teaching and learning, such as books and whiteboards as well as computers and multimedia.
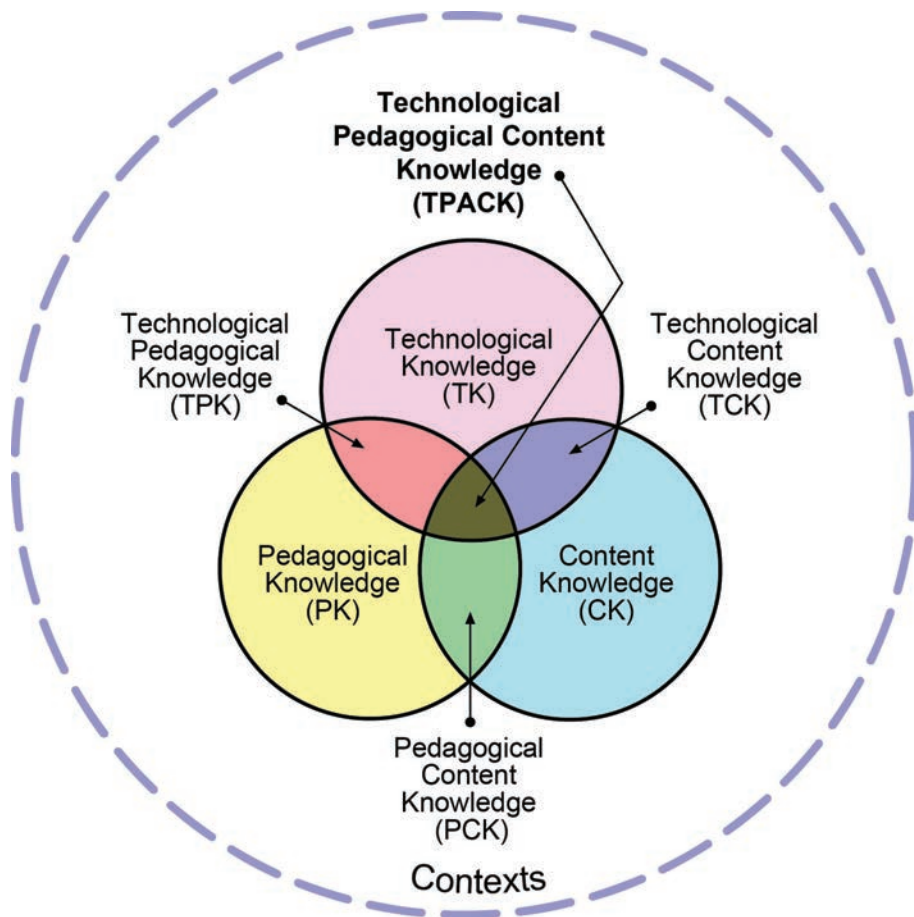

Figure 1. The Technological Pedagogical Content Knowledge (TPACK) framework.
Source: Reproduced by permission of the publisher, © 2012 by tpack.org.

The interactions between and among content, pedagogy and technology are depicted in the TPACK framework (see Figure 1; Koehler and Mishra 2009). These interactions are based on the belief that technology 'integration efforts should be creatively designed or structured for particular subject matter ideas in specific classroom contexts' (Koehler and Mishra 2009, p. 62). For example, an instructor who uses chemistry lab classes to lecture from PowerPoints laden with bullet points of the content may demonstrate exemplary disciplinary knowledge but is not maximising their classroom time pedagogically for hands-on learning or making effective use of interactive visuals afforded by technology. From this perspective, educators must interweave their knowledge to design learning experiences that flexibly match their content areas and their contexts, which are inherently different in every classroom, with technology and effective instructional approaches.

Pedagogical content knowledge involves applying a variety of instructional methods to teach content in the most effective ways based on students' prior knowledge, such as facilitating experiments to discover concepts rather than simply reading about them. Technological pedagogical knowledge examines how technology can be utilised while teaching, such as showing video clips of a procedure versus modelling the procedure on the whiteboard. Technological content knowledge represents how technology and content knowledge influence each other, such as tools utilised in different subject areas. For example, a middle school science instructor may demonstrate chemical reactions using a PhET interactive simulation of chemical reactions which would be too dangerous to facilitate physically in the classroom.

Technological pedagogical content knowledge is the basis of effective teaching with technology. It is at the intersection of technological pedagogical content knowledge that educators must make key decisions for their students and classrooms based on knowing how and when to use technology in constructive ways to teach content. Implications from this framework have impacted educational technology research (Niess 2019), professional development of technology integration (Pareto and Willermark 2019), and teacher education (Baran *et al.* 2020). Educators interested in learning more about TPACK can find valuable resources and good examples of implementation and planning in the literature, particularly in the special issue of *The Asia-Pacific Education Researcher* on TPACK (Koh, Chai, and Lee 2015).

Open education

In discussions of open education, many tout the benefits for students of such initiatives. With the rising costs of textbooks, between 2013 and 2018, OER textbook use in introductory higher education courses was estimated to save students $1 billion worldwide (Allen 2018). Additionally, research shows that courses using OER provide students with easier access to course materials (Hilton *et al.* 2019) and result in greater satisfaction with learning materials (Ross, Hendricks, and Mowat 2018). These benefits are even greater when educators facilitate participatory, collaborative learning experiences encouraged in OEP. Open pedagogy deconstructs the traditional student–teacher relationship by providing space for and empowering students to actively engage in dialogue about concepts, curation of resources and co-creation of content (Paskevicius 2017). DeRosa and Jhangiani (2017) explain,

'Open pedagogy, as we engage with it, is a site of praxis, a place where theories about learning, teaching, technology, and social justice enter into a conversation with each other . . . as a process of designing architectures and using tools for learning that enable students to shape the public knowledge commons of which they are a part.' (para. 2)

This pedagogical shift positions the instructor and students as co-constructors of knowledge motivating students to take more ownership of their learning and providing more equitable learning experiences that value diverse student voices (Paskevicius 2017). Although the utopian ideal of open education seems to meet the calls for inclusive and equitable education for all, without interrogation educators may reproduce hegemonic materials and learning opportunities that are simply easier to access (Jhangiani 2019). Therefore, we argue that to effectively engage in OEP, educators must not only possess knowledge, skills and dispositions related to their discipline, but also related to open education, CC licensing, open pedagogy, digital tools that facilitate OEP, and intentionality and care in negotiating openness with students.

Open education and social justice

Questions such as 'Open for whom?' encourage critical examination of open education and OEP placing principles of social justice and equity at the forefront by taking into account social, cultural and political contexts. Lambert (2018) examined how social justice has been noticeably absent from open education literature. She posits that open education should be prioritised 'by and for the benefit and empowerment of non-privileged learners who may be under-represented in education systems or marginalised in their global context' (Lambert 2018, p. 239). Drawn from critical theory, Cronin (2020) proposes the following questions about power and participation in openness:

- Who defines openness?
- Who is included and who is excluded when education is 'opened', and in what ways?
- To what extent, by whom, in what contexts, and in what ways do specific open education initiatives achieve their stated aims of increasing access, fostering inclusivity, enhancing learning, developing capacity and agency, and empowering individuals, groups, and communities, if at all?
- Can open education initiatives, in practice, do the opposite of what they are intended to do?
- What does emancipatory open education look like? (p. 5)

These questions encourage educators to analyse and, subsequently, reconceptualise open education in ways that expand access, participation and social justice. For example, textbook affordability is a barrier for historically underserved students; Jenkins *et al.* (2020) found that OER adoption fostered social justice through increased access and cost savings for students. Focusing specifically on OEP, Bali, Cronin, and Jhangiani (2020) analysed how specific pedagogical practices impact economic, cultural and political social justice efforts in transformative, ameliorative, neutral or even negative ways. As an example, asking students to publicly blog about class content can be ameliorative by giving voice to groups who are often left out of public scholarship or transformative by allowing marginalised groups to challenge hegemonic ideals of

academic knowledge. At the same time, public blogging can be negative for those who may be more vulnerable through a public online presence (e.g. witness protection, political surveillance) and those with minimal digital literacies or Internet access (Bali, Cronin, and Jhangiani 2020). In these critiques, we acknowledge that OEP doesn't automatically further social justice without intentional and thoughtful design.

Critical digital pedagogy

According to Collins and Halverson (2018), inequities between those in different social classes continue to expand because technical advancements afford social and cultural advantages to the wealthy. Therefore, educators must think critically about the nature and effects of technology and the tools they are using with students. Stommel (2014) explains, 'Critical Digital Pedagogy demands that open and networked educational environments must not be merely repositories of content. They must be platforms for engaging students and teachers as full agents of their own learning' (para. 18).

From the perspective of critical digital pedagogy, it is clear that educators who are designing curriculum and instruction steeped in OEP require a plethora of requisite knowledge, skills and dispositions. For example, educators seeking equitable learning experiences must take a critical stance in examining the affordances and constraints of digital tools (Jhangiani 2019). Educators must understand and develop their own digital literacy skills required to interact with these tools and know methods for developing and nurturing students' digital literacy skills and digital identities. Simultaneously, they should consider issues of access to digital tools and skills (see Gilliard and Culik's 2016 work on digital redlining) and the priorities of their institutions and students as influenced by political, cultural and social contexts (Cronin 2020). As previously discussed, these aspects should be critically considered alongside disciplinary applications as there will likely be variations based on the content to be taught.

The intersections of TPACK and OEP

Similar to the argument proposed by Mishra and Koehler (2006) about integrating technology into instruction, we believe that merely integrating open practices into the curriculum is not enough to ensure social justice and equity. Instead, there are layered complexities in considering how, and the extent to which, OER content (content knowledge), open pedagogy (pedagogical knowledge) and digital tools utilised in these practices (technological knowledge) increase access, foster inclusivity, enhance learning, develop capacity and agency and empower learners when designing curriculum and instruction. While others have designed OER using the TPACK model to guide content (OER in Mathematics Professional Development Project, n.d.), designed OER about TPACK (Hofer and Harris 2016), and recently proposed that OER be viewed through TPACK (Grotewold, Kohler, and Krimbill 2022), to our knowledge no one has fully analysed OEP through TPACK. Yet, when OEP is layered onto the TPACK framework, educators become more aware of the content, pedagogy and technology knowledge needed specifically related to open practices and can consider these aspects to design more socially just learning environments. In the following sections, we explicate open knowledge connections within these areas with examples from a variety of disciplines.

Content knowledge connections

When engaging in OEP, educators must possess knowledge of their disciplines as well as knowledge specific to open education. For many, basic understanding begins with the 5R's which define the five rights of OER: retain, reuse, revise, remix and redistribute. Given that OER can take various forms from books to full courses to audio and video files (and more!), the 5R's provide a framework for thinking about the principles associated with open education.

Other essential content knowledge of open education includes identifying the various CC licensing symbols (see Figure 2), understanding the permissions afforded by each, and examining the affordances, constraints, and impact of the licenses for the materials they use or choose to place on OER they create. For example, one must understand that selecting a resource with an ND (no derivatives) license constrains how the resource may be used. Since no derivatives are allowed, educators may not remix chapters or sections of an ND textbook to create a new one contextualised for their local community, such as translations. Selecting a license to apply to resources can become further complicated when one chooses to adapt or remix material from sources with multiple CC licenses (see Fazzino and Turley 2019). While CC represents the licenses most closely associated with written work, music and video, other open license designations may be associated with different disciplines, such as General Public License (GNU) for open-source software. Educators should also check their
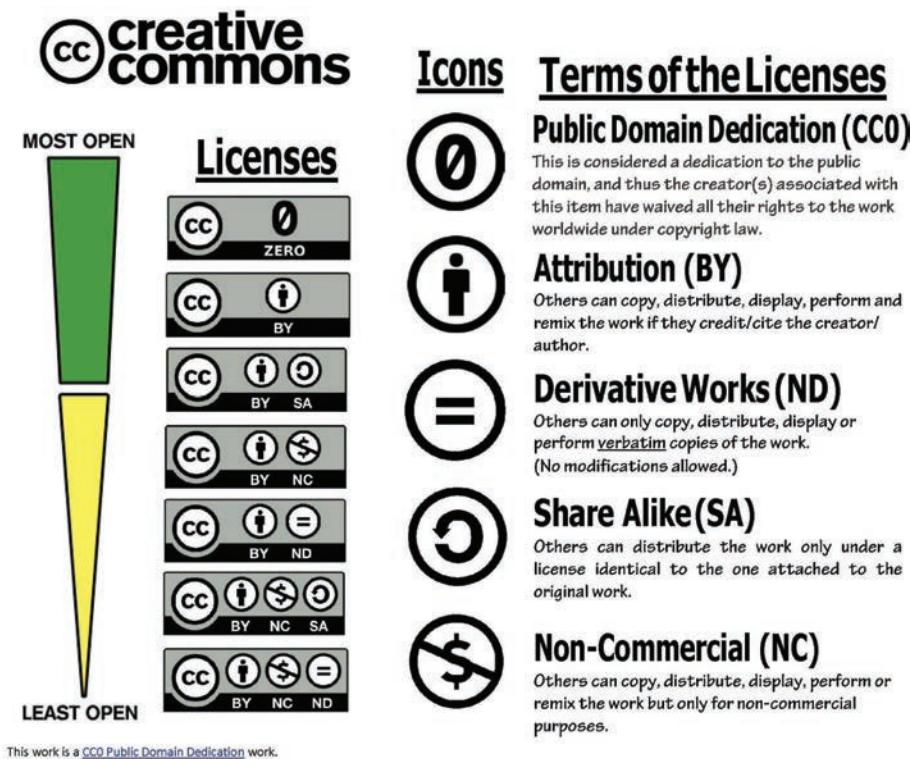

Figure 2. Creative commons terms and licensing symbols.

employer's policies to determine the copyright holder of the materials they create and if they can openly license these resources.

Utilising OER also involves knowledge of attribution practices; this differs from citation which can cause confusion for educators and students. An attribution statement is a legal requirement of all the CC licenses as all of the licenses require CC Attribution (CC-BY), which provides credit to the creator and marks the work as open content. Additionally, although attribution statements may vary in formatting, the title, author, source and license should always be included. Works that are a derivative of an original resource must include the information of original source along with the title, author and license of the derivative.

When sharing work openly, educators should be aware of the decisions that are made by individuals in the process. Cronin (2017) explains that there are four levels of balancing privacy and openness in open practices: macro (global level), meso (community or network level), micro (individual level) and nano (interaction level). At the macro level, one must determine whether or not they will participate in open sharing of their work or open networking with others. Those who choose to share must then identify who they want to share with (meso level; e.g. the class, a specific community/organisation or the wider public) and who they want to share as (micro level; e.g. their name, a pseudonym or anonymously). For example, educators may invite students to share work with the wider public on a general website as a class contribution or within a Virtual Learning Environment as an individual contribution (see example in Jeffrey *et al.* 2021). Finally, individuals must negotiate what they will share and if they will interact with others at the nano level (Cronin 2017). Understanding the types of decisions that are made by individuals engaging in open practices is essential for future pedagogical practices.

Pedagogical knowledge connections

While the content knowledge required by educators to engage in OEP largely focuses on technical aspects of OER and openness, pedagogical knowledge includes awareness of and skill in implementing various instructional practices associated with open pedagogy. In the process of finding open materials, educators exhibit pedagogical knowledge by selecting lessons and resources that meet their class' needs (Jung, Sasaki, and Latchem 2016). For example, in selecting an open textbook for a course, educators may carefully consider the population of students they serve and evaluate textbooks to ensure their communities are represented and recognised therein.

As discussed previously, open pedagogy prioritises students as contributors in the creation of knowledge shared publicly and openly. OEP requires educators to commit to student-centred learning that fosters agency and encourages participation in knowledge creation for the public commons (DeRosa and Jhangiani 2017). Therefore, pedagogical knowledge is demonstrated by selecting and implementing activities and assessments that address learning outcomes and utilise open practices, such as those listed in Table 1.

Pedagogical content knowledge connections

Becoming aware of various OEP allows educators to flexibly apply different methods for actively engaging students in their discipline-specific content and demonstrate pedagogical content knowledge. For example, a history instructor whose learning

Table 1. Open pedagogy activities and assessments.

Open activities	Description	EdTech tools	Example(s) of use
Social Annotation	Social annotation involves educators and learners commenting on a common text (written, video, image or audio) through a digital platform in a collaborative environment. Students support one another in sharing their connections, thoughts and perspectives on the text through comments and replies to others. As a result, students read multiple viewpoints of their peers and collaboratively deepen their understanding.	Hypothes.is Perusall NowComment	The Marginal Syllabus and Open Pedagogy
Renewable Assignments	Renewable assignments are tasks in which students compile and openly publish their work so that the assignment outcome is inherently valuable to the community. In some cases, renewable assignments may be originally developed by the students, and in others, students may remix or adapt existing OER.	Varies based on task Text processing software Google Docs Websites	Evolving into the Open
Wikipedia Assignments	Wikipedia assignments provide an opportunity for students to examine Wikipedia articles to identify gaps in knowledge, inaccuracies, biases, etc. in the information. Then, using scholarly sources, they create a new Wikipedia article, add to or edit an existing one, add citations, and/or add visuals. Through Wikipedia assignments, students develop information and digital literacy skills, writing and communication skills, reference skills and critical thinking.	Wikipedia Wiki Edu	Teaching Wikipedia
Blogging	Educators can encourage students to show their understanding of course content through blogging. Blogs may be used in classes in many ways such as entries that are responses to a prompt, responses to readings, reflective or exploratory entries, showcases of student work or open-ended entries related to the content being addressed. Educators may set up class sites where students can create their blogs or encourage students to blog on a personal site that is linked to the class site. Learning management systems often allow educators to set up class blogs within the system for students who do not wish to share their entries publicly.	WordPress	Discussion Strategies

Continued

Table 1. Continued

Open activities	Description	EdTech tools	Example(s) of use
Design OERs	By adapting, remixing or creating OER with students, educators help students con-tribute to knowledge. This can be as simple as creating problem sets, adding examples to existing OER or asking students to help reframe and re-present content in new and innovative ways to create a new OER.	Pressbooks Manifold Fulcrum Google Docs	Open Textbook Annotation Project
Public Chats with Experts	Engage students in scholarly conversa-tions with professionals and scholars in the field through public chats. Using social media tools, students can engage in dialogue with others sharing their thoughts, asking questions, and receiv-ing feedback on their work by tagging individuals or organisations on their posts. Create a hashtag for your class to organise all of the students' posts.	Twitter Facebook TikTok	Class Hashtags #EDCI336 #StratComm2321
Co-Created Syllabi	Build course policies, outcomes, assign-ments, rubrics and class schedules collaboratively with students. Not only does this give them a voice but it also provides them more ownership over the content and work. The syllabus becomes a collaborative document that is shaped by and with students.	Google Docs	Collaborative Syllabus Design Co-created atten-dance policy
Curate Course Content	Educators can also empower students within their classes by allowing students to curate the content they engage with during the class. Provide students with limited choices of different texts or allow them to curate texts for an upcoming unit/topic.	Pressbooks Manifold	Against Product Based Learning

objective is to compare and contrast two accounts of a historical event may have students engage in social annotation of the texts. Social annotation encourages close reading and allows students to view the connections others made between the two texts (Bakermans *et al.* 2022). Whereas, a mathematics instructor with a learning objective of communicating mathematical ideas to others may have students blog about the steps they took to solve a mathematical equation. As students blog about their pro-cess, they clarify their own understandings and can also view others' solutions to see the variety of methods that can be applied to arrive at one solution (DeWaard and Roberts 2021).

When implementing OEP, pedagogical content knowledge also reflects care when educators intentionally support students in making decisions about their level of openness while balancing privacy concerns. Cronin (2017) notes that openness is 'complex, personal, contextual, and continually negotiated' (p. 28). Highlighted

by Bali, Cronin, and Jhangiani (2020) as social justice concerns, there are many reasons students may not want to share their work openly and publicly. Likewise, Hilton *et al*. (2019) urge instructors to consider the ethics of requiring or strongly encouraging students to share their work openly. Thus, educators should intentionally apply their OEP content knowledge of Cronin's levels of openness when designing open learning activities, assignments and projects. Inviting students to share their work in open repositories and guiding students selection of CC licenses, and choices of who to share work as, while providing assignment alternatives, honours student agency.

Technological knowledge connections

Because OEP almost always requires the use of technology to facilitate sharing and creation of resources, much technical knowledge is needed to engage in these practices. To make strategic decisions for their classrooms, educators need knowledge about the digital resources most appropriate for sharing and producing OER, such as those listed in Table 1. In addition to raising awareness of various tools, platforms and applications associated with open education, educators should explore the resources to become familiar with them and simultaneously develop their own digital literacy skills in using them. Although teaching with these resources does not typically require in-depth knowledge and skill, familiarity provides educators with a starting point for imagining pedagogical use with their specific student populations and content areas. For example, when involving students in the co-creation of open content, educators will be prepared to guide students to tools that can achieve the goals of the resource being co-created. Then, as the project progresses, educators and students learn from each other and broaden their knowledge and digital literacy skills together.

In any use of technology, the accessibility of a resource or making it usable by everyone, is important. It is particularly important to incorporate accessibility in open practices, where the goal is inclusivity and equity. As the BC Campus Open Education Accessibility Toolkit asks, 'If the materials are not accessible for each and every student, do they fulfil the mandate to deliver fully open textbooks?' (Coolidge, Doner, and Robertson 2015, para. 3). Designing for accessibility requires an understanding of universal design, which is both a process and an outcome to create something that is usable by all, without needing specialised adaptation (see https://udlguidelines.cast.org/). Open textbooks, such as the Accessibility Toolkit, include an Accessibility Statement detailing the accessibility features and the standards that it meets as well as other file formats available. They also include known accessibility issues and a form and email address for users to report accessibility issues so they can be addressed promptly.

Technological content knowledge

While educators need to develop an awareness of general open repositories and tools, there are many discipline-specific resources available as well. The National Science Digital Library provides links to high-quality open online educational resources in STEM disciplines for educators to use with students at all levels. Similarly, OER Commons is an open repository designed for educators to search for, adapt and create open teaching and learning materials, with a particular emphasis on primary and secondary school subjects and lessons. Educators in the Humanities and Arts,

among others, may find Smithsonian Open Access useful as it provides digital access to millions of open-access items from the Smithsonian's museum collections, as well as access to research data sets, all of which may be reused and remixed in the Smithsonian Learning Lab. Learning about repositories such as these provides educators with the knowledge needed to adopt OER tailored to their subjects and the resources needed to support OEP with students.

Technological pedagogical knowledge

Just as educators must consider their own digital literacy skills, they should not automatically assume students possess the digital literacy skills needed to effectively engage in OEP. When using specific open repositories and tools, educators should intentionally scaffold learning experiences to prepare students to use the digital tools. To illustrate, if an instructor wants students to engage in public social annotation throughout a course using Hypothes.is, students will first need to know to use the Google Chrome browser, install the Hypothes.is extension, and sign up for an account. Educators will likely need to model how to create annotations and replies to others, including steps for creating annotations and expectations for producing culturally sensitive and respectful comments to others. Additionally, Sawyer *et al.* (2020) caution that educators must help students develop the dispositions of critical curators, consumers and creators. To do so, educators must intentionally plan OEP activities and assignments that support these dispositions as related to their field.

With a focus on equity, educators must also be mindful of issues with student access to technology and other challenges related to digital equity (Resta *et al.* 2018). Given the wide variety of tools available to access online content, educators need to be cognisant of the devices their students are using and the extent to which they will be able to navigate the materials. Surveying students at the beginning of a class is one way to ensure equitable access to required class tools. If an educator finds that some students may not have access to digital OEP tools, they should consider how to plan for participation and engagement offline as well as online. Many OER can be downloaded and saved in different file formats but may not always translate well when printed. Likewise, students without consistent access to the Internet may not be able to engage in a public chat with an expert in the field. Thus, these are technological pedagogical concerns and digital equity issues that must be intentionally considered and planned for when integrating OEP.

The open in TPACK

Mishra and Koehler (2006) originally argued that quality teaching 'requires a thoughtful interweaving . . . [and] nuanced understanding of the complex relationships between technology, content, and pedagogy. . . to develop appropriate, context-specific strategies' (p. 1029). It is impossible to view OEP in isolation from content, pedagogy and technology since they exist in dynamic transactional relationships as the examples in the previous sections show. We argue that equitable teaching with OEP requires an understanding of the complex ways open is embedded within content, pedagogy and technology and the intentional design of learning environments and instruction as shown in our open application of the TPACK framework (see Figure 3). For instance, educators integrating a renewable assignment for the first time are forced
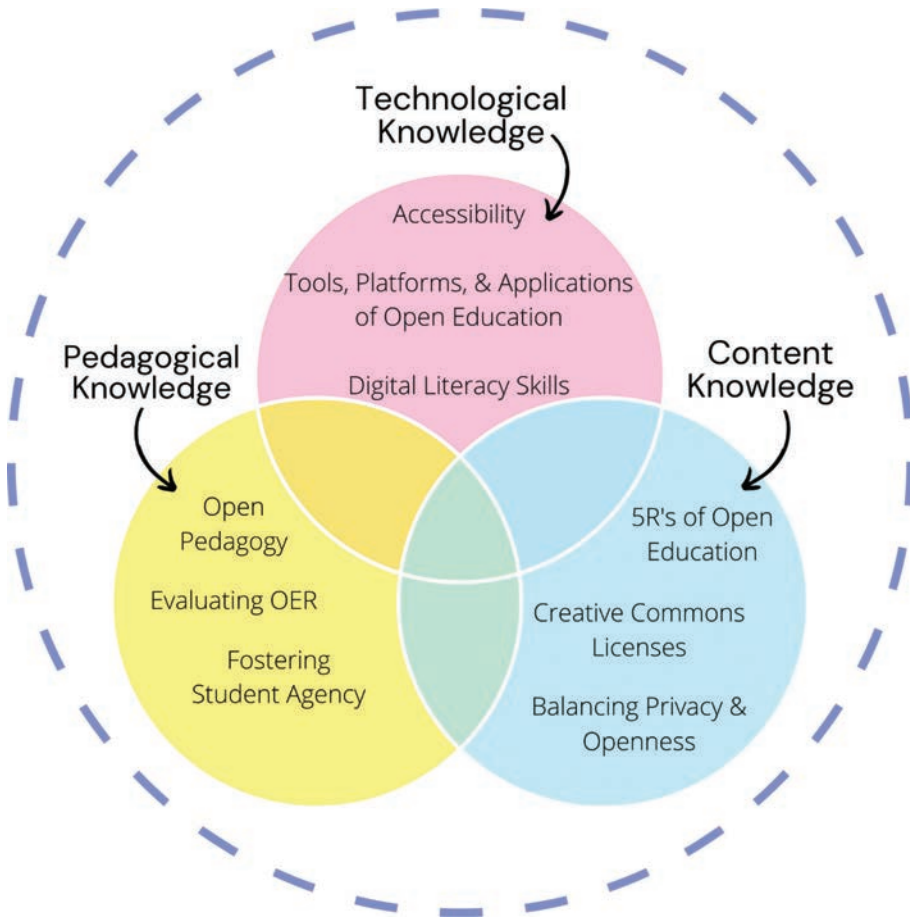
Figure 3. The knowledge, skills and dispositions of open in TPACK.

to consider what type of student work will demonstrate the learning objectives of the course and result in a good contribution to the public knowledge commons (Katz and Van Allen 2020). Among these factors, they must decide on specific tools they will ask students to use (ones accessible to students), and how they will scaffold support (such as including multiple rounds of peer review) so that students feel confident selecting a CC license and sharing their work publicly. The newness of these considerations can cause educators to interrogate their understandings of content, pedagogy and technology and rethink their teaching practices in new ways.

Since educators often find the technical aspects of open education to be nuanced and complex, it is essential they are aware of who to turn to for support. Librarians and instructional designers often have expertise in open education and can alleviate some of the barriers associated with OEP (Van Allen and Katz 2020), particularly through collaborative relationships. For example, librarians can support educators in finding and selecting OER or understanding the permissions of an open license through professional development workshops or other training experiences (Clifton and Hoffman [eds] 2020). Additionally, instructional designers can support educators in designing learning experiences that capitalise on OEP and help problem-solve

challenges that arise during implementation (Ren 2019). Regardless of the method used, it is clear that training and support are essential to developing educators' knowledge, skills, and dispositions of open education, CC licensing, open pedagogy, the digital tools that facilitate OEP, and intentionality and care.

Conclusion

Our conceptualisations of the intersections between OEP and the TPACK framework are intended to provide educators adopting open practices, and those who support them, with an awareness of the kinds of knowledge, skills and dispositions needed. Some characterise open as an ethos, a commitment to caring, democratic, participatory teaching and learning practices; yet OEP requires educators to make decisions that are personal, contextual and nuanced (Cronin 2017). Some educators will prioritise OEP to empower learners for more socially just classrooms, while others may adopt OER to reduce the costs of their textbooks and increase student access to learning. No matter their reasons for entering into OEP, educators need competencies related to technological knowledge, pedagogical knowledge and content knowledge to provide successful learning experiences for students. However, making teaching and learning more widely available does not necessarily result in a more socially just education. To avoid replicating hegemonic materials and opportunities, careful application of OEP when considered through the TPACK framework can guide educators in integrating open practices in their content areas and classroom contexts for more inclusive and equitable education for all.

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