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A Framework for Evaluating the Creation and Adaptation of Open Textbooks

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Abstract

The COVID-19 pandemic resulted in dramatic growth in the use of open education resources, such as open textbooks, as classes moved online around the world. This highlighted the importance of evaluating the creation and adaptation of open textbooks used in online courses. In reviewing the research literature, I found existing rubrics or frameworks had gaps in the categories and criteria being evaluated. Therefore, I synthesized the evaluation and quality criteria from 31 articles into a single framework, which online instructors can consider using as they create or adapt an open textbook. The criteria include content, accessibility, technology, open licenses, instructional design, and a new category I termed verification.

Keywords: open education resources, OER, open education, open textbook, quality

Introduction

In 2020, the COVID-19 pandemic caused a massive pivot in the modality of educational offerings worldwide. Overnight, educators and institutions were forced to transition most programming to an online format. Ossiannilsson et al. (2020) found that during this time there was an increase in the use of open education resources (OER) worldwide. For example, OpenStax reported 27,000 new accounts were created between March 11, 2020 and March 19, 2020 (Kurp, 2020). OpenLearn reported an increase from 40,000 to 200,000 daily visitors in March 2020 (OpenLearn, 2021). Additionally, MERLOT (Multimedia Educational Resource for Learning and Online Teaching) reported that the number of downloads of their SkillsCommons resources had increased by more than 40% during the pandemic (Hanley, 2021).

This dramatic growth highlighted the importance of evaluating the creation and adaptation of OERs to ensure they are effective. However, in reviewing the research literature, I discovered that existing rubrics and frameworks did not address some elements important in the evaluation of open textbooks. Accordingly, I searched the research literature and synthesized the evaluation and quality criteria into a single framework that instructors can consider using as they create or adapt an open textbook for use in an online course.

Impacts of Using Open Textbooks

The zero cost to students is an important feature of OER because commercial textbook costs have been dramatically increasing over the past several decades. In 2016, the US Bureau of Labor Statistics reported the price for commercial college textbooks had increased 88% since 2006 alone (US Bureau of Labor, 2016). In Canada, such data is not available publicly (Jhangiani & Jhangiani, 2017). However, the rise in textbook costs can be inferred by the amount of provincial funding directed to open textbook initiatives (Caldwell, 2019; eCampusOntario, n.d.; Kelloway, 2020; Open Education Alberta, n.d.) and the development of zero textbook cost programs (Kwantlen Polytechnic University, n.d.)

High textbook costs mean that some students are unable to purchase the learning materials necessary to be successful in their courses. Moreover, students are not necessarily affected equally by high textbook costs. Jung et al. (2017) and Fischer et al. (2015) reported that students belonging to lower socioeconomic classes may experience larger negative impacts. Thus, textbook cost thus becomes an access-to-education issue (Bethel, 2020).

Open textbooks provide flexibility in how, when, and where students learn (Brandle et al., 2019; Lin, 2019). Cummings-Clay (2020) found grades were similar between students in sections of a course that used OER compared to a commercial textbook. Fischer et al. (2015) found students enrolled in courses using OER had higher rates of course completion and higher course grades compared to students in courses using commercial textbooks. Hilton (2020) reviewed 25 peer-reviewed studies about the value of OER and found students had the same or better learning outcomes when using OER. Similar results have been reported by Afolabi (2017), Choi and Carpenter (2017), Clinton and Khan (2019), Hassan et al. (2019), Jhangiani et al. (2018), and Jung et al. (2017).

Creating the Framework

As I was particularly interested in open textbooks for use in online classes, I used search keywords connected with OER and distance education, distance learning, online education, or online learning, in my literature search, as shown in Table 1.

Table 1

Keywords Used to Search the Literature

OER or open education resources	AND	Design	AND	distance education or distance learning or online education or online learning
OER or open education resources	AND	Design* or Develop*	AND	distance education or distance learning or online education or online learning

The resulting 58 publications were then reviewed by reading them several times. Only those that discussed the quality of OER broadly or in relation to a specific aspect of open textbooks were included. In total, criteria from 31 articles were synthesized into the new framework.

Considerations When Designing or Adapting Open Textbooks

Quality

The free nature of OER have led to suspicions about their quality (Wiley et al., 2014; Willems & Bossu, 2012). Bates (2019) described the biggest quality issues being "reams of text with no interaction, often available in PDFs that cannot easily be changed or adapted, crude simulation, poorly produced graphics, and designs that fail to make clear what academic concepts they are meant to illustrate" (Section 11.2.4.1, para 1). Miao et al. (2019) highlighted the examples included in an open textbook, how localized they are, and what languages the resource is available in as factors affecting perceptions of quality. Furthermore, the Commonwealth of Learning (2022) and Joint Research Centre et al. (2013) have reported this poor quality is thought to be the result of OER not undergoing peer review prior to publication. Commercial textbooks typically have many people reviewing the content throughout the development of the book, whereas open textbooks typically do not (Hashey & Stahl, 2014; Jhangiani, 2014).

Whether perceived or actual, poor quality is a barrier to further reuse, including adaptation and adoption (Wiley et al., 2014; Windle et al., 2010). An important point to consider is that "the ideal textbook does not exist … There are always tradeoffs that faculty make when adopting a textbook. Often it is a question of whether the content is 'good enough,' assuming that several other resources are in place" (Jhangiani, 2014, para 13).

Existing Rubrics

While instructors selecting open textbooks should be sufficiently skilled and knowledgeable in determining what is a quality textbook (Windle et al., 2010), many faculty do not feel confident in doing so (Jhangiani et al., 2016) or may not be skilled in doing so because they are teaching at

the edge of their expertise (Windle et al., 2010). As well, some faculty do not feel well-versed in assessing open textbooks for accessibility features (Jung et al., 2017; Moon & Park, 2021) or open licenses and copyright (Joint Research Centre et al., 2013).

Rubrics can potentially be helpful when creating or adapting an open textbook (Achieve, 2011). However, Zhadko and Ko (2020) cautioned against using checklists or rubrics designed to evaluate commercial textbooks because the openness of OER may demand additional considerations not relevant for commercial textbooks (Zhadko & Ko, 2020).

Achieve (2011) developed a series of rubrics to assess various aspects of OER, including alignment to standards, explanation of subject matter, utility of materials designed to support teaching, quality of assessments, quality of technological interactivity, quality of instructional and practice exercises, opportunities for deeper learning, and assurance of accessibility standards. However, while these rubrics enable overall evaluations in each category, they do not facilitate more granular evaluations of key aspects within each category.

Nikoi et al. (2011) developed the CORRE framework (content, openness, reuse, repurpose, and evidence), but there are considerations related to technology and accessibility that are not addressed.

Kawachi (2014) found 40+ frameworks in the literature, and then compiled several of them into a single list comprising 62 criteria. While the list is comprehensive, including domains such as cognition, affect, metacognition, environment, and management (Kawachi, 2014), there are considerations related to technology and accessibility that are not addressed.

Conole and Brown (2018) described three tools—the 7Cs of Learning Design Framework, the SAMR model, and the ICAP framework—that can inform the process of designing OER. From my assessment, the 7Cs of Learning Design Framework is strongly oriented towards instructional design considerations, the SAMR model focuses heavily on technology in learning, and the ICAP Framework focuses on student behaviours and cognitive engagement. While these frameworks are helpful, there remain considerations relevant to developing and evaluating open textbooks that are not included.

Yuan and Recker (2015) reviewed 14 existing quality rubrics specific to the assessment of OER and found there was great variation in the criteria being evaluated, whether the rubrics were tested and validated, and what rating scales and scoring guides were being used. In another study, they noted significant variability in how designers applied the rubrics and rating scales (Yuan & Recker, 2019). Because the publication year of the rubrics they included dated back to 2002, I did not review them because the capabilities of the internet and learning technologies have changed significantly during the past 20 years.

Zhadko and Ko (2020) developed a comprehensive checklist that includes content, quality, currency, alignment with student needs, accessibility, format, adaptability, and supplementary resources, which could be helpful to many instructors. However, there are still gaps. Interestingly, they recommend designers of open textbooks consider developing their own checklist of criteria that best meets their needs (Zhadko & Ko, 2020). This is precisely what Neely et al. (2016) did; their checklist included things like technology, student experience,

learning materials, and administration. While a good example of designers creating their own evaluation tool, it is specific to their context and project and is of limited broader utility.

A New Framework

While these existing frameworks could be useful in some contexts, there remain gaps regarding the evaluation of accessibility, technology, pedagogy, social justice, and other considerations. Therefore, I compiled a comprehensive framework based on my review of the literature.

It is evident the breadth of quality indicators differs substantially among researchers and organizations (Windle et al., 2010). Moreover, what constitutes quality can be subjective (Almendro & Silveira, 2018) and open to interpretation (Yuan & Recker, 2015). Nevertheless, the framework I developed (see Appendix A) can be used to evaluate the quality of content, accessibility, technology, open licenses, instructional design, and a new category I termed verification.

Content

The evaluation of the effectiveness of content pertains to the subject matter of the open textbook.

Technology

The evaluation of the technology of open textbooks primarily focuses on the flexibility of the technologies being used and how students can interact with the open textbook in a digital format.

Accessibility

Evaluating the accessibility of the open textbooks ensures students with disabilities are able access to them. I included the use of Universal Design for Learning (UDL) principles in the instructional design category (rather than in the accessibility section) because I believe instructors should strive to teach all learners in their class, and UDL principles are not just applicable to students who require accommodations for disabilities.

Instructional Design

Numerous researchers advocate for creating or adapting an open textbook with the needs of students and the learning outcomes of the course in mind. However, it is reasonable to question: Why use a textbook at all? Many instructors believe course textbooks are important course learning resources (Bates, 2019; Benoit, 2018; Conole & Brown, 2018; Cuttler, 2019; Fischer et al., 2015; Hilton, 2020; Ivić, 2019). However, students don't necessarily share this sentiment (Benoit, 2018; Dennen & Bagdy, 2019). Accordingly, it is important instructors be intentional in their use of the course textbook.

Open Licensing

When an instructor creates or adapts an open textbook, they are making available material that can be further shared, modified, and distributed. Because the creator of a new work is free to assign their own license, the level of restriction imposed on subsequent users is an important

consideration (Wiley et al., 2014). Highly restrictive content has reduced remix potential (Amiel, 2013). From an equity perspective, restrictive licenses can prevent the use or repurposing of materials by global populations who were originally being targeted but for whom additional customization is relevant (Willems and Bossu, 2012).

Verification

The verification criteria actively validate or cross-check the overall quality of the open textbook.

Conclusion

While some rubrics or frameworks for evaluation of open textbooks exist, they do not comprehensively evaluate open textbooks across several quality categories. I reviewed the published literature and synthesized the criteria from 31 articles to create a new framework that could be helpful to instructors of online courses in evaluating the effectiveness of open textbooks they create or adapt.

Author's Contributions

The author confirms sole responsibility for all aspects of this project and submission.

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Ethics Statement

Ethics review was not applicable because this article was a review of published literature.

Conflict of Interest

The author does not declare any conflict of interest.

Data Availability Statement

Data sharing is not applicable to this article because no new data were created or analyzed.

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Appendix A

Table 1

A Framework for Evaluating the Effectiveness of Open Textbooks

Category	Criteria	Sources
Content	Is the content supported by evidence?	BCcampus (2018)
		Wiley University Services (2018)
	Is the content accurate and free or errors?	BCcampus (2018)
		Jhangiani et al. (2016)
		Jung et al. (2017)
		Wiley University Services (2018)
		Windle et al. (2010)
		Zhadko & Ko (2020)

Category	Criteria	Sources
	Is the content unbiased?	Hashey & Stahl (2014)
		Wiley University Services (2018)
	Is the content current?	BCcampus (2018)
		Jung et al. (2017)
		Oelfke et al. (2021)
		Wiley University Services (2018)
		Windle et al. (2010)
	Is the content cohesive?	Zhadko & Ko (2020)
	Is the content comprehensive?	Zhadko & Ko (2020)
	Is the writing clear?	BCcampus (2018)
		Jung et al. (2017)
	Is the content of readable and reasonable lengths?	Brandle et al. (2019)
		Dennen & Bagdy (2019)
		Jung et al. (2017)
		Marczak (2013)
		Zhadko & Ko (2020)
	Have personas been developed to represent the target learners to ensure the content aligns with the learners?	Baaki et al. (2017)
	Is the content customized to the students/course?	BCcampus (2018)
		Jung et al. (2017)
	Is the content at an appropriate level for students?	Moore & Butcher (2016)
		Zhadko & Ko (2020)
	Is the author a subject matter expert?	Wiley University Services (2018)
	Does the content use storytelling to provide examples of real-life experiences?	Ives & Pringle (2013)
	Is the open textbook interactive and engaging?	BCcampus (2018)
		Conole & Brown (2018)
		Dennen & Bagdy (2019)
		Hockings et al. (2012)
		Ivić (2019)
		Jung et al. (2017)
		Marczak (2013)
		Moore & Butcher (2016)

Category	Criteria	Sources
		UNESCO & Commonwealth of Learning (2011)
		Zhadko & Ko (2020)
	Does the open textbook use multimedia, and are the images, illustrations, and other visual aids or interactive components of appropriate quality and are they identified, labelled, and numbered?	BCcampus (2018)
		Conole & Brown (2018)
		Dennen & Bagdy (2019)
		Hockings et al. (2012)
		Ives & Pringle (2013)
		Ivić (2019)
		Marczak (2013)
		Moore & Butcher (2016)
		National Center on Accessible Educational Materials (2021)
		Oelfke et al. (2021)
		Wiley University Services (2018)
	Are examples and activities/exercises included?	Jung et al. (2017)
	Are links to additional resources provided?	Ives & Pringle (2013)
	Are supplementary materials available?	Jung et al. (2017)
		Marczak (2013)
		Zhadko & Ko (2020)
	Does the content adhere to any established standards?	Hashey & Stahl (2014)
		Zhadko & Ko (2020)
	Does the open textbook adhere to a style guide?	BCcampus (2018)
	Is the content separated into chapters and sections?	Marczak (2013)
	Does the open textbook have a table of contents?	Marczak (2013)
	Is a glossary of new or unknown words provided?	Ivić (2019)
	Is the content biased towards Western/Eurocentric perspectives?	Amiel (2013)
	Is the textbook available in languages other than English?	Karakaya & Karakaya (2020)

Category	Criteria	Sources
	Is the level of language conducive to translation?	Amiel (2013) Karakaya & Karakaya (2020)
	Is the content conducive to modification and customization?	Moore & Butcher (2016)
Instructional Design	Does the open textbook match the intended use?	Jhangiani et al. (2016)
	Does the content align with the course learning outcomes?	BCcampus (2018) Ivić (2019) Jhangiani et al. (2016) Moore & Butcher (2016) Wiley University Services (2018) Windle et al. (2010) Zhadko & Ko (2020)
	Does the open textbook explicitly state what learning outcomes and needs are being addressed?	Moore & Butcher (2016) UNESCO & Commonwealth of Learning (2011)
	Is the reader oriented to how to navigate the open textbook?	Benoit (2018) Marczak (2013)
	Has the instructor explained to students why this particular open textbook is being used?	Zhadko & Ko (2020)
	What will student success look like when using this open textbook?	Zhadko & Ko (2020)
	Does the open textbook relate to the course content and is it used in class activities?	Zhadko & Ko (2020)
	Does the open textbook scaffold the learning?	Ivić (2019) Moore & Butcher (2016)
	Have principles for Universal Design for Learning been followed?	Hashey & Stahl (2014) Moon & Park (2021) Zhadko & Ko (2020)
	Is the open textbook well-designed?	Jung et al. (2017)
	Is there version control in place?	Hashey & Stahl (2014)
Open Licensing	Is the open textbook publicly available and shareable?	Marczak (2013) Wiley University Services (2018) Windle et al. (2010)

Category	Criteria	Sources
	Does the content have a flexible license (to improve reusability)?	Moore & Butcher (2016) UNESCO & Commonwealth of Learning (2011) Wiley University Services (2018)
	If adapting an open textbook, how restrictive is/are the open license(s)?	Amiel (2013)
	If creating an open textbook, how restrictive is the assigned open license?	Amiel (2013)
	Does the open textbook use remix material accurately within the terms of the Creative Commons license(s) of the remix material?	Moore & Butcher (2016)
Technology	Is the open textbook hosted at a permanent URL?	Wiley University Services (2018)
	Are institutional hosting options available?	Zhadko & Ko (2020)
	Are all links functional?	Marczak (2013) National Center on Accessible Educational Materials (2021) Wiley University Services (2018)
	Does the open textbook have a consistent look and feel?	BCcampus (2018) Ives & Pringle (2013) Wiley University Services (2018)
	Is the colour scheme consistent?	Marczak (2013)
	Is the font of a readable size?	Marczak (2013)
	Is the open textbook easy to navigate and use?	BCcampus (2018) Hu et al. (2015) Jung et al. (2017) Oelfke et al. (2021)
	Does the open textbook have a user-friendly interface?	BCcampus (2018) Marczak (2013) Wiley University Services (2018)
	Is the open textbook mobile-responsive?	Benoit (2018) Choi & Carpenter (2017)

Category	Criteria	Sources
		Commonwealth of Learning (2022)
		Dennen & Bagdy (2019)
		Hu et al. (2015)
		Jung et al. (2017)
		UNESCO & Commonwealth of Learning (2011)
	Is the open textbook downloadable or available in offline formats?	Amiel (2013)
		Choi & Carpenter (2017)
		Dennen & Bagdy (2019)
		Lin (2019)
		Oelfke et al. (2021)
		Ozdemir & Hendricks (2017)
		Marczak (2013)
		Willems & Bossu (2012)
		Windle et al. (2010)
		Zhadko & Ko (2020)
	Can the open textbook be transferred between digital devices?	Dennen & Bagdy (2019)
		Marczak (2013)
		Ozdemir & Hendricks (2017)
		UNESCO & Commonwealth of Learning (2011)
		Zhadko & Ko (2020)
	Has accurate and appropriate metadata been included when making the open textbook available online?	Hashey & Stahl (2014)
		Windle et al. (2010)
	Is the open textbook print optimized?	Benoit (2018)
		Brandle et al. (2019)
		Dennen & Bagdy (2019)
		Oelfke et al. (2021)
	Can users highlight within the open textbook?	Benoit (2018)
		Brandle et al. (2019)
		Conole & Brown (2018)
		Marczak (2013)
	Can users take notes within the open textbook?	Benoit (2018)
		Brandle et al. (2019)
		Conole & Brown (2018)
		Marczak (2013)

Category	Criteria	Sources
	Can the open textbook be searched using advanced search functions?	Conole & Brown (2018) Marczak (2013)
	Can the user bookmark pages in the open textbook?	Conole & Brown (2018)
	Is the supporting IT environment tracking user analytics?	Marczak (2013)
Accessibility	Have automated accessibility checking tools been used in addition to reviewing for accessibility manually?	National Center on Accessible Educational Materials (2021)
	Have the authors consulted with accessibility experts at their institution?	Zhadko & Ko (2020)
	Do the headings follow accessibility standards?	National Center on Accessible Educational Materials (2021) UNESCO & Commonwealth of Learning (2011) Zhadko & Ko (2020)
	Do the links follow accessibility standards?	National Center on Accessible Educational Materials (2021)
	Do images have accurate alt text?	Hockings et al. (2012) National Center on Accessible Educational Materials (2021) UNESCO & Commonwealth of Learning (2011) Zhadko & Ko (2020)
	Do embedded videos and audio include captions or transcripts?	Hockings et al. (2012) National Center on Accessible Educational Materials (2021) UNESCO & Commonwealth of Learning (2011)
	Does the colour scheme in the open textbook follow accessibility standards?	National Center on Accessible Educational Materials (2021)
	Does the font follow accessibility standards?	National Center on Accessible Educational Materials (2021)

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	Are any remix components that are used accessible?	Zhadko & Ko (2020)
	Is the open textbook accessible overall?	BCcampus (2018)
		Commonwealth of Learning (2022)
		Dennen & Bagdy (2019)
		Hashey & Stahl (2014)
		Jung et al. (2017)
		Moon & Park (2021)
		UNESCO & Commonwealth of Learning (2011)
		Zhadko & Ko (2020)
Verification	Has the open textbook been tested technically and pedagogically?	Almendro & Silveira (2018)
	Has a testing protocol been followed?	Almendro & Silveira (2018)
	Has the open textbook been peer reviewed?	Almendro & Silveira (2018
		Wiley University Services (2018)
		Yuan & Recker (2019)
	Are users able to provide comments and feedback on the open textbook?	Almendro & Silveira (2018)
		Windle et al. (2010)