Supporting Literacy With Accessibility: Virtual School Course Designers' Planning for Students With Disabilities

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Abstract

As more K-12 students with disabilities enroll in online courses, virtual schools and programs are working to make courses accessible through stronger course design. When course designers approach the issue of accessibility, they must comply with legal requirements and mitigate the challenges many students with disabilities face for literacy and learning. These challenges include a lack of vocabulary support and complex text in online course materials. This study describes qualitative research that sought to uncover strategies course designers used to meet accessibility standards and promote literacies online for all students, especially students with disabilities. Three strategies emerged as findings: (1) composing clear articulations of learning objectives, (2) promoting personalized and contextualized learning, and (3) planning for visual and audio representation of concepts. While the course designers displayed emerging understandings of accessibility, they were less adept at addressing the interplay between literacies that promote access and accessibility features that promote literacies.

Keywords: K-12 online course design, collaborative online course design, instructional design for students with disabilities, course design literacies, accessibility in online courses

Online learning emerged rapidly as a method of K-12 instructional delivery (Gemin, Pape, Vashaw, & Watson, 2015; Picciano, Seaman, & Day, 2015). In 2016, the Evergreen Foundation report on K-12 online learning indicated that millions of students in the United States are taking online courses, and several hundred thousand are taking all their courses online. The National Education Policy Center reported that one in 10 students enrolled in a virtual school had a disability (Molnar et al., 2013). In fact, students with disabilities—as part of the at-risk population—are the fastest-growing segment of virtual school enrollments (Miron, 2016). While students with disabilities are guaranteed individualization per the Individuals with Disabilities Education Act

(IDEA, 2004), virtual schools—state or corporate sponsored—invest little in this population (Molnar et al., 2013). Potential negative outcomes for students with disabilities and other historically underserved students who enroll in virtual school courses include high attrition and low achievement (Deshler, Rice, & Greer, 2014; Freidoff, 2018).

While online learning in fully virtual schools has the potential to increase learning opportunities, such as access to different types of courses, credit recovery, and personalized learning, there is no guarantee that these benefits will occur automatically (Barbour, Archambault, & DiPietro, 2013). Instead, courses must be made *accessible* to students. *Accessibility* means that students with disabilities can enroll in online courses *and* use and learn from the content presented to them (Moore & Kearsley, 2011).

This study describes course designers' collective understandings about literacy and accessibility and how those understandings translated into strategies as they designed a fully online Algebra II course in a large virtual program. The research question was, What strategies do online course designers use to promote accessibility and literacies for all students, particularly students with disabilities? At the heart of this study is an argument that course designers must possess professional literacies around technological use and curriculum design that help them make courses accessible. In turn, when course designers can make content more accessible, the literacies of students are better supported (see Figure 1).

In this article, I present a theoretical framework that describes online course designers' roles in general design and accessibility as they relate to this study. Then, I expand on the general design and accessibility as they relate to complex and expanding notions of literacy (New London Group, 1996). After explaining the theoretical grounding for this study, I reveal my methodological choices for gathering, collecting, and analyzing data around my research question. I share the strategies uncovered during the research that represent course designers' collective thinking about making accessible courses that promote literacies. Finally, I discuss practical, research, and policy implications of these findings.
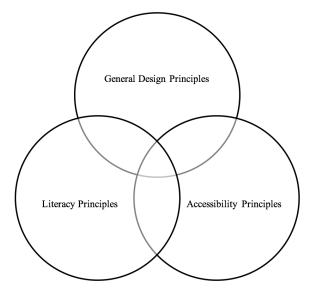

Figure 1. Integration of general design, accessibility, and literacy principles.

Online Course Designers' Roles as *Designers*

While some online teachers design their own courses (particularly at the university level), most K-12 online courses are collaborative efforts (Baran & Correia, 2014; Gayabak, Ottenbreit-Leftwich, & Ray, 2015). In a collective course design model, responsibilities for *planning*, *implementing*, and *evaluating* belong to different individuals. The new, increasingly common division of roles where course designers, technical design staff, and teachers are separate individuals who do at least part of their work independently of each other requires new ways of thinking about collaboration and coordination to support a wide range of users (Bullough, 1992; Danforth, 2015; Dewey, 2013).

Understanding the work that courses designers undertook in the current study requires additional theoretical background about design. Work in online course development is rooted in conceptions of general design. Five core orientations to design drive the field: (1) design is the mere creation of artifacts, (2) design is a reflexive practice, (3) design is a problem-solving activity, (4) design is a way of reasoning and making sense of things, and finally, (5) design is the creation of meaning (Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013). I expected that attending to complex issues like accessibility and literacy support would not be a simple exercise in creating artifacts; it would require engagement in problem solving, technical and moral reasoning, and meaning making simultaneously (Rogers, Graham, & Mayes, 2007).

Differences in course designers' capacity to engage in higher level design processes might be linked to experience. In one study, 16 designers (eight experts and eight novices) participated in a think-aloud activity for a fictional design task (Kim & Ryu, 2014). Researchers found that expert course designers focused heavily on problem *framing* while novices spent time problem *solving* instead. In addition, novices tended to think about how much future users would enjoy their fictional products at the affective level. Alternatively, the experts in the study were more concerned with individual attributes of the product's design without considering the potential users. The researchers characterized this difference as a tension between *artifact empathy* and *person empathy*. In my study, there were multiple types of diverse users that would eventually use the Algebra II course. Potential users included adults, such as online teachers, on-site mentors, and parents with a variety of skills for supporting children in online settings. In addition, I expected that there would be learners with a range of experiences and commitment to the class who would eventually enroll. I wondered how expectations for different types of users and users with different abilities would emerge during the course design process.

In another study, Rapanta and Cantoni (2013) conducted an analysis of online course designer discourse. These researchers were interested in the perceived relation to users as an element of designer empathy. In their findings, they noted that designers, particularly as they had more experience in the field, exhibited less interest in users' needs. They also found that when user-oriented discussion did take place, it was not grounded in knowledge or data regarding the learners for whom they were currently designing but in their own experiences with online courses. Considering these findings, Rapanta and Cantoni (2013) suggested designers add user-experience anticipation exercises to team meetings and spend more time constructing scenarios about how students and instructors might experience various designs. Rapanata and Cantoni also invited further research on this topic: "Although e-learning designers try to empathise with learners and tutors, the extent to which they can do so effectively is in doubt" (p. 775). Since this study focused on designers' strategies for accessibility, it was worth considering whether and how course designers developed and asserted empathy.

Online Course Designers' Role in Promoting Course Accessibility

Online course designers draw on three overlapping orientations to accessibility: (1) adding personalized learning elements (Drexler, 2018), (2) including concepts of Universal Design for Learning (Rose, 2000), and/or (3) adhering to the requirements of amendments to Section 508 of the Rehabilitation Act of 1973 (§ 508, 29 U.S.C. § 794(d)). Key features of accessibility that cut across these three orientations include the following:

- Organization of content around objectives, goals, aims, and/or themes
- Presentation of content in multiple formats
- Strategic, incremental content presentation
- User choices about when and how to engage with content
- Hypermedia support features for comprehension of text, image, and sound
- Information for users regarding upcoming content or points of difficulty
- User choices for products that demonstrate mastery
- Opportunities for collaboration with instructions and peers
- Assistive technologies

Because the roles in curriculum making are distributed between and among individuals, it is not always clear who is responsible for ensuring accessibility in online courses. In previous studies of course designers in K-12 settings, course designers reported that they felt their work was to design a template of curriculum materials for a general population of students, but that teachers, parents, and on-site mentors should individualize for students with special needs. This belief was expressed even when other personalization features were embedded in the course (Rice, Mellard, Pace, & Carter, 2016). Alternatively, research with online instructors has found that these teachers lean heavily—sometimes exclusively—on the course curriculum materials and resources provided to them by designers, and they modify these a little or not at all (Archambault & Crippen, 2009; Crouse, Rice, & Mellard, 2018). In these cases, teachers reported difficulties delivering individualized instruction to students with disabilities using those materials. They wished that courses had been designed for greater initial accessibility (Rice & Carter, 2015). As I planned this study, I considered that course designers may not have felt responsible to make the course accessible. However, I was hopeful because they had invited me to come and observe their work knowing my interest in accessibility.

For some scholars, ensuring high-quality online course design emerges from standardized practices (Cavanaugh, Barbour, & Clark, 2009; Dikkers, 2015). However, if course design is regarded as a socially situated set of literacy practices unique to specific context (and I argue that it is), then such standardization may not be desirable. During the study, I paid specific attention to strategies for course design and spaces for expressing views that revealed (mis)understandings about accessibility and learner variability in general. The intention was not to uncover a formula for course design, but instead to offer insight into the literacy processes as they guided accessibility that held promise for supporting student literacies.

Online Course Designers' Role in Promoting Literacy

For the purposes of this study, *literacy* was defined as the ability to gain information and express oneself (Keefe & Copeland, 2011). However, to do these things, learners must engage with and understand a variety of texts, including the linguistic, visual, symbolic, and gestural. With

this view, literacies are learnable by all students—even those with severe disabilities—and they transcend content and subject matter (Ruppar, Gaffney, & Dymond, 2015).

Previous research on online course development has found that courses often fail to provide even basic access to opportunities to develop literacies online. For example, Rice (2017) tested the text complexity of online learning instructional materials and found that much of the linguistic text was too difficult for the age ranges that the materials were marketed to, and the difficulty levels vacillated without warning to readers for no discernible reason. More recently, Rice and Deshler (2018) analyzed vocabulary difficulty and support from three large K-12 fully online providers and found that instructional materials asked students to learn more words than was recommended by vocabulary acquisition research and then provided little support for students to notice, practice, and learn the words.

Finally, Marteney and Bernadowski (2016) found that even when students have resources that would enhance their literacy, such as audio or visual support, they do not take full advantage of them. Thus, it is vital to provide resources that fall in line with accessibility guidelines as well as build the course so that users recognize the supports and see the benefits of using them. Therefore, courses must be designed *for* literacies as well as *with* literacies. Table 1 highlights several newer conceptions of literacies and ties them to online course designers' professional work.

Table 1

Key Ideas of Postmodern Literacies and Connections to Course Design

Idea	Definition	Course Design Connection
Literacy as social practice	Literacy is a sociocultural construct that conveys values, identities, ideologies, and social practices (Freire & Macedo, 1987; Gee, 2008; Luke, 2004; Street, 1995).	Course designers should work in groups with various levels of accountability, but individuals should bring design know-how to their work.
New literacies	Internet, information, and communication technologies create constantly changing contexts for meaning finding and meaning making (Coiro et al., 2008; Lankshear & Knobel, 2010, 2011; Leu et al., 2004).	Course designers should learn to use new technologies for courses as well as update lessons and activities.
Multimodalities	Meaning making is not just written language delivered via the page. Instead, communication is *always* comprised of multiple modes and can be conveyed in multiple ways (boyd, 2014; Jenkins, Ford, & Green, 2013; Jewett, 2009; Kress, 2010; Kress & Van Leeuwen, 2001).	Course designers should create courses that use more than the written word to convey content.

Table 1, cont.
Key Ideas of Postmodern Literacies and Connections to Course Design

Idea	Definition	Course Design Connection
Digital literacies	Digital hardware and software mediate social practices and identities. Relationships between practices and identities change as people engage with them. Further, knowledge lies not with individuals but in collective work supported by Internet-enabled connectivity (Downes, 2012; Jones & Hafner, 2012; Siemens, 2005).	Course designers' collective work is conducted over distances. In fact, their charge is to design courses that can be conveyed over distance.
Critical media literacy	Representation of social and cultural phenomena are held to critique. There is inequitable access to devices, infrastructure, media, and messages related to the production and distribution of knowledge (Baker, 2016; Garcia, Segler, & Share, 2013; Hammer & Kellner, 2009; Warschauer, 2004).	Course designers should consider who might use their courses, for what reasons, and what design features are necessary for students to succeed.

New literacies incorporate knowledge, skills, and dispositions for participating in work supported by, even reliant on, Internet and/or Web-based technologies (Coiro et al., 2008; Lankshear & Knobel, 2010, 2011; Leu et al., 2004). When literacies are taken into consideration, designers are better positioned to create spaces where knowledge can be constructed with accessible tools. Designing these tools requires the same high caliber of literacies that designers should be aiming to develop in learners through the course materials. In addition, course designers must learn to operate with information from multiple resources—some of which are people and some of which are not—and with whom they have varied types of relationships. For this study, I viewed online course design work as a set of complex, interrelated literacies, rather than discrete skills or as unreflective adherence to Section 508 standards. In taking this perspective, I established a better connection between the theoretical understandings and the methodological strategies I used to engage in this work.

Methods

In this study, I wanted to capture information about the process of online course design as it related to literacy and accessibility. I was not collecting facts and arranging them into a chain of causality. However, I was not aspiring to access individual's realities, either. Instead, my research took place at dialectic between the participants and the course design event (McConville, 1978). Acquiring a sufficient view of their course design process and the strategies as they emerged through dialogue required a substantial time investment. Primary information-gathering activities lasted six months. Afterward, another four months were spent asking clarifying questions, negotiating shared understandings, and engaging in analytic processes. This extensive time investment is germane to many forms of qualitative research (Marshall & Rossman, 2014).

Because these data gathering activities rely on subjectivities and careful looking and thinking, methodological decisions are the epicenter of the project, and detailed explanations are necessary for trustworthy research (Smagorinsky, 2008).

Participants

The team of course designers in this study was divided into two groups—one primarily responsible for working on the first half of the course and one primarily responsible for the second half. Each group consisted of a course design specialist and a course content specialist. Both groups were supervised by the same course development manager. One course content specialist was a college professor who had experience teaching math at the college level and teaching math methods to prospective math teachers. The other was an experienced math content writer with a background in education and mathematics. All team members had five or more years of experience designing courses.

Data Sources

The data sources in this study included recorded weekly meetings, instant message logs, course design documents, and course design resources provided by the virtual school. In addition to these major data sources, I collected email correspondence between myself and the participants.

Recorded weekly meetings. The first major source of data was the recorded Google Hangout meetings of the course design team. These meetings ranged from 15 minutes to over 100 minutes. Course design specialists met with course content specialists to report on their progress and discuss the content as it was integrated into the structure of the courses. The course development manager supported the team during these meetings and met with both groups as needed. During the meetings, I spoke with the team and answered their questions regarding resources for accessibility. Initially, I tried to keep a low profile and muted my microphone or cut my video, but the team members wanted to see and hear me. While I did participate in the meetings, my involvement was minimal.

Instant message logs. In addition to weekly meetings, there were three sets of logs generated within several Google Hangouts: one log for each group and a collective one for the team. In these messages, team members asked questions about design, reported difficulties, sought advice, and checked on deadlines. They also shared resources for instructional materials. I responded to messages and sent resources that related to a group's current task. During the study, almost 200 messages were exchanged.

Course design templates. Each group had a set of documents outlining the objectives of the courses and mapping the progression of content through the courses. These documents were usually the focus of the weekly meetings. All team members had access to each other's documents, and I did as well. I only viewed these design documents and did not add information to them.

Course design resources that emerged during the study. During the study, members of the design team shared resources with each other. These were in the form of links to websites as well as other documents. Many of these, though perhaps not all, were shared with me. Examples of the resources I accessed included OpenStax materials from Rice University. Another example was Wolfram Alpha, a computational engine available over the Internet. There were also numerous clips from Khan Academy and YouTube about various mathematical concepts.

Course design resources from the virtual school. The virtual school offered video and other resources in the form of articles and industry papers to course design specialists and course

content specialists. These materials were provided in training programs and were also available to team members as they wished to review them. The materials reflected an artifact-oriented design with some reflexivity—that is, identify an objective, design an activity that matches the objective, make sure that activities are engaging for students, and then evaluate outcomes (Johansson-Sköldberg, Woodilla, & Çetinkaya, 2013). The virtual school had a previous agreement to use an Algebra II course developed at another virtual school. Although they had been offering this course for several years, they desired to build their own to reduce delivery costs and because school-level leaders requested a new course as part of a new course marketing model. I viewed the materials from the course the school had been paying to use. No materials among those offered by the institution focused specifically on disability.

Data Analysis

Conventional content analysis techniques were used to analyze data the data. Content analysis involves gathering a corpus or body of information and then organizing that information to identify themes, concepts, or key ideas. The goal of these techniques is to prepare the researcher to make inferences about large amounts of data (Hsieh & Shannon, 2005). During the coding process, I avoided using preconceived categories (Cho & Lee, 2014). Instead, categories and names for categories came from the data (Hanington, 2015).

Analysis proceeded in several steps. The first was to aggregate all the data into a central location or database. The second step was to engage in repeated readings of the data (Marshall & Rossman, 2014). The third step was to identify the key ideas from the data related to the research question: What strategies do online course designers use to promote accessibility and literacies for all students, particularly students with disabilities? I designed an initial set of identified strategies and shared them with the director of my research for feedback. With the assistance of the director, I made several revisions. Finally, I searched for counterevidence in the data using negative case analysis (Williams, 2011, 2013). During this step, I took the themes and searched in the data for evidence that a theme was incomplete or did not represent the range of data. As necessary, I adjusted the language of the themes that represented the strategies.

Results

This study sought understandings about the strategies course designers used to promote accessibility and build literacies in an Algebra II course. Three key strategies were used by the team: (1) composing clear articulations of learning objectives, (2) promoting personalized and contextualized learning, and (3) planning for visual and audio representation of concepts. Each of these themes will be discussed in this section. Exemplar data is provided to illustrate these themes (Polkinghorne, 2005).

Composing Clear Articulations of Learning Objectives

The virtual school required courses to be grounded in learning objectives. The course design team wrote the learning objectives. While each group directed the design of one half of the course (the first or second half), both groups saw each other's objectives and reviewed one another's work. These objectives followed an incremental pattern that conformed to the traditional instructional design ideology in the materials provided by the virtual school.

The team strove to balance the incremental objectives and their own instincts to design courses with more thematic concerns in mind. For example, one course content specialist planned

an authentic situation for young people to learn mathematical functions. Although she was excited about the idea, she struggled with whether to continue to use the same scenario multiple times across different levels to illustrate new concepts or to design new situations that might fit different concepts better across the course. Her goal was to reduce the cognitive load of a student with disabilities who needed concrete examples and who might struggle to recall multiple concrete scenarios across a course.

As an additional layer for consideration during the course design process, the school adopted a nationally recognized evaluation framework built by an external evaluation company. The team strove to adhere to these guidelines in writing the objectives. Over the course of the design process, the objectives were written and rewritten many times until the team agreed that a clear and consistent articulation had emerged. The following is a conversation about the content specialist's work to understand the relationship between the evaluation standards and her own reasoning about objectives that serve students with disabilities:

> **Course content specialist**: There seems to be some confusion. I am getting different information from different people. Do we want the objectives to be written as guiding questions or statements?

> **Course design specialist**: We definitely need statements for [evaluation standards], but we also put them in the lessons as questions. We believe they are more useful to students as questions because they provide them with a means of self-assessing as they progress through the lessons.

> **Course content specialist**: I am open to whatever the group wants to do if we are consistent. In regards to [evaluation standards], questions are fine as long as the verbs are measurable. So, something like "Describe" and "How would you describe" would both work.

> **Course design specialist**: Questions are not fine in [the external evaluation standards] even if the verbs are measurable, based on our experience going through the review process. We have had to add the objective statements even though we have the statements posed as questions with measurable verbs. This has happened every time we did not have the objectives written as statements. So we have just moved toward including the statements as well as the questions.

> **Course content specialist**: We are using the standards as the unit objectives, and each is brought down to the applicable lesson; they include the measurable verb. We are also including only the part of the standard that the lesson covers; in some cases, there are multiple objectives or concepts covered in one standard, so we are sure to only use the part of the standard that the lesson addresses. I list these in the unit overview so [the evaluator] sees these at the beginning of every unit. The guiding questions are written in the lessons themselves to help guide the students and think about what they will learn in the lesson.

Here, the course content specialist opened space for discussion by saying, "I am getting different information from different people." She wanted to write questions for students as an engagement strategy and because she reasoned it was more straightforward. However, she had also received feedback in meetings that the objectives must be statements. This course content specialist asked for clarification and was told that she could not use questions as objectives because it would not score well on the external evaluation. In the end, the course content specialist yielded to her

supervisor's request for statement-style objectives but also asserted agency in saying that she still intended to add questions. At other points in the course design process, this course content specialist referred to concerns about whether the students could understand the purpose of the statement-style objectives and whether they would even read them. The questions were superior (in her reasoning) because they activated curiosity and gave learners something concrete to look for as they engaged. Before, during, and after the lesson, learners would be positioned to self-assess their comfort in answering the question. By contrast, the statement format would fail to evoke response; it would not invite an answer.

Overall, there was a struggle to combine the measurability and observability necessary for a positive external review with the language that the course designer thought students would comprehend. If students would not (or could not) read the objective and understand what that objective meant for their learning, that would constitute a substantial barrier to accessibility. It also follows that if a simple, concrete learning objective was the most desirable from an evaluation standpoint, a simple concrete task might be preferable to a more complex one. However, simpler tasks are less likely to elicit complex new literacies. Another consideration was that no discussion took place that accounted for users other than learners. There might be on-site mentors, including parents who would have to read the objectives. The needs or expectations of these other users did not emerge, such as which style of objective adult users might prefer or understand better.

Promoting Personalized and Contextual Learning

The team desired to include personalization elements to increase accessibility, but they had difficulty determining what students might need in terms of additional options. One course writer lamented, "You know, if I were just teaching the students, I could listen to them and figure out what they needed and then go from there, but instead I keep having to anticipate the needs of children I do not know." A need to anticipate where the learners would misconceive was also mentioned by a course content specialist who often said, "I'm just worried a student will see this and think [something incorrect]." To face these challenges of empathy, the team worked to conceptualize integrated activities for difficult content. Further, the team held ongoing discussions about whether activities with more choices would work, how they would be managed by parents or other on-site mentors, and how they might be assessed.

In the end, the team determined that they did not have the time or resources to provide learning that was truly personalized. Most of the course consisted of efficiently presented items and tasks that matched the recommended objective format. For example, one course content specialist believed that under the external evaluation rubric, point deductions occurred when website links were added that led the user out of the course because it interrupted the stream of content delivery. However, the team also agreed that some links were necessary for learners to access additional support or more interesting examples. During one meeting, the course design specialist indicated that she had read data from the virtual school indicating that students liked additional links and visited them when they were provided. To settle the issue, they asked the overall course design manager. The manager indicated that deductions from the rubric would only occur when the link led to adult content. After this clarification, the team focused on how to find specific clips from YouTube and view them without the advertisements on the side of the screen that might host adult content. With that resolved, the team added features that would allow for some elements of a personalized learning experience while maintaining fidelity to the established lesson-presentation structure for the virtual school.

As the team moved deeper into the design of the course, they began asking more questions about the learning contexts for learners that enrolled in the course. The course designer informed the course content specialist that many students actually took the courses in school buildings and would be supervised by computer lab attendants that were untrained in pedagogy. When one of the course content specialists heard this, he asked if he could be involved in writing professional development materials for those lab attendants. This request sparked what had the potential to be a new project where the course content specialist could infuse more of their professional knowledge and more equally distribute the responsibility for accessibility among adults involved in course design, implementation, and evaluation.

The interest in making professional development materials was an important way in which literacies folded into one another. As the team members used their professional literacies to build empathy and understand users better, they laid plans for using additional, expanded literacies as well. This occurred as they infused choice into the instructional materials so students had some ability take up work that interested them. Nevertheless, the team struggled to integrate this kind of learning because of constraints like the evaluation framework and the limited allotment of time to plan the course and difficulties conceptualizing the learners' needs.

Planning for Visual and Audio Presentation of Content

The team considered the accessibility of content such as visual and audio support as some of the most important instructional maneuvers they could make. For example, they knew that some students with disabilities need to use screen reading software. Screen readers also read descriptive alternative text (alt text) about pictures, charts, and graphs to users. Alt text is not generated automatically. Someone must write it. Writing alt text requires time and training. The team dedicated many hours to rearranging, rewriting, and re-rendering mathematical content to adhere to basic accessibility guidelines in terms of screen reader readiness, font suitability, and appropriate pagination. They also ran additional tests with the alt text script for many of the mathematical problems to ensure that what was heard through a screen reader was accurate.

One interesting challenge for including audio support emerged when a course content specialist was trying to make a quiz for problems that required graphing. Since graphs were an often-used type of image, they needed alt text. The team had great difficulty writing alt text that described the graphs without giving away the answer to the math problem requiring the graph. One course content specialist lamented that "math is such a visual subject ... when you look at a math image and put it into words, oftentimes, the answer is right there in the words." The literacy of math was seen as closely linked to the literacy of reading images and changing them into words, but for individuals with certain kinds of disabilities, that literacy skill cannot be the only skill that makes someone a mathematician.

Another complication occurred when the course design team was interfacing SoftChalk with screen reading technologies. Challenges arose when presenting complex equations. This was frustrating to the team because the documentation provided in SoftChalk's Volunteer Product Accessibility Tool (VPAT) indicated that the program was accessible and would support those types of equations. The team found that free screen readers could not read the alt text tags produced within the program. The overall course design manager indicated that substantial time was spent researching the problem and consulting with the company that created SoftChalk, but no resolution was reached. In the end, the course design specialist and consulting colleagues elected to trust the

company's VPAT and use SoftChalk even though there were screen reading programs that would not read the alt text.

In addition, the team was encouraged to use open educational resources (OERs) since they were free, and they believed time would be saved by speeding up the search for resources and then negotiating payment. However, many of these resources did not meet accessibility standards or were otherwise in need of modification. One course content specialist was especially keen to use the OER videos and other content, but she was worried about the captioning. The overall course design manager told her that some of the videos could be sent to other employees for captioning, but it was important to be judicious in what was selected for captioning because of limited resources. The course content specialist also had concerns about whether the OERs were engaging. She explained:

> I definitely wish we had access to some more visually appealing videos. Ones that show real-life application or are more engaging versus just someone with a board. If they didn't take so long, I would make them; but I am a very slow video creator.

Although they were technically expert course designers (based on years of experience), the team seemed to have remained interested in the affective benefits of designing instruction that learners would enjoy as well as learn from.

As they proceeded in their work, they noticed more ways to use accessibility to support literacies. For example, they initially regarded the audiovisual support as a shortcut for accessing difficult linguistic text. Over time, they realized that those supports were also texts that needed supplementary support. Moreover, the captions were not just for accessibility; they functioned as literacy support since a learner could experience an idea in multiple modalities. One course design team found some OERs that allowed interaction, where teachers could use a video and stop it periodically to ask questions, effectively becoming part of the literacy support. It was only in the context of this OER support that a teacher had been envisioned who could provide support in tandem with the visual and audio elements.

Discussion

The purpose of this study was to identify strategies a team of course designers used as they worked to design instructional materials for an Algebra II course while attending to issues of literacy and accessibility. However, the goal of this study was not to test actual accessibility or make judgments about the final courses. This study also makes no claim to generalizability in the traditional sense, but programs can undertake similar process to uncover strategies in preparation for testing their effectiveness.

Developing more accessible courses has the potential to promote participation, persistence, and positive outcomes for all learners, particularly students with disabilities. It is also critical for their continued literacy development in more basic comprehension skills as well as for sophisticated, complex literacies. Some of the implications of this work could resonate with practitioners in designing and delivering online courses. Other implications suggest additional research. Finally, there are implications for policies that govern course design evaluation and monitoring.

Implications for Course Design Practice

The course design team strove to make the course objective and outcome information clear to learners. However, the design team members focused on objective alignment to meet external review standards more than to promote literacy skills. Interestingly, these course designers used advanced literacy skills to advocate for changes in the courses that would promote accessibility, but the support for learners to develop literacies as a result of engaging with the objective was unintentional. Instead, objective writing was a task where work as a designer and work as a guardian of accessibility did not automatically overlap.

To guide other course designers in this thinking, it might be useful to promote conceptualizations of accessibility and literacy support more explicitly in designer preparation and professional development. Each element of the instructional materials design could contribute to literacy and enhance the accessibility of the course materials. In doing so, courses would be less likely to emerge from the design process with too many vocabulary words to learn and too little support for learning them (Rice & Deshler, 2018). In this orientation, there could be more planning for learner engagement. While there were efforts to deal with text complexity, the design team did not place much emphasis on either academic or content vocabulary. This element of literacy support needs to make it into the conversation as courses are designed. Further, there could be more conversation about what parts of the course should be targeted to the young users and which should be aimed at the adults who support them (e.g., teachers and on-site mentors).

In addition, the team considered how they might add elements of personalization to the courses. Much of this personalization focused on providing additional materials for learners to use. Now, the question is whether learners will use these resources. Given Marteney and Bernadowski's (2016) findings that students with disabilities are the least likely to use provided resources, course designers should consider ways to draw attention to the embedded tools and resources that they worked so hard to build and find. Further, deciding when and how to use these resources presents an opportunity to engage with more complex literacies.

Also, given that text complexity is a major barrier for many students, course designers might consider options they have for offering instructional text at different levels of complexity for different readers or embedding user-friendly support for both personalization and literacy development (Rice, 2017). Where using technology to build leveled texts is impractical, courses might guide students in searching out texts to add elements while developing awareness about how to choose texts that are comprehensible and how to evaluate their quality and utility (Coiro, Knobel, Lankshear, & Leu, 2008). As such instruction conflicts with external evaluation standards, a small canon of preselected choices might be a place to start developing and supporting general and Internet reading skills.

Finally, the course designers assumed that adding visual and audio support would automatically increase the comprehensibility of the materials. They also thought these materials would support engagement. One designer specifically said that her goal was to find "appealing" videos that also taught the concept. In adding this supplemental support, along with the more Section 508–compliant captions and alt text, course designers attended to some aspects of accessibility. They also began to realize that audio and visual elements were also texts that they could not assume would automatically be accessible just because they were not traditional linguistic ones. However, increased accessibility might also come from conceptualizing audio and visual supports as new literacy texts where they could embed more sophisticated opportunities for

engagement with content (boyd, 2014; Jenkins, Ford, & Green, 2013; Jewett, 2009; Kress, 2010; Kress & Van Leeuwen, 2001). In so doing, designers might make the materials more "appealing" as catalysts for engagement as well as more supportive of the other aspects of UDL (Rose, 2000).

Implications for Future Research

Future research projects might use similar methods to determine what strategies course designers are using and test them in the epistemological paradigm. In addition, studies that describe or evaluate professional development for course designers that merges accessibility with concepts of literacy are needed. Besides studying course designers, researchers might study the outcomes of courses designed with greater attention to vocabulary support, text complexity, personalization with various materials, and more sophisticated uses of audio and visual support. These outcomes might certainly be about satisfaction and perceptions of learning, but they could also focus on persistence through a course, achievement, and literacy growth through a variety of literacy frameworks. More research is also needed that examines technological literacies as they change, and new tools become available for course design and the ways in which course designers take up these literacies and then incorporate into the online courses they design for young learners and those who mentor and supervise them.

Other researchers with content or disciplinary foci could study course designers' work in accessibility as literacy and literacy as accessibility for subject matter specialties besides Algebra II. In this study, course designers had specific beliefs about mathematics as a visual language, and these beliefs appeared in their course design practices. Researchers could identify content knowledge or disciplinary beliefs that might pose challenges or bring clarity to designing for accessibility and literacy support in course design.

Suggestions for Policy Development

This study identified an issue around what constitutes due diligence on the part of course designers and virtual schools for accessibility. In this study, course designers questioned the accuracy of the VPAT table, but trusted it even when the program was clearly not compatible with free screen readers students with disabilities are likely to use. Section 508 was not intended to apply to every entity—only those owned by the government or funded by the government, such as schools. Moreover, students with disabilities qualify for a Free and Appropriate Education (FAPE), and accessibility is key to providing it (IDEA, 2004). Currently, software for basic accessibility features like screen-reader-enabled content appeared to fall short on user friendliness and even functionality when faced with complicated graphic and complex numerical equations. Greater vigilance is necessary to ensure reasonable Section 508 compliance in courses.

Online course quality requirements should also reflect the intent of IDEA to provide FAPE. While evaluation frameworks from private companies might take Section 508 guidelines into account, their rubrics may not strongly address IDEA. This makes sense because online course evaluation frameworks were initially created for university students, who are not protected by IDEA, and research about effective integration of IDEA into K-12 online learning is only emerging (Rice & Dykman, 2018). Therefore, IDEA compliance at the course level may fall more appropriately into the purview of virtual schools (and/or traditional schools, depending on state law) because in the end, schools have the mandate to serve the children—not a private course evaluation company. Unfortunately, that means that for course designs in K-12 virtual schools, it may not be appropriate for the external evaluation rubrics to be the final arbiter of what constitutes adequate course design for students with disabilities.

The need to adhere to external evaluation guidelines superseded the greater goal of imagined young people—with a variety of learning needs and strengths—logging on to the course and engaging with instructional materials alongside mentors who also have diverse strengths and needs. Virtual schools should identify policies that would support the demands of external evaluation (as artifact empathy) while not losing sight of user empathy (Kim & Ru, 2014). Finally, in the frame of new and emerging literacies, learners need more experiences finding, evaluating, and integrating their own materials from the Internet. This is a messy process that requires mentorship and guidance. It will not be easy to follow highly structured, linear templates for courses and support complex literacies. That said, online courses will not achieve their potential as instruments of equity until polices guarantee that users can access courses promoting the full range of literacies.

Conclusion

This study brought notions of accessibility and literacies into conversation with each other during the course design process. The findings of this study highlighted the need to imagine different types of users with a range of skills and then plan for content that is accessible because it complies with federal directives but also because it considers ways to support literacy development through engaging and educative materials.

While this study is not generalizable, it may resonate with other K-12 online programs that employ course designers, particularly when those designers work in teams. Administrators in these programs might ask themselves questions such as the following: What literacies do we desire in our designers? What materials are we providing to course designers to support accessibility? What do these materials imply about our orientation toward accessibility and their connections to literacies? How can we make the courses we design reflect research about accessibility from technical and literacy perspectives? How can we embed literacy support in courses to ensure FAPE? With the likelihood that online learning will continue to grow and that responsibilities for design work will continue to fragment, supporting literacies through stronger course design is a promising pathway to courses that are both more accessible and more effective at promoting literacy for all learners, if not all users.

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