Success for All: Maximizing Digital Accessibility in Special Education Teacher Preparation Courses through Universal Design for Learning

AUTHORS
Jeongae Kang
Kimberly A. Patton
Stephanie J. Gardiner-Walsh

Journal of Special Education Preparation
4(3), 4-15
© 2024 Kang, Patton, Gardier-Walsh
Licensed with CC-BY-NC-ND 4.0 License
DOI: https://doi.org/10.33043/4a6kfo46

ABSTRACT
Digital accessibility has become one of the most critical components for post-secondary student success because accessibility is the first step to learning for the diverse college student population. However, emerging studies show that teacher candidates experience challenges in program completion due to inaccessible course materials or course implementation. Furthermore, teacher educators address the need for more knowledge and skills for designing digitally accessible courses. Despite the demands, few guidelines exist for teacher educators to improve classroom digital accessibility. This article suggests multiple avenues of action for teacher educators to enhance accessibility through the lens of universal design for learning so that all teacher candidates with and without disabilities can succeed. Embedded vignettes illustrate an experience of a practicing teacher educator faced with modifying content with increased demands beyond their own training in special education.

KEYWORDS
Digital accessibility, course materials, course delivery, special education teacher educators, Universal Design for Learning (UDL)

Cindy is a teacher educator for a special education teacher preparation program at a large, 4-year public institution. She has taught undergraduate assessment courses for multiple years and feels confident in preparing teacher candidates. Each semester, Cindy receives accommodation letters for some students who require specific course accommodations from the University's Disability Center. In the past, examples of the primary accommodations included providing a note taker (established by university) or extended time on exams. She has been able to easily provide these accommodations for her students without requiring additional support or making any significant changes to how she prepares her course.

Before starting the fall semester, Cindy received course accommodation requests for multiple students, including Hanna and James, in her face-to-face assessment class. In Hanna's email to Cindy, she disclosed that she is Deaf but uses cochlear implants. The accommodations she is eligible to receive include a copy of any displayed materials (e.g., handouts, assignment descriptions) and PowerPoint (PPT) slides, closed captioned videos, and in-class sign language interpreters.

James disclosed that he is blind, and he is eligible to use a laptop/tablet/phone in class for notes and class assignments. He also may require course materials to be converted into Braille or tactile graphics. All her course materials will need to be converted into Braille or an accessible electronic version. This should be done by university disability services, though little direction was provided. Cindy was concerned that she would have to completely revamp her class and course materials as she uses digital materials and websites. Thinking about how to implement the accommodations her students need to access her class made her feel overwhelmed.

The US Department of Education's Office for Civil Rights (2013) defines the requirements for accessibility as "the person with a disability must be able to obtain the information as fully, equally and independently as a person without a disability". The enactment of federal civil rights laws (e.g., Americans with Disabilities Act [ADA, 1990], Section 504 of the Rehabilitation Act of 1973) guarantees anyone, regardless

of their disability status, to have accessibility to facilities, social activities, employment, or learning. In education, access to information is the first step for learning, so guaranteeing accessibility in the class materials plays a critical role in making classrooms more inclusive and equitable. Digital accessibility means providing electronic course materials in an accessible manner to students with and without disabilities for their full learning engagement in the classroom (Bhardwaj & Kumar, 2017; Khalid & Pedersen, 2016). The "Dear Colleague" joint letter highlights and reconfirms the requirement of accessible technology used in higher education classrooms for anyone regardless of their disability (U.S. Department of Justice, 2010). Despite these legal documents, few changes have occurred (Putnam et al., 2016).

DIGITAL ACCESSIBILITY IN HIGHER EDUCATION

Since the Higher Education Opportunity Act (2008) emphasized accessible post-secondary education, college enrollment has increased in diverse student demographics. The National Center for Education Statistics (NCES, 2018) report showed that about 18 percent of undergraduates enrolled in education programs during the in 2015 - 2016 academic year self-reported as having one or more disabilities. These disabilities included not only visible disabilities (e.g., physical disabilities, orthopedic or mobility impairments), sensory disabilities (e.g., blindness or visual impairments, deafness and hearing impairments) but also invisible disabilities (e.g., mental, emotional, or psychiatric conditions). Many students with these diagnoses receive accommodations for physical and digital learning needs through university access and accommodation centers.

Regardless of course formats, digital accessibility becomes more critical in higher education courses because of the required use of digital tools, open educational resources, and online learning materials (Keane et al, 2023; Kennedy et al., 2008). Students in higher education use technology to access and navigate course materials (e.g., learning management systems (LMS, EdPuzzle, Teams), participate (e.g., Zoom, Teams), collaborate (e.g., video conference, cloud space, shared drives), conduct field-specific training (e.g., specialized software and hardware), and demonstrate learning (e.g., publishing, word processing, assessments). Although past research indicates all students have a learning period with digitial navigation of course materials (Li et al., 2015; Margaryan et al., 2011), additional barriers may exist for students with disabilities.

Past studies show students with disabilities face an inaccessibility in digital spaces because instructors are ill-equipped to plan for and assess (Kent, 2015; Patel et al, 2020). Additionally, instructional designers and digital tool creators also lack training on accessibility (Kearney-Volpe et al., 2019). These barriers are just some of the reasons that teacher candidates with disabilities do not complete programs at the same rate as their non-disabled peers (Cassidy & Draves, 2017). Even within special education, teacher educators often lack the knowledge and skills for designing for accessibility (Bong & Chen, 2021). This complex issue of inaccessibility illustrates inherent ableism, or explicit/implicit denial of services to disabled people, which negatively affects teacher candidates (Dolmage, 2017; Powell, 2012).

High-leverage practices (HLPs) in special education provide a list of effective practices to guide special education teacher candidates to use effective strategies in their classroom. HLP #19 highlights using assistive technologies and instructional technologies in promoting student engagements (McLeskey et al., 2017). Teacher competency in many forms of accessible technology is critical because pre- and in-service teachers are expected to implement inclusive practices in their classrooms (e.g., making accessible materials to students with disabilities, enhancing independent living) and increases inclusivity (Council for Exceptional Children [CEC], n.d., a). Special education teacher educators (i.e., faculty) serve as role models for teacher candidates to create accessible digital spaces and use accessible digital tools to provide opportunities for teacher candidates to exercise those same skills (CEC, n.d., b). In other words, teacher educators need to prepare teacher candidates to be fluent in implementing and evaluating accessible technology. To do so, teacher educators must be equipped with up-to-date knowledge of course material accessibilities (Fichten et al., 2009). In addition, they need to ensure that course planning and implementation are based on multiple aspects, such as individual student needs and contextual factors (Shaheen, 2022). However, most research on digital accessibility has been focused on K-12 teachers' roles for improving accessibility for students with disabilities with less attention being paid to another important player in making this possible; teacher educators (Rock et al., 2016). Furthermore, few practical guidelines are available for teacher educators to improve the accessibility of instructional materials. The goal of this article is to reduce the knowledge gap by sharing guidelines for teacher educators to use in enhancing digital accessibility through the Universal Design for Learning (UDL) framework.

Applying Digital Accessibility through UDL Framework

Universal Design for Learning is a learning design framework that intends to improve accessibility for all students by identifying potential barriers inter-

TABLE 1: Applying Universal Design for Learning to Digital Accessibility

	Universal Design for Learning (CAST, n.d.)	**Digital Accessibility through UDL lens**
Multiple Means of Representation	Offer ways of customizing the display of information Offer alternatives for auditory information Offer alternatives for visual information	Transform non-readable PDF files to readable. Add alternative text for images. Format documents for accessibility. Make video learning materials accessible.
Multiple Means of Engagement	Optimize individual choice and autonomy Optimize relevance, value, and authenticity Minimize threats and distractions	Provide flexible teaching environments that students can exercise their executive functions (EFs). Activate student background knowledge about how to use digital tools before class starts. Provide explicit directions for class activities, including group works.
Multiple Means of Action and Expression	Vary the methods for response and navigation Optimize access to tools and assistive technologies (ATs)	Provide options of product formats, considering digital accessibility. Provide students support in developing products.

rupting student access to learning and improving access by using multiple means of representation (i.e. presenting content different ways), engagement (i.e. increasing interaction with content), and action and expression (i.e. providing varied ways to demonstrate learning) (CAST, 2018; Rose & Meyer, 2002; Terrazas-Arellanes, 2018). The Individuals with Disabilities Education Act (2004) includes UDL with expectations that special educators create accessible learning environments and materials for students with disabilities. As authors, we have chosen to use UDL as a framework for inclusiveity because UDL has been used to help educators identify potential barriers to mitigate the demands and to better meet the needs of diverse learners in the classroom (e.g., Thomas et al., 2015). Because its key message is to decreases barriers and increases access, integrating digital accessibility from a UDL lens to digital learning environments, materials, and activities in coursework is appropriate to guarantee students' accessibility (Powell, 2012).

In addition, the development of UDL-infused digital accessibility guidelines for teacher educators is timely because teacher educators are the ones who model how to implement digital accessibility for everyone's success. The synthesis of UDL and digital accessibility supports 21st century learning in the classroom and makes our classrooms more inclusive, accessible, and equitable. Table 1 shows how key access aspects of UDL could be applied to digital accessibility with brief tips on what teacher educators can do to increase accessibility. This section explores each principle of UDL through the application of a vignette with specific examples demonstrating the identification of potential barriers and improving accessibility.

Guideline 1: Consider Multiple Means of Representation

During the summer, Cindy was able to attend a digital accessibility professional development (PD) from her university's summer institute, and she remembers from the PD how important digital accessibility is for everyone's success in learning. However, she has not had a chance to apply the skills yet. Cindy is not sure where to start to ensure that her course materials, assignments, and activities are digitally accessible and will meet the needs of all her students including Hanna and James. She also thought about other students who might not disclose their difficulties or have other needs in accessing classes. Cindy questioned if she could use UDL to incorporate accessible digital materials and activities. She reviewed her university's digital accessibility resources on their website, but couldn't find guidelines or a checklist to help her apply how to incorporate digital accessibility tools. Cindy met with her university's digital accessibility specialist to receive additional support on how to create accessible documents and how to structure course materials for all students to engage with the content effectively. During the meeting, the specialist went over potential barriers her students might face while using her current course materials and how to improve course materials for accessibility.

Cindy has taught her current assessment course multiple times. Although she has continuously updated the course materials, she has used the same reading materials, including specific book chapters, for several years, because they are seminal pieces in the field. She plans

to use them again this semester; however, the PDF files are low resolution because she photocopied the book chapters multiple times over several years. She knows that James requires readings that are digitally accessible so that his screen reader can read the text for him. However, she doubts that those book chapters would be accessible. Cindy also uses PPT slides for the majority of her class presentations with many images because she intends to provide content in multiple ways as a part of UDL; however, Cidny relaizes using those images without planning for visual access creates a barrier for James She feels she needs an additional action to improve accessibility.

As Cindy thought about the additional materials she uses in her class, she realizes that some of the videos she has used in the past do not have closed captions available. She knows that Hanna requires closed captions for all video and audio content but is unsure of what she needs to do to update the videos she uses to include closed captions. She also wants to make sure she can provide closed captions during her presentations and lectures but is not sure what she needs to do to set that up. Additionally, she recognized that some of her videos rely on the visuals to show students how to do certain tasks. For example, in creating a video to teach students how to use Excel to graph data, Cindy's directions in the videos included things such as "Watch how I set up the data in Excel. Please make sure you use similar procedures for when you put your data in Excel." These types of directions in the video, will make it a challenge for James to understand how to engage in the task in the same way as his peers.

Representing information in multiple ways (i.e., how information is presented, pedagogical approaches, and materials) increases the pathways in which the brain connects and retains information (Hinton, 2007). However, as brain research shows that multiple means increase learning, multiple ways to represent materials increases the likelihood of inaccessibility. We recommend teacher educators to (a) identify potential barriers and (b) improve access accordingly.

FIGURE 1: Screenshot of Accessibility Audit

Identify Potential Barriers in Representing Information

Every student perceives and processes information differently; in other words, using only one format in providing course information could be a potential barrier. For example, texts and lectures with complex language demands contain inherent barriers for deaf/hard of hearing learners, multilingual learners, and learners with langauge disabilities. Teacher educators commonly use visual realm (e.g., graphic organizers, tables, pictures) to deliver content in multiple ways; however, these common strategies without adequate descriptors are infrequently accessible or adapted for learners with visual impairments. Those students using screen reader AT have difficulty accessing the information listed on the table or image because of its formatting issues. To identify those barriers, teacher educators could complete accessibility audits or use accessibility check features in software programs.

Complete Accessibility Audits. An accessibility audit is a thorough, professional evaluation of the degree to which a website meets the needs of all users regardless of disability status. The existing accessibility audit complies with the ADA requirements through the Web Accessibility Initiative Guideline (WCAG) technical standards. Accessibility audits examine web pages, media, and content based on the WCAG standards. Audits identify the potential accessibility barriers on course websites and online materials, which can help instructors know where to start to improve digital accessibility before a barrier is created, while also providing evidence of an instructor's attempts to improve course design. Teacher educators can use accessibility audits in reviewing course LMS or open access materials. The accessibility audit tools available online show inaccessible features of the online web pages and how to improve accessability (see Figure 1 for an example). World Wide Web Consortium (W3C), an international consortium developing web protocols and guidelines more accessible, lists existing accessibility evaluation tools and guidelines on

how to select the tools.

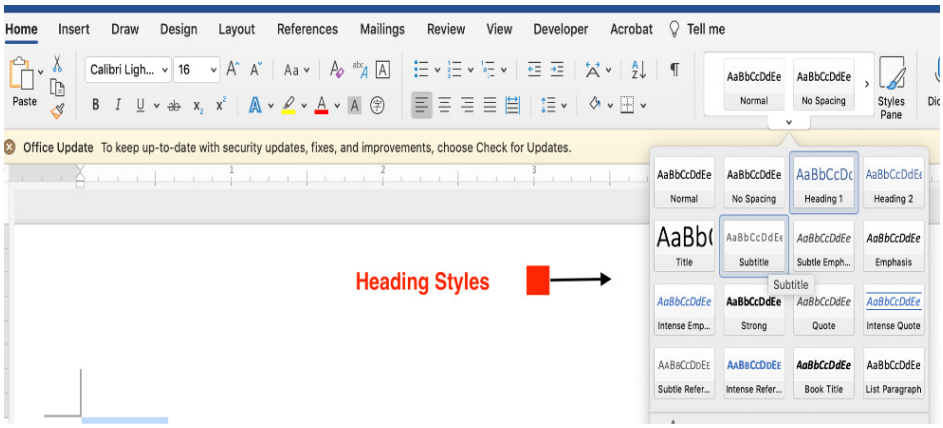
Use the Accessibility Check Features in Software Program. Use the built-in accessibility features of software programs to evaluate the potential barriers to the learning materials they are using. For example, Microsoft products include general accessibility checkers, as do Adobe, Google, and Apple. These general accessibility checkers ensure most users will have access to materials. Instructors who find accessibility "violations" can use promts to change instructional design or seek supports to modify design. By meeting the basic accessibility checks, instructors establish a norm of UDL which benefits users who have access needs, as well as those who benefit biproximity of the inherent organziation of accessible design.

Improve Access for Representing Information

After identifying potential barriers in presenting the course materials through accessibility audits or software built-in accessibility check features, instructors need to resolve barriers to digital accessibility in course materials. Remember, from a UDL standpoint, accessible documents are not only beneficial for those that are using AT, but for everyone using accessing digital platforms. By increasing the accessibility of the document, navigation, searches, and other interactions with documents become more efficient.

Transform Non-readable PDF files to Readable. There are many reasons why course materials are not accessible. Like Cindy, teacher educators frequently use seminal pieces published long ago. Those reading materials are often scanned as an image, not in a text format, and then documents cannot be read by AT devices or screen readers. In other words, this would not allow some students to access the content. The first step to resolve this issue is to make PDF files readable by using Optical Character Recognition (OCR). Teacher educators may consider using the auto tag function to tag headings for navigation, also.

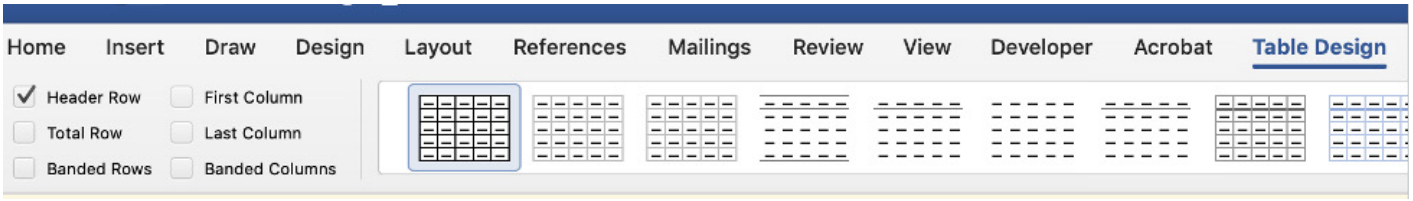
FIGURE 2: Selecting Heading Styles in Word



Create Accessible Visual Print Images. W3C provides guidelines on color contrast and Alt text to create accessible visual images. Visual information should also be accessed for color contrast. Alt text provides descriptions of images so that students who use AT devices, like screen readers, may access audio or visual descriptions of the visual. While automatically generated descriptions exist, teacher educators must ensure accuracy. Specifically, alt text should provide cognitive connections to the content for learning, as well as adjustments based on the purpose of the visual (e.g., to provide content, decorative). For example, Cindy's PPT includes a decorative image of a question mark on a slide asking students if they have any questions. This visual can be marked as decorative for the alt text because it does not provide any additional meaning for a learner who will use a screen reader to access the PPT slides. However, on another slide, Cindy provides an image of three types of distributions, including a normal bell curve and both a positively and negatively skewed bell curve to highlight the differences in data distributions depending on the data students are collecting. For this slide, Cindy needs to include specific alt text to explain what the image shows to provide contextual meaning of the image. For example, she may include the following as an alt text: "Three bell curves representing different distributions: a) A negatively skewed distribution with a longer tail on the left, b) A normal distribution with a symmetrical shape, and c) A positively skewed distribution with a longer tail on the right." This alt text allows James and other students who may use screen readers to have the same access to the image content on the page in a concise manner.

Format Documents for Accessibility. To improve access, course instructors must consider using heading styles rather than adjusting font format solely. Headings (see Figure 2) are intended to organize the information, assist learners to navigate the document easily, and decrease cognitive load of students. These heading styles structure documents by making headings stand out from the body text. To format documents with headings in Word, teacher educators need to select the text and the heading style from the Style Box located on the Home tab in the ribbon (see Figure 2). Even if the document is converted into PDF, the heading styles will be retained. Likewise, embedded hyperlinks can help users navigate to referenced materials within a document and can

FIGURE 3: Formatting Table Properties



also be used to engage learners with further resources (such as this document provides).

In the same way, building accessible tables establishes the reading order and purpose of visually organized information. Figure 3 illustrates the design of tables using the MS Word built-in features. These styles may not adhere to the formatting of your professional writing norms (e.g., APA, Chicago, MLA).

In formatting tables, there are several considerations that course instructors need to keep in mind. First, the table formatting is enabled only when the table is added in text format. If the table is added to the document as an image (e.g., screenshot), teacher educators need to add the Alt text. Second, simple table structure is more accessible. If the table has any merged cells, it is hard for learners to navigate the information.

Make Video Learning Materials Accessible. Quality of captioning and video descriptions affect video accessibility. Captioning (closed) provides access to auditory information to deaf and hard of hearing users, deaf-blind users, multilingual users, and users accessing video without sound and have specific needs. Open captions (captions printed on the video-- like on TikTok, instead of in the 'background interface') may not be accessible to deaf-blind users. Described and captioned media provides a full description on captioning, description, and subtitling videos for best access. Teacher educators must not assume that videos created by independent creators (e.g., Youtubers, influencers, other faculty) are accessible, even when settings indicate that the accessibility features are present. When creating and incorporating closed captions to course materials, teacher eudcators must consider following four requirments of the quality captioning rules created by Federal Communications Commission. Specially, teacher educators ensure if captions are accurate, appear at the same time as the corresponding spoken words, cover the whole program, and does not cover up any important information on the screen.

For learners with visual impairments, it is important that the videos provide a clear description of what is happening in the video. If videos rely only on the visuals to portray information to students, then students who are listening to the video without being able to access the visual components will not be able to access the content in the same ways as their peers. In instructional videos, reference onscreen visuals descriptively, rather than generally (i.e., "You can see this on the screen"). WAGC provides guidelines on increasing accessibility for visual information without creating separate files for modifications.

Once Cindy identified various book chapters and articles that may not be accessible, she was able to work with the disability center to follow the steps to ensure that any PDF documents she was using were updated to OCR versions to allow for screen readers to read the documents. Additionally, she was able to check the accessibility in her PPT slides and update any images with text that explicitly described the image to make it accessible. Cindy now adds in descriptive alt text for all images in new PPT slides she creates to ensure that her PPT slides are accessible to all of her students now and in the future.

In preparing for course materials, including PPTs and online worksheets, she made sure she used correct headings and table properties and PDF tags in logical order for PDF files. Wherever she plans to use open access materials as class activities, she ensured they are accessible before sharing them with students. Unfortunately, when she realized one of her class activity sheets from an open access learning module was not accessible to some students, Cindy made additional documents so that all students could still access the information. At the same time, Cindy reviewed her existing videos and updated videos with closed captioning and explicit directions as necessary.

Cindy also worked with the disability center to learn how to add closed captioning to learning materials she planned to use in her class. The disability center was able to assist her with creating closed captioning to the videos that she was using. While working with the center, Cindy added auto-generated closed captioning in YouTube to ensure her videos had correct closed captions. Additionally, Cindy set up her PPT presentations to automatically include subtitles and closed captioning whenever she starts to present. To ensure that her video contents were clear to all learners, Cindy recreated videos that relied on the visual component to add in a clear description of what she was doing when providing directions to the class rather than telling them to watch what she was doing.

Guideline 2. Consider Multiple Means of Engagement

Cindy worked hard to adjust her plans to best support her students and meet their accommodation needs. However, even with her best-laid plans, she still observed some barriers that interrupted her students from engaging in class in the way she planned. For example, Cindy presented directions for group activities orally, and Hanna mentioned that she sometimes had a hard time following what to do for group activities because she often got lost. Cindy also noticed that other students would often ask questions for clarification on the group activities. Cindy realized that she had to make some changes in order for her students to engage fully in her class.

Another barrier that Cindy noted was when she shared links with the class, she often included the link as-is with text that was difficult for a screen reader to capture in a meaningful way because the screen reader read the entire web address aloud. She also realized that the hyperlinks included in her slides and materials were not always easily accessible because they were not clearly labeled as hyperlinks. Sometimes she linked pictures in her slideshows, but it was not clear the picture was a hyperlink so students could not find the link easily.

Identify Potential Barriers in Engagement

Diverse level of executive functioning (EF) could be barriers to student engagement in learning. In particular, EF plays critical roles in many areas of student learning processes, including working memory and short- and long-term attention (Cartwright, 2012; Diamond, 2013; Flores et al., 2014). Given that EF and cognitive load closely interplay, it is not surprising that students with weak EF might not effectively engage in learning (Kennedy & Romig, 2021; Sweller, 2020). Processing new information and managing tasks could be overwhelming because they happen to overuse their working memory and attention to new information.

Indeed, students must have the shared background knowledge to process new information and maintain attention to engage in the course activities. In other words, unfamiliar content knowledge could be a barrier for students in the classroom to engage in class discussions and activities (Diamond, 2013; Sweller, 2020). When especially students do not know how to use digital tools, students cannot participate in course activites as expected. Furthermore, the issues combined with digital representation could distract or threaten student engagement. For example, some students might need help accessing collaboration platforms during activities because they cannot find the links. Therefore, course instructors must consider how to address both those potential barriers and potential representation barriers.

Improve Access for Engagement

UDL highlights the diverse learners' affective aspects (e.g., motivation to learn, engagement) to improve student learning (CAST, n.d.). To provide engagement opportunities for students, Zhang and colleagues (2022) indicate the need for a comprehensive approach to improving individualized learning with technology for all learners, including student attributes (e.g., interest, motivation, self-regulation) and instructional practices (e.g., facilitating goal setting). Improving engaging opportunities aids learners in exchanging information with others. Based on the potential barriers listed above, teacher educators must consider planning courses for enhancing student engagement in different ways.

Activate Student Background Knowledge on Digital Tools before Class. Teacher educators need to check accessibility statements (e.g., Flipgrid, Padlet, EdPuzzle) in advance and provide the related information and activities for students to enhance their background knowledge of how to use the digital tools. Providing explicit directions of how to use the digital tools could minimize accessibility issues. Low-stake assessments (i.e., checklists, Likert scales, engagement activities) surveying ability to use the digital tools before the class not only identify barriers created by different background experiences but also have students prepare by improving student background knowledge on the tool used. Furthermore, giving students the opportunities to practice how to use digital tools to retrieve the required course materials and provide feedback to the instructor also reduces stress for all.

Provide Flexible Support in Digital Learning. Teacher educators need to consider providing digital tools that use and develop EF skills. For example, a weekly checklist on the course website helps students monitor their progress and exercise self-regulation. Graphic organizers used in class enhance organization skills, working memory, cognitive flexibility, and planning.

Provide Explicit Directions for In-class Activities. Providing clear guidelines on in-class activities enhances student engagement. The directions include which materials to explore, what to do, and how to do it. Directions need to be given in multiple formats (e.g., verbal, written, images) so that all students can access the directions without confusion. Furthermore, documents for in-class activities need to state clear learning goals, directions for student activities, materials needed, and where and when they need to submit the work. For group work, more specific directions on collaboration expectations would help students to understand how they should work together during group activities and assignments. Redundancy and scaffolded supports do not weaken the content or expectations, but provides tools to reduce anxiety, improve organization, and models expecta-

tions for the future classroom teacher.

Cindy realized that an easy fix for Hanna included providing written instructions and a checklist to the class for group activities, which she provided online to be accessed by everyone and a screen-reader could be used for James as well. While this helped Hanna and James participate more fully, Cindy noted that it was beneficial for all her students as they did not need to clarify directions and were able to spend more time working and talking with their groups.

Cindy also updated the full web address links and changed them to embedded links with a title to describe the link instead of the web addresss (e.g., changing the web address https://www.google.com/slides/about/ to a link such as Link: Google Slides. This made it easier for her students to find links they needed to access and allowed for screen readers to easily read the content of the link rather than the entire web address.

Guideline 3. Consider Multiple Means of Action and Expression

One of the major assignments in Cindy's assessment class includes having the students write up portions of an Individualized Education Program (IEP), and she traditionally had students use the template provided from her state's board of education website. However, after sharing the template with the class, James mentioned that the template was not accessible with his screen reader as the embedded tables could not be read in a logical order. Furthermore, Cindy observed that James' group members entered his response to the template for him because the IEP form was not formatted in a way that allowed James to use his AT device to enter his responses.

Cindy also has her students write individual reflections about different topics throughout her class. She has noticed that some students are able to express their thoughts well in class but sometimes do not provide in-depth written responses to the reflection questions. This made her wonder if there are other ways to help students reflect on the class topics through more accessible means to produce higher quality responses.

Identify Potential Barriers in Action and Expression

There are different reasons why students feel challenged in expressing what they know. CAST (n.d.) indicates that obstacles to student action and expression could vary depending on students' diverse needs (e.g., EF, physical and emotional status). Diverse needs of students could be challenging in a digital setting. In particular, response formats could be barriers for some students. For example, James in the scenario above might not be able to demonstrate his knowledge and skills because formatting the document was not accessible for the AT device he uses to enter information. Additonally, given that the teacher candidates' demographics haves become more diverse, teacher educators must adapt to meet learning and access needs. Specifically for special education teacher preparation, to diversify the profession to include professionals with lived experiences, the field of special education must include and support teacher candidates with disabilities (Strimel, 2022). Teacher educators must consider multiple ways for students to demonstrate their understanding of the content presented in their classes.

Improve Access for Action and Expression

Allowing for multiple means of action and expression gives learners opportunities to show their understanding and reduces barriers (e.g., anxiety). These methods help students to focus attention and retrieve/recall information (deWinstanley & Mjork, 2002). To address the potential barriers, course instructors must consider various ways to enhance student action and expression.

Provide Options of Product Formats, Considering Digital Accessibility. UDL highlights providing multiple means of products for students to show what they know. When combined with digital tools, it is critical to review the accessibility of the learning materials teacher candidates are working on. If the assignment is to complete IEP forms, which is an essential practice for special education teacher candidates, it is necessary for teacher educators to find a way to make it accessible. For example, Cindy's priorities must be checking table properties to make the IEP form accessible. At the same time, Cindy must check if students' AT devices are compatible with the digital documents they are working on. If the class has group projects, it is essential for course instructors to provide documents in a variety of formats for the projects that will meet all students' needs. For example, teacher candidates need to be familiar with the traditional IEP forms, but they also need to be given an accessible format that anyone can access to express their knowledge. This indicates that it is even more important to audit the accessibility of the materials addressed in guideline one of this article.

Provide Support to Students in Completing Products. EF plays a role in completing tasks and achieving learning goals since it covers inhibitory control, working memory, cognitive flexibility, attention, self-regulation, metacognition, organization, and planning (e.g., Cartwright, 2012; Diamond, 2013; Flores et al., 2014). When EF is weak, students might not priotize, plan, and compelte the given work. Therefore, teacher educators must pay careful attention in monitoring their progress and provide support for students to exercise EF accordingly. For example, in interpreting data, some students might have challenges about what and how to do the task, although general directions were given. Providing prompts for analyzing and

TABLE 2: Checklist for Improving Digital Accessibility before and during Class

REPRESENTATION

While preparing for course materials, did you:

- ☐ complete accessibility checks with software program (e.g., Microsoft Word, PDF)?
- ☐ adjust materials based on feedback from accessibility check?

If your document is a PDF file, did you:

- ☐ use OCR to make the PDF document readable?
- ☐ adjust PDF tags in logical order to be read by screen readers?

If your document is a word file, did you:

- ☐ use heading styles when creating headings?
- ☐ change abbreviated words to full words? For example, write Monday instead of Mon.
- ☐ use embedded links instead of writing out links in-text (e.g., Journal of Special Education Preparation instead of https://open-journals.bsu.edu/JOSEP)?

If you are working on tables or images, did you:

- ☐ build accessible tables?
- ☐ format tables in text rather than adding it as an image (e.g., screenshot) to the document?
- ☐ create descriptive alt text to images?

If you are using audio and video learning materials, did you:

- ☐ check the accuracy of closed captions?
- ☐ turn on captions and subtitles in PowerPoint Slides during synchronous presentation?

ENGAGEMENT

For better student engagements, did you:

- ☐ check if your course materials have any digital accessibility representation issues listed above?
- ☐ provide students background information on digital tools (e.g., accessibility statements) that will be used in the class in advance before coming to class?
- ☐ provide students opportunities to assess their knowledge skills on the digital tools by using low-stake assessments (e.g., checklist, Likert scales, engagement activities)?
- ☐ provide flexible support in digital learning (e.g., weekly checklist, graphic organizers)?
- ☐ provide explicit directions or modeling for class activities, including group works?

ACTION AND EXPRESSION

To help students express what they know, did you:

- ☐ check if digital documents are formatted in the right way that students using AT devices enter their responses?
- ☐ provide various formats of response in completing tasks (e.g., traditional and accessible IEP Forms)?
- ☐ provide explicit prompts in managing and completing tasks?
- ☐ include those prompts in the rubric, checklist, or timeline?

interpreting data supports (e.g., self-monitoring assignment checklists) students in managing information. Embedding those prompts in a rubric and timeline helps them enhance their capacity to monitor their progress.

To ensure that James and future students who might need an accessible IEP template, Cindy worked with the disability center to create an IEP Word document to allow for screen readers to read the template in a logical order. This version of the document took some work to create, but it allowed James to complete the assignment, and Cindy has offered to share the template with other professors in her department who may also have students needing an accessible version of this form.

In response to student difficulties in interpreting the assessment data, Cindy added several prompts for any student to use in completing the data interpretation. When thinking about some students struggling with written reflections, Cindy decided to give students other options to do their reflections. She still gave students the option of writing their responses, but also told students they could do an audio or video reflection or could create an infographic or drawing to reflect on the various topics discussed in class. In addition, she added prompts to the rubic. After providing these additional options, she noticed that while many students still chose to write their responses, others thrived with having new creative options that allowed them to reflect more deeply and thoughtfully.

CONCLUDING RECOMMENDATIONS

This article suggests multiple avenues of action for teacher educators to enhance digital accessibility through the lens of UDL. In doing this, we highlighted potential barriers to improve accessibility through vignettes (see Guidelines 1, 2, and 3 above), focusing on two students with sensory disabilities. However, all students in the classroom can benefit from these actions. For example, closed captions can provide additional context for understanding meaning with videos or lectures regardless of if learners have hearing impairments. Using alt text with images can enhance learners understanding of images they are seeing even if learners do not have visual impairments. As student needs are becoming more diverse in the classroom, teacher educators struggle with where to start to improve digital accessibility in their courses. Below, we created a checklist (Table 2) to assist teacher educators as they work to improve their practice of incorporating digitally accessibile supports to ALL learners.

Requiring Teacher Candidates to Use and Create Digitally Accessible Materials

Digital accessibility is critical for teacher candidates' success and future K-12 student outcomes. Teacher candidates must be knowledgeable and fluent in establishing inclusive classrooms, including utilizing accessible digital tools to meet the needs of their future K-12 students. To respond to the needs, teacher educators must provide teacher candidates opportunities to practice using and creating digitally accessible materials and assignments as a routine part of the teaching process, not an extra component. Therefore, teacher educators need to develop and update guidelines for improving digital accessibility in the classroom to ensure teacher candidates' learning needs are met and to model how to incorporate digitally accessible content in their future classrooms. Potential activities or assignments that teacher educators can embed in the teacher education program include having teacher candidates make accessible documents or use the accessibility check feature before submitting assignments. These activities can assess teacher candidates' competency in digital accessibility and their awareness of this topic. Furthermore, practicing digital accessibility as a part of course requirements can help teacher candidates have a better sense of how to apply these skills in their future classrooms.

Providing Support for Teacher Educators

Likewise, special education teacher educators are tasked with modeling digital accessibility in their teacher preparation courses. Furthermore, teacher educators are responsible for providing accessible tutorials across the courses. However, unclear support on the accessibility of materials, supports for increasing accessibility, and evaluating accessibility adds to the complexity of inaccessibility barriers (Linder et al 2015). Unfortunately, depending on the institutions' compacity, faculty support in this area may vary. To keep up with the changes in technology and laws, teacher educators need support and access to learning opportunities through PD and various resources and services related to digital accessibility. Furthermore, teacher educators and university access and accommodation centers must closely collaborate to meet the needs of those who need disability-specific accommodations beyond digital accessibility. CEC subdivisions, including Innovations in Special Education Technology (ISET) and Teacher Education Division (TED), as leaders in the field of special education, must continue to provide resources and guidelines to teacher educators in enhancing digital accessibility for equity and inclusion (e.g., Kaczorowski et al., 2022).

Continue to Work to Improve Digital Accessibility

Digital accessibility needs continuous efforts because students and context-related factors vary every semester (Shaneen, 2022). For a constant step in

ABOUT THE AUTHORS

Jeongae Kang, Ph.D.

Jeongae Kang, PhD, is an associate professor at the Department of Special Education at Illinois State University. Her scholarship focuses on special education teacher preparation, data-based instructional decision, accessibility, and case learning.

Kimberly A. Patton, Ph.D.

Kimberly A. Patton, Ph.D., is an Assistant Director of the Illinois Neurodiversity Initiative at the University of Illinois Urbana-Champaign. She is a former special education teacher who worked primarily with students with extensive support needs. Dr. Patton's research interests include special education teacher preparation and increasing employment outcomes for young adults with disabilities.

Stephanie Gardiner-Walsh, Ph.D.

Stephanie Gardiner-Walsh, PhD, is an associate professor in Deaf Education and Special Education at Illinois State University. Her research emphasis focuses on deaf and hard of hearing students in the mainstream classroom and teacher preparation for underserved populations. Prior to her time at ISU, she served as an itinerant teacher of the deaf in rural North Carolina and a classroom teacher in urban North Carolina.

enhancing digital accessibility, teacher educators could consider adopting the UDL plus one approach, consisting of (a) identifying barriers to learning, (b) targeting one barrier to address, (c) setting a goal for one element in their course for the targeted barrier, and (d) implementing and evaluating one instructional change (Tobin & Behling, 2018). Such a continuous cycle of selecting one specific barrier would make a big difference in the class and setting goals and plans to reduce barriers in learning (Flanagan et al., 2022). By implementing these cycles, courses evolve to be even more accessible across learners.

When the semester was over, Cindy was excited to realize her materials did not take a great deal of additional time to make them digitally accessible. By incorporating multiple means of representation, engagement, and action and expression in the planning phase of her instruction, she can better meet all of her student's needs without stigmatizing individual students. Cindy spent some time reflecting on her course and thinking about all she learned to increase the digital accessibility in her class. While she learned so much from her students and felt good about the changes she made, she also knows that she needs to continue to learn more about how to make all of her classes accessible to meet the needs of all of her students. She also realized that she can use her class to model and teach the importance of digitally accessible materials and content so that teacher candidates are prepared to meet student needs. Cindy also plans to attend some additional PD focused on digital accessibility and start collaborating with her colleagues to generate new ideas and ensure that this is an area of focus as they prepare teacher candidates in special education.

REFERENCES

Bhardwaj, R. K., & Kumar, S. (2017). A comprehensive digital environment for visually impaired students: user's perspectives. Library Hi Tech, 35(4), 542-557. https://doi.org/10.1108/LHT-01-2017-0016

Bong, W. K., & Chen, W. (2021). Increasing faculty's competence in digital accessibility for inclusive education: a systematic literature review. *International Journal of Inclusive Education*, 1-17. https://doi.org/10.1080/13603116.2021.1937344

CAST (n.d.). The Universal Design for Learning (UDL) Guidelines. https://udlguidelines.cast.org/?_gl=1*6ongt0*_ga*MTAwNjc3MDY1LjE2ODI2OTU3OTc.*_ga_C7LXP5M74W*MTY4MjY5NTc5Ny4xLjEuMTY4MjY5NjQ0My4wLjAuMA

Council for Exceptional Children (CEC; n.d., a). Advanced Special Education Preparation Standards. https://exceptionalchildren.org/standards/advanced-special-education-preparation-standards

Council for Exceptional Children (CEC; n.d., b). Initial Special Education Preparation Standards. https://exceptionalchildren.org/standards/initial-special-education-preparation-standards

deWinstanley, P. A., & Bjork, R. A. (2002). Successful lecturing: Presenting information in ways that engage effective processing. *New directions for teaching and learning*, *2002*(89), 19-31. https://doi.org/10.1002/tl.44

Dolmage, J. T. (2017). *Academic ableism: Disability and higher education*. University of Michigan Press. https://doi.org/10.3998/mpub.9708722

Fichten, C. S., Asuncion, J. V., Barile, M., Ferraro, V., & Wolforth, J. (2009). Accessibility of e-learning and computer and information technologies for students with visual impairments in postsecondary education. *Journal of visual impairment & blindness*, *103*(9), 543-557. https://doi.org/10.1177/0145482X0910300905

Flanagan, S., & Morgan, J. J. (2021). Ensuring access to online learning for all students through Universal Design for Learning. *TEACHING Exceptional Children*, *53*(6), 459-462. https://doi.org/10.1177/00400599211010174

Hinton, G. E. (2007). Learning multiple layers of representation. *Trends in cognitive sciences*, *11*(10), 428-434. https://doi.org/10.1016/j.tics.2007.09.004

Kaczorowski, T., McMahon, D., Gardiner-Walsh, S., & Hollingshead, A. (2022). Designing an inclusive future: Including diversity and equity with innovations in special education technology. *TEACHING Exceptional Children*, *55*(5), 507-518. https://doi.org/10.1177/00400599221090506

Keane, T., Linden, T., Hernandez-Martinez, P., Molnar, A., & Blicblau, A. (2023). Digital technologies: students' expectations and experiences during their transition from high school to university. *Education and Informa-*

tion Technologies, 28(1), 857-877. https://doi.org/10.1007/s10639-022-11184-4

Kearney-Volpe, C., Kletenik, D., Sonka, K., Sturm, D., & Hurst, A. (2019, October). Evaluating instructor strategy and student learning through digital accessibility course enhancements. In *Proceedings of the 21st International ACM SIGACCESS Conference on Computers and Accessibility* (pp. 377-388). https://doi.org/10.1145/3308561.3353795

Kennedy, G. E., Judd, T. S., Churchward, A., Gray, K., & Krause, K.-L. (2008). First year students' experiences with technology: Are they really digital natives?. *Australasian Journal of Educational Technology*, *24*(1), 108-122. https://doi.org/10.14742/ajet.1233

Kennedy, M. J., & Romig, J. E. (2021). Cognitive load theory: An applied reintroduction for special and general educators. *TEACHING Exceptional Children*. https://doi.org/10.1177/00400599211048214

Kent, M. (2015). Disability and eLearning: Opportunities and barriers. *Disability Studies Quarterly*, *35*(1). https://doi.org/10.18061/dsq.v35i1.3815

Khalid, M. S., & Pedersen, M. J. L. (2016). Digital exclusion in higher education contexts: A systematic literature review. *Procedia-Social and Behavioral Sciences*, 228, 614-621. https://doi.org/10.1016/j.sbspro.2016.07.094

Li, L., Worch, E., Zhou, Y., & Aguiton, R. (2015). How and why digital generation teachers use technology in the classroom: An explanatory sequential mixed methods study. International Journal for the Scholarship of Teaching and Learning, 9(2), 9. https://doi.org/10.20429/ijsotl.2015.090209

Linder, K. E., Fontaine-Rainen, D. L., & Behling, K. (2015). Whose job is it? Key challenges and future directions for online accessibility in US institutions of higher education. *Open Learning: The Journal of Open, Distance and e-Learning*, *30*(1), 21-34. https://doi.org/10.1080/02680513.2015.1007859

Margaryan, A., Littlejohn, A., & Vojt, G. (2011). Are digital natives a myth or reality? University students' use of digital technologies. *Computers & education, 56*(2), 429-440. https://doi.org/10.1016/j.compedu.2010.09.004

McLeskey, J., Barringer, M-D., Billingsley, B., Brownell, M., Jackson, D., Kennedy, M., Lewis, T., Maheady, L., Rodriguez, J., Scheeler, M. C., Winn, J., & Ziegler, D. (2017). High-leverage practices in special education. Arlington, VA: Council for Exceptional Children & CEEDAR Center. https://system-improvement.org/uploads/files/CEC-HLP-Web.pdf

National Center for Education (2018, May). Table 311.10. Number and percentage distribution of students enrolled in postsecondary institutions, by level, disability status, and selected student characteristics: 2015–16 [Data table]. In *Digest of education statistics*. U.S. Department of Education, Institute of Education Sciences. Retrieved from https://nces.ed.gov/programs/digest/d20/tables/dt20_311.10.asp

Patel, R., Breton, P., Baker, C. M., El-Glaly, Y. N., & Shinohara, K. (2020, April). Why software is not accessible: Technology professionals' perspectives and challenges. In *Extended abstracts of the 2020 CHI conference on human factors in computing systems* (pp. 1-9). https://doi.org/10.1145/3334480.3383103

Powell, J. J.W. (2012). From Ableism to Accessibility in the Universal Design University. *Review of Disability Studies: An International Journal, 8*(4). http://hdl.handle.net/10125/58542

Putnam, C., Dahman, M., Rose, E., Cheng, J., & Bradford, G. (2016). Best practices for teaching accessibility in university classrooms: cultivating awareness, understanding, and appreciation for diverse users. *ACM Transactions on Accessible Computing (TACCESS)*, *8*(4), 1-26. https://doi.org/10.1145/2831424

Rock, M. L., Spooner, F., Nagro, S., Vasquez, E., Dunn, C., Leko, M., ... & Jones, J. L. (2016). 21st century change drivers: Considerations for constructing transformative models of special education teacher development. *Teacher Education and Special Education*, *39*(2), 98-120. https://doi.org/10.1177/0888406416640 63

Shaheen, N. L. (2022). Accessibility4Equity: Cripping technology□mediated compulsory education through sociotechnical praxis. *British Journal of Educational Technology, 53*(1), 77-92. https://doi.org/10.1111/bjet.13153

Strimel, M. (2022). Socially-just disability resources: An approach to enhancing equity for teacher candidates with disabilities. *Journal of Special Education Preparation*, *2*(3), 60-67. https://doi.org/10.33043/JOSEP.2.3.60-67

Sweller J. (2020). Cognitive load theory and educational technology. *Educational Technology Research and Development, 68*, 1–16. https://doi.org/10.1007/s11423-019-09701-3

Thomas, C. N., Van Garderen, D., Scheuermann, A., & Lee, E. J. (2015). Applying a universal design for learning framework to mediate the language demands of mathematics. *Reading & Writing Quarterly*, *31*(3), 207-234. https://doi.org/10.1080/10573569.2015.1030988

U.S. Department of Education Office for Civil Rights (Feb 28, 2013). Resolution Agreement. South Carolina Technical College System OCR Compliance Review No. 11-11-6002. Retrieved from https://www2.ed.gov/about/offices/list/ocr/docs/investigations/11116002-b.html

U.S. Department of Justice (2010). Joint "Dear Colleague" Letter: Electronic Book Readers. https://www2.ed.gov/about/offices/list/ocr/letters/colleague-20100629.html

Zhang, L., Carter Jr, R. A., Basham, J. D., & Yang, S. (2022). Integrating instructional designs of personalized learning through the lens of universal design for learning. *Journal of Computer Assisted Learning*, *38*(6), 1639-1656. https://doi.org/10.1111/jcal.12725