

REVIEW



Increasing faculty's competence in digital accessibility for inclusive education: a systematic literature review

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ABSTRACT

The use of information and communications technology (ICT) in higher education institutions has increased in the past 20 years. While ICT has brought many benefits to students and faculty, research shows that it also creates barriers and challenges for students with disabilities due to the inaccessibility of digital tools and learning materials. Faculty members play an important role in inclusive higher education. Previous studies have emphasised the need to train faculty about digital accessibility to achieve inclusion in higher education. This systematic literature review aims to study existing work on increasing the faculty members' competence in providing accessible and inclusive digital learning materials and environments to students in higher education. Sixteen peer-reviewed papers were included and analysed. Most trainings included topics on disability and awareness, legislation, and methods of producing accessible digital materials and providing inclusive digital learning environments. While surveys and interviews were mostly used to evaluate training outcomes, there was a lack of objective data and commonly accepted instrument for evaluation. Good practices and further research opportunities are identified. This study has implications for researchers and higher education institutions that are interested in research and practice on increasing general competence in digital accessibility and inclusive education.

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Introduction

In recent years, researchers have shown considerable interest in providing students with

accessible and inclusive learning environments in higher education institutions (Burg-stahler 2018; Moriña 2017; Gilligan 2020). From developing curricula for disabled stu-dents to addressing the various needs of students from learning environments, researchers have attempted to contribute to inclusive education to a large extent. Similar to higher education institutions, many nations and international organisations, such as United Nations International Children’s Emergency Fund (UNICEF), Edu-cational, Scientific and Cultural Organization (UNESCO), the Council of Europe

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(CoE), and the European Union (EU), support the move toward inclusion in education (Haug 2017). One of the United Nation's sustainable development goals is 'quality education.' This goal aims to ensure equal access to all levels of education and vocational training for the vulnerable, which includes persons with disabilities, indigenous peoples, and children in vulnerable situations (United Nations 2020).

The use of ICT in the educational context has increased in the last two decades. Many students and faculty members (in this paper, they include both academic and administrative staff) benefit greatly from digital technologies. Learning management systems (LMSs) and digital learning materials offer the possibility to improve traditional classroom environments, thus making learning environments more effective (Njoku 2015). In the US, over 50% of students benefit from online learning as they return to higher education after starting work or while working; many have families while pursuing higher education (Hiltz and Turoff 2005). Students can also enrol in online courses, such as massive open online courses (MOOCs), which help address barriers related to time and distance.

COVID-19 has raised significant challenges for the higher education community worldwide. Due to this pandemic, the use of ICT by higher education institutions has been accentuated more than ever. Because of lockdowns, many works have to be switched to digital formats (Richter 2020), and many teaching activities have to be conducted online (Bao 2020; Rapanta et al. 2020). According to Bao (2020), the significant impact of COVID-19, that is, widespread use of digital works, would set new trends for the future; hence, it is now more pressing to ensure that the digital learning environments provided by higher education institutions are accessible and inclusive.

Moriña (2017) in her literature review reported that inaccessibility of ICT was identified by students with disabilities (SWDs) pursuing higher education as one of the barriers they encounter. Similarly, ICT use was reported to pose challenges to SWDs by another literature review on the experiences of SWDs in higher education (Kimball et al. 2016). Research shows that faculty members generally have positive attitudes toward inclusive education, and their attitudes are essential factors influencing their willingness to contribute to inclusive education (Rao 2004). However, faculty members lack the knowledge and skills needed to fulfil this goal, and training is necessary to increase their competence (Marquis et al. 2016). A study reported that only 4.5% of 1857 instructors who teach accessibility consider themselves 'experts'; 66.1% claim to have 'some knowledge,' and 10.7% believe that they are 'not knowledgeable' (Shinohara et al. 2018). Among students pursuing higher education in the US, 11% to 12% have at least one disability (Skomsvold 2014). According to the 2018 European Student Survey (Hauschildt, Gwosc, and Vögtle 2018), an average of 18% of students in higher education reports having a disability or chronic disease. In order to provide equal access to digital learning tools and materials for students, accessibility trainings should be conducted for faculty members to give them the necessary competence to contribute to more accessible and inclusive digital learning environments.

While promoting a more accessible and inclusive digital learning environment in higher education, Gilligan (2020) extended the European Framework for the Digital Competence of Educators (DigCompEdu) to include the aspect of digital accessibility. This framework illustrates what it requires of an educator to be digitally competent and it provides a basis for the training contents to increase faculty members' competence in digital accessibility in higher education. The systematic literature review presented in

this paper aims to study the state of the art in increasing the competence of faculty members in digital accessibility. This work also synthesises good practices from existing works to provide recommendations for further research and practice.

Methods

We performed the search on six databases based on the guidelines for performing systematic literature review: five recommended by Brereton et al. (2007) (IEEE, ACM, Google Scholar, ScienceDirect, Engineering Village) and one (Springer) by Keele (2007). Before the search, the following inclusion and exclusion criteria were defined.

- (1) The papers must focus on training activities that aim to provide more accessible and/or inclusive digital learning environments to students in higher education. The inclusive digital learning refers to inclusive education in digital context, which aims to provide equal opportunities to everyone, regardless of gender, age, race, colour, ethnicity, as well as people with disabilities, migrants, etc. (UNESCO 2016).
- (2) The training activities should have been conducted.
- (3) The target group of the training activities should be faculty members in higher education. Papers focusing on teaching students were excluded.
- (4) Papers focusing on attitudes, experiences, models, guidelines, and/or frameworks without involving faculty members being trained, were excluded.
- (5) Only peer-reviewed publications were included. Dissertations and theses, as well as grey literature such as presentations, reports and white papers were excluded.
- (6) Non-English-language papers were excluded.

The search was conducted from June 19, 2020, to June 21, 2020. A range of keywords were used in different combinations, including ‘accessibility training’, ‘digital accessibility’, ‘universal design (UD)’, ‘higher education’, ‘faculty member’, ‘teaching staff’, ‘academic staff’, and ‘administrative staff’.

The search yielded 3357 results (17 from ACM, 80 from Springer, 53 from ScienceDirect, 502 from Engineering Village, 11 from IEEE, and 2695 from Google Scholar). After the removal of duplicates, 2310 records remained. The titles and abstracts of these papers were read, and their contents were screened against the inclusion and exclusion criteria. After the screening, 2251 records were excluded. The full texts of the 59 included records were then assessed for eligibility. At this stage, 43 papers were excluded: 33 for not focusing on training faculty, eight for not focusing on digital accessibility, one for its training not being conducted at the time of writing, and one for its training not being aimed at higher education. Sixteen papers were identified as relevant and thus included in a qualitative synthesis. No papers were subjected to quantitative synthesis due to the big variation in the data measured in these 16 papers.

Based on the aim of the systematic literature review, the included papers were analysed according to the following criteria:

- (1) Objective of the study;
- (2) Methodology used in training (who conducted/provided the training, how it was conducted);

- (3) Sample size (number of faculty members involved);
- (4) Country where the study was conducted;
- (5) Characteristics of the faculty members involved;
- (6) Areas/topics covered during the training;
- (7) Methodology for evaluating the outcomes of the training; and
- (8) Outcomes of the training.

Results

Table 1 summarises the details of each of the 16 included papers according to the analysis criteria. All studies included training that aimed to increase faculty members' competence in producing accessible digital materials and providing inclusive learning environments, which is the main objective of these studies. In addition to demonstrating the process and outcomes of the training, some studies also showed other research goals. For instance, sustainability was one of the research goals in Hsiao et al. (2019)'s study, where the trained faculty members aimed to become trainers and liaisons in their home academic units. Pearson (2003) developed a set of guidelines for a staff training development program, and the intention was to explore the extent to which this set of guidelines can be used.

All studies except Hope (2020a) mentioned including experts in fields related to accessibility and/or disability to provide training and/or training materials. Kontio and Radtke (2019) reported two case studies: one from Rutgers University and one from Princeton University. Although the two cases used different approaches, the training programs were conducted by specialists in the relevant field: Rutgers University's Office of IT Accessibility (OITA) and Princeton University's User Experience Office (UXO). The training program demonstrated by Burgstahler (2003) was on a bigger scale and involved instructors and administrators from 23 postsecondary institutions nationwide. Whiting (2018)'s study involved personnel from human resources (HR), and the training was incorporated into HR onboarding materials. In terms of mode of training delivery, there were three main types: on-site training, online training, and a hybrid of the two types.

In terms of the sample size of participants, four papers did not report the numbers of trained faculty members (Pearson 2003; Spencer and Romero 2008; Slater et al. 2015; Hope 2020a). For those that reported, the numbers ranged from three (Hope 2020b) to 15,223 (Whiting 2018). These numbers are related to how the trainings were conducted. Online courses can be provided to large numbers of participants (Whiting 2018), whereas only two on-site workshops in this review managed to have around 100 participants (Murray et al. 2014; Murray et al. 2009). The other on-site trainings had fewer than 40 participants. Geographically, 11 studies were conducted in the US. Other studies were conducted in Portugal, the United Kingdom (UK) and Australia. No study from other regions such as Asia, South America and Africa was included.

Similarly, not all papers provided information about the participants. Six papers specifically mentioned the inclusion of administrative staff (Burgstahler 2003; Pearson and Koppi 2003; Slater et al. 2015; Heap and Thompson 2018; Murray

	Objective of the study	Methodology of training faculty members (who conducted, how it was conducted)	Sample size and characteristics	Country of the study	Covered areas/topics	Methodology of evaluating training outcomes
Burgstahler (2003)	To increase faculty members' knowledge and skills in supporting students with disabilities (SWDs)	Administrators and instructors from 23 higher education institutions A curriculum with different delivery options: on-site presentations, electronic mail, and videotapes on public television stations	More than 5000 for models 1, 2, and 3; not stated for models 4, 5, and 6 Faculty members from higher education institutions nationwide	US	Six models including topics such as academic accommodations for SWDs, campus resources, and legal issues; model 3, which comprised training sessions designed to make accessible web pages and develop accessible distance-learning courses	Survey The participants felt better prepared to accommodate SWDs in their classes and were more aware of campus resources
Regadas and Ribeiro (2011)	To provide training to teachers on working with students with special needs in a classroom setting	Department of New Technologies in Education & Disabled Students Service An e-learning course with seven modules	10 All academics with backgrounds concerning students with special needs	Portugal	Disabilities, general accessibility, and university policies on accessibility and inclusion; optional activities, including topics on web accessibility	Not specified The contents of the course were deemed over-simplistic due to the background of the participants
Hope (2020b)	To improve the accessibility of the online courses at a university	Centre for Excellence in Teaching and Learning and the Accessibility Resource Centre Accessibility training on professional development for faculty	Three in the first year Participation was expected to grow	US	Accommodations for SWDs: creating fully accessible PDFs and links to resources for captioning videos, and incorporating universal design (UD) into classroom and online settings	Survey assessing participants' understanding of accessibility No results were presented

Kontio and Radtke (2019)	To increase the awareness of faculty members and build accessibility liaisons in a campus community	Rutgers University: Office of IT Accessibility (OITA) Weekly workshops and webinars (continual, linear curriculum and once-off training) Princeton University: User Experience Office (UXO) A curriculum of online courses and instructor-led meetings	Rutgers University: size not specified University personnel Princeton University: 10–20 University staff	US	Rutgers University: general and web accessibility, making digital contents accessible, and laws and guidelines (web content accessibility guidelines [WCAG]) Princeton University: disabilities and assistive technology (AT), UD, accessibility, laws, and organisational strategies, among others	Rutgers University: not specified Princeton University: not specified Not specified
Pearson (2003)	To use developed guidelines as a basis for staff development and to encourage designers to develop inclusive and accessible courses for all students	Educational Development & Technology Centre (EDTeC) at University New South Wales (UNSW) and Special Needs Computing Research Unit (SNCRU) at University of Teesside (UoT) A face-to-face workshop and an online course	Sample size and characteristics of faculty members not specified	Australia and UK	Legal or quality assurance requirements, available guidelines and protocols, ATs used by SWDs, designing for inclusion, and available tools and mechanisms for checking the accessibility of web pages	Not specified The training has helped the academic staff from novice to competent designers of accessible online courses. The participants had possibility to revisit and re-examine the online courses after training. Based on feedback, the authors refined activities for online courses.
Pearson and Koppi (2003)	To evaluate a mixed-mode course with regard to designing accessible and inclusive learning environments and raising staff awareness	EDTeC at UNSW and SNCRU at UoT A six-month mixed-mode course (online and face-to-face) consisting of four types of weekly activities (group topics, such as workshops, project development, project groups, and online activities)	45 (15 in each of the 3 cohorts) A mixture of academic, IT, and library staff	Australia and UK	Accessibility issues in online learning for SWDs, AT, accessibility barriers in existing websites and online courses, accessibility guidelines, checking mechanisms, and development of accessible online courseware	Feedback given during and after the course, paper evaluation, online discussion and survey, and email request for feedback Most participants gained new knowledge and skills. The online course was integrated well into the face-to-face workshops, although there was insufficient time for the workshop activities. Access to the specialist software was helpful, and awareness increased.

Fraser and Sanders (2004)	To present a case study introducing academics to concepts and issues involved in teaching SWDs	Central Higher Education Development Unit & Disability Liaison Unit A module with reflective report writing, face-to-face workshops, brochures, and assessment of peers' reports	37 Teaching staff with teaching experience ranging from one year to more than 10 years	Australia and others not specified	Understanding of several disabilities, challenges experienced by SWDs at universities, ways to make classes more inclusive and accessible for SWDs, legislation and regulations, and web accessibility	Questionnaire The participants reported being more confident about accommodating SWDs. Most participants learned new knowledge –from understanding disabilities to assisting SWDs and having empathy. The peer assessment was deemed valuable by the participants.
Murray et al. (2014)	To evaluate the short-term effects of a disability-focused training program on faculty members' disability-related self-efficacy	Disability Services Office's director, one faculty member of educational leadership, and two faculty members from special education Training sessions with activities such as presentations, discussions, student panels, and group activities	102 Full-time tenure-track faculty members from 43 departments and programs	US	Awareness, laws, accommodations, university support, practice (including creating accessible digital documents), and institutionalisation strategies	Questionnaire measuring self-efficacy and participant satisfaction Self-efficacy (consisting of knowledge of UD, disability, services, and information sharing) increased among the participants. Overall, they expressed high satisfaction with their training experience
Spencer and Romero (2008)	To initiate change within higher education institutions via professional development on UD principles and strategies	Higher Education Disability Support–UD Principles (HEDS–UP) project team Workshops (smaller workshops offering hands-on opportunities) and large- and small-group presentations	Only reported increase in the number of faculty members participating in large or small workshops; otherwise not specified	US	UD, UD for instruction (UDI) across courses, fieldwork expectations, and survey results from students and faculty members about making syllabi and materials more accessible and universally designed	Survey The faculty members engaged more with UD, and there were more references to UD in a variety of curriculum and committee discussions. A rubric of UD principles was developed to enable the faculty members to apply UD in their teaching in systematic ways

Whiting (2018)	To develop and implement an accessible technology project and the framework of a university's AT initiative	Representatives from computer services (CS), university counsel, human resource (HR), and Disability Resources and Services (DRS) A 20-minute course on learning management systems (LMSs)	15,223 (9755 completed, 726 in progress, and the rest not started) Adjunct and full-time faculty	US	Obligations, laws and policies, accessibility, accessible design, and instructional design practices (colour contrast, captioning, keyboard usability, alternative text, and document formatting)	Not specified The participants raised concerns regarding the policy, standard and workflows in the training being unfounded decisions because these decisions added various levels of effort and education on individual. There was a need for a broader dialogue and guidance on educating and integrating tasks for increasing accessibility into daily operations.
Slater et al. (2015)	To explore accessibility specialists' experiences with production teams in making curricula accessible	Faculty accessibility specialists Workshops, seminars, presentations, talks, briefings, individual support, and adjustments for content and assessment after production	Not specified Participants across diverse faculties and roles	UK	Accessibility topics, such as inclusive design, anticipatory adjustments in curriculum production, and reasonable individual adjustments after production	Not specified Improved accessibility was observed in the works delivered by the working groups. The faculty members' awareness increased, which resulted in considerable progress in bringing about institutional change to include the needs of all students, including SWDs, as a part of module design and production.
Heap and Thompson (2018)	To improve training workshops for faculty members and professionals working in e-learning- and massive open online course (MOOC)-based environments	Centre for Innovation in Teaching and Learning Accessibility and UD training workshops, and post-training services	30 targeted (ongoing) Participants in various roles and disciplines involved in creating and developing educational materials	US	Theoretical component: WCAG 2.0, section 508 (standards and best practices); practical component: production of accessible instructional materials in different LMSs and in various formats, and exposure to AT	Survey on participant opinions about the training This initiative has increased instructors' awareness of the diverse needs of students, including SWDs, and competence in creating accessible content. One team of e-learning professionals created their own instruction manual on

Park, Roberts, and Stodden (2012)	To provide training to instructional faculty members to enhance their attitudes, knowledge, and skills in accommodating SWDs	Centre on Disability Studies project staff A three-day Summer Institute course with presentations, discussions, and group work	16, with 7 joining the follow-up case study Participants with varied experiences with SWDs, from colleges in different fields	US	Disability culture, student and faculty rights and responsibilities, accessible distance education and AT, UDI, hidden disabilities, and multiculturalism and disability	creating accessible educational materials. Case study (only reported interviews) The participants showed increased competence in instructing SWDs, meeting their needs, and accommodating them. The implemented strategies included reading written course content aloud, providing course materials in PDF format (can be easily enlarged), and developing a more welcoming accessibility statement.
Hsiao et al. (2019)	To enhance faculty members' competence in inclusive practices via a training program; to ensure the program's sustainability by having faculty members become trainers and liaisons	Disabilities, Opportunities, Internetworking, Technology (DO-IT) Centre and cross-campus collaborations A year-long program in formats of live streaming (via WebEx) and LMS engagement (via Canvas) supplemented by Internet-based resources and individualised support	25, of which only 19 completed all the given modules Faculty members from various university units and with different teaching experiences (3–36 years)	US	UDI; characteristics of diverse learners; accessible online learning; disability-related laws and regulations; panel dialogue with SWDs; and a final project on disseminating, integrating, and applying the knowledge and skills learned during the program	Inclusive Teaching Strategies Inventory (ITSI) questionnaire and interview (pre and post) The questionnaire results indicated an improvement in the participants' willingness to provide accessible and inclusive learning environments and to accommodate SWDs. The interviews revealed the most knowledge growth in legislation issues, characteristics of SWDs and reasonable accommodations, awareness of strategies, and instructional methods

Murray et al. (2009)	To present a model demonstration project aiming to promote disability awareness, understanding, and responsiveness among faculty members	Productive Learning u Strategies (PLuS) project team A workshop for instructors and a training institute for administrative staff using the train-the-trainer model (expected to impact institutional change) in the form of presentations, group activities, and provided training materials, among others	98 Instructors from different departments of nine major colleges; administrative staff from over 45 different units that regularly interacted with SWDs	US	Characteristics of learning disability, history, laws, relevant accommodations, university advocacy and training peers, and institutionalisation strategies; participants expected to become trainers of others and asked to set training goals during the workshop	Follow-up face-to-face meeting; follow-up interview via phone and/or mail for those who did not attend face-to-face meeting. Survey across university. 77 participants provided follow-up data (attained 302 of 478 goals, assuming non-responders did not implement their goals). Faculty members attended the workshops had the most positive views, followed by those attended other trainings and then those who did not attend any training. Identified other predictors of attitudes & actions
Hope (2020a)	To increase staffs' training program completion & skills in creating accessible online courses	Not specified Five redesigned modules in an instructor-facilitated online course	Not specified Instructional designers	US	Disability, web accessibility guidelines, legal standards, accessible digital materials (Word, PDF, and multimedia formats), and course design	Pre and post-course survey. Results not specified

et al. 2009; Hope 2020a). Pearson and Koppi (2003) recruited IT staff and library staff; Heap and Thompson (2018) had graphic and instructional designers as participants; Murray et al. (2009)'s study involved administrative staff from different units that had regular interactions with SWDs (e.g. library, student services, financial aid). Three papers did not mention the characteristics of the faculty members (Hope 2020b; Pearson 2003; Spencer and Romero 2008). The academic staff involved in the training covered a variety of disciplines, such as business, veterinary medicine, computer science (Heap and Thompson 2018), social sciences, natural sciences, medicine, social work, and education (Park, Roberts, and Stodden 2012). Murray et al. (2009) held separate sessions for teaching and administrative staff: five- and four-day training with some variations in training content. The teaching staff participated in a 'practice' session on their own, which included planning for instruction, designing syllabi, delivering instruction, evaluating instruction and assessment, and attending pre-presentations from the university support service. Although the tailoring of training content can be challenging, it can make the training more useful for participants as it is more technological, discipline-specific, and time-related (Heap and Thompson 2018).

The topics included in the training covered different main areas of concern, such as disability and awareness, laws and regulations related to accessibility, practices in producing accessible digital materials and providing inclusive digital learning environments, and available support and guidance from universities. The numbers of topics covered were affected by factors such as training length and training delivery mode. Among the included papers, only Kontio and Radtke (2019) and Heap and Thompson (2018) included WCAG as parts of their training contents. Three papers covered web accessibility in their training without stating the presence of WCAG (Burgstahler 2003; Fraser and Sanders 2004; Hope 2020a), and one paper (Regadas and Ribeiro 2011) incorporated web accessibility into optional training activities. Pearson (2003) first developed guidelines based on WAI to assist academic developers who have limited technical competence in making online courses accessible. These guidelines served as a basis for their staff development course. Three papers included universal design for instruction (UDI) (Spencer and Romero 2008; Park, Roberts, and Stodden 2012; Hsiao et al. 2019).

A range of different training and assessment methods were used in the 16 included studies. Two of the 16 included papers involved SWD in their training. Hsiao et al. (2019) held a panel dialogue with SWDs. The participants were exposed to topics such as characteristics of diverse learners, their challenges and strategies in overcoming barriers, and suggestions for faculty members to create inclusive learning environments. In Fraser and Sanders (2004)'s study, 37 participants were required to deliver reflective reports. They were asked to first interview one SWD (with one or more disabilities) to learn about the student's specific disability and his/her experiences. Accommodations or adjustments that the participants could make for their chosen SWDs were then identified. In addition, the participants were required to assess each other's work so that they could learn from their peers. This assignment was deemed a valuable experience by 23 out of 30 respondents (only 30 responded to the questionnaire). Pearson and Koppi (2003) reported success in raising participants' awareness of accessibility issues by providing them hands-on experience with AT. Other hands-on practices, such as video captioning and remediation of Word,

PowerPoint, and PDF files, have also yielded positive results (Heap and Thompson 2018; Hope 2020a; Pearson and Koppi 2003; Kontio and Radtke 2019). However, the time spent on such activities should also be considered because it may also influence training outcomes (Murray et al. 2009).

The delivery methods used in the included papers have reflected the changes in ICT landscape. More recent studies have used e-learning platforms, live streaming and webinars (Murray et al. 2009; Murray et al. 2014; Hsiao et al. 2019; Whiting 2018; Burgstahler 2003; Kontio and Radtke 2019; Pearson 2003; Fraser and Sanders 2004; Heap and Thompson 2018; Hope 2020a). Pearson and Koppi (2003) argued that the face-to-face workshops could ensure that the participants committed their time and played a part in immediate discussions. However, these happened briefly only. The online courses enabled the participants to revisit the materials whenever they wanted, but it could be difficult for them to allot the time needed to review. This approach is similar to the Dis-abilities, Opportunities, Internetworking, and Technology (DO-IT) training curriculum, which was demonstrated in Burgstahler (2003)'s study and delivered through several options: on-site presentations, online instruction, discussion and lessons via mail, and videotapes on television stations.

Surveys were used to evaluate the training outcomes in ten of the 16 studies. The survey questions included participants' understanding, knowledge, awareness, and/or satisfaction with the training. They were distributed among participants after training in these studies. Other studies conducted follow-up after the training. For example, Pearson and Koppi (2003) administered an email survey to collect qualitative comments to evaluate the post-training effects on attitude and practice in a period of 6–12 months. The included studies generally received positive feedback from the trained faculty members, which included comments about being better prepared for and having more knowledge about accommodating SWDs, and being more aware of the resources and support provided by universities in relation to accessibility and inclusive education. In addition, two studies reported that the training resulted in higher awareness among faculty members at an institutional level (Whiting 2018; Murray et al. 2009).

Discussion

According to Gilligan (2020), web content accessibility guidelines (WCAG) principles can establish the foundation for embracing digital accessibility. He therefore applied WCAG compliance to several competences in the framework, such as information and media literacy, and content creation (both under the 'facilitating learners' digital competence' area). However, WCAG and web accessibility are not widely included in training content. Among the 16 included papers, only two papers (Kontio and Radtke 2019; Heap and Thompson 2018) stated having WCAG in their training. The Web Accessibility Initiative (WAI), which is central to Gilligan (2020)'s augmentations to the DigCompEdu framework, develops standards and support materials that help people understand and implement digital accessibility. The above-mentioned WCAG is one of the WAI's developed guidelines. Only one of the 16 included papers (Pearson 2003) have used WAI while developing guidelines that served as a basis in the staff development course.

Another augmentation to the competences in DigCompEdu by Gilligan (2020) is device knowledge. The importance of understanding how devices work together with assistive technology (AT), such as screen reader programs and speech-to-text software, has been highlighted in several studies (Gilligan 2020; Kimball et al. 2016). Five out of the 16 papers in this review incorporated the topic of AT into their training programs (Kontio and Radtke 2019; Pearson 2003; Pearson and Koppi 2003; Heap and Thompson 2018; Park, Roberts, and Stodden 2012). Several of them used practical exercises such as hands-on exercises with AT, video captioning, and remediation of digital materials and have exerted considerable impact.

Gilligan (2020) considered the universal design for learning (UDL) essential for building educators' competence in digital accessibility. Using UDL, educators can follow a structure while developing instructions that can meet the diverse needs of all learners (Rose and Meyer 2002). According to Morina (2017), with the practice of UDL, students can benefit from proactive designs and inclusive strategies in teaching. In our study, none of the included papers reported to have taught and/ or trained about the guidelines of UDL and three papers reported that their training covered UDI (Spencer and Romero 2008; Park, Roberts, and Stodden 2012; Hsiao et al. 2019).

In a review on faculty members' attitudes toward SWDs, Rao (2004) reported that faculty members who have better knowledge of the relevant legislation have more positive attitudes. Laws and regulations were covered in the training programs presented in most of the studies included in this review. One of the 16 included papers Hsiao et al. (2019) reported that knowledge about disability-related legislation and legal issues was the area where the most growth was achieved by the participants of their faculty development program. Consistent with Rao (2004)'s findings, the thematic analyses by Hsiao et al. (2019) indicated that the perceptions and attitudes of their training participants improved concerning their (i) flexibility and open-mindedness toward accommodating SWDs; (ii) belief that SWDs can succeed; (iii) understanding of the responsibilities of schools, the Disability Support Services, and faculty members and the shift from reactive to proactive approaches; and (iv) understanding that inclusive instruction can benefit all students in classrooms.

After reviewing ten studies, Rao (2004) reported six studies that identified 'experience' as a variable that significantly influences faculty attitudes; a faculty member who is 'experienced' with SWDs tends to have a more positive attitude. Two included studies in our review involved SWDs in their training (Fraser and Sanders 2004; Hsiao et al. 2019). Although the approach of involving SWDs is useful, ethical, privacy, and practical concerns must be addressed (Marquis et al. 2016). In addition, tailor-made training content is important to suit the knowledge levels and needs of the participants. Out of the 16 included studies, only three papers stated that they tailor-made training content (Heap and Thompson 2018; Burgstahler 2003; Murray et al. 2009). The participants in one of the included study commented that the training materials and contents were over-simplistic (Regadas and Ribeiro 2011). This was because all of the staff enrolled in the training course needed to work with a specific problem concerning SWDs. Tailor-made training course content can address this issue.

The 31-item Inclusive Teaching Strategies Inventory (ITSI), developed by Lombardi, Murray, and Gerdes (2011), measures six constructs: (i) multiple means of presentation, (ii) inclusive lecture strategies, (iii) accommodations, (iv) campus resources, (v) inclusive assessment, and (vi) accessible course materials. One of the studies in our review (Hsiao et al. 2019) used this questionnaire to evaluate the immediate effectiveness of faculty training. Most of the other included studies in our review covered topics similar to those that the ITSI measures. Therefore, this questionnaire could serve as a standard instrument for evaluating training outcomes. In assessing training outcomes, most of the reviewed studies used surveys or interviews as data collection methods and collected subjective data, such as self-reported attitudes, beliefs, and confidence in accessibility and inclusion. However, such methods could have potential limitations in gaining a precise understanding of the competence of participants. Asking the participants to demonstrate their knowledge in practice would enable a more objective assessment of their competence.

Such training must be administered to both academic and administrative staff. Establishing accessible and inclusive digital learning environments in higher education is the responsibility of not only the teaching staff but also administrative staff (Glazatov 2012; Hope 2020a). From communicating with SWDs to building accessible digital online platforms for them, administrative staff's roles are comparable to those of teaching staff. According to the university student survey results in Meier-Popa and Rusu (2015), SWDs indicated the existence of administrative barriers in addition to social (attitudinal), physical, and organisational challenges. It is encouraging to see that most of the studies in our review had administrative participants in their training.

Motivation of participants and flexibility in training activities, deliver methods, and time of completion are considered important when designing faculty training program, as reported by Padgett and Conceição-Runlee (2000). According to them, motivational issues varied from one individual to another, and resources required to motivate each type of individual were different. For instance, resources in terms of time and software could motivate early adopters (a group that initiated the effort for information or training); while early majority (a group who learned new technologies only after others recommended them) would be motivated more resources with rewards and incentives. Several included studies demonstrated different approaches to keeping participants motivated. For instance, some institutions offered participants training completion certificates (Hope 2020b; Kontio and Radtke 2019), and faculty accessibility specialists helped motivate faculty members while guiding them (Slater et al. 2015). In addition to motivation, providing flexibility is crucial because faculty members are already busy with their everyday work. In order to combine the training with their everyday duties, some included studies offered self-paced training activities (Burgstahler 2003; Hope 2020a) and mixed-mode training (online activities and discussions with the support of face-to-face workshops) for their participants (Pearson and Koppi 2003).

Based on our analysis of the reviewed paper, we have identified a listed of recommendations for use in training to increase faculty's competence in digital accessibility for inclusive education. They are listed in Box 1.

Box 1. Recommendations.

- [1] Engage all faculty members with training programs and activities to increase institutional competence (all included papers).
- [2] Offer flexible and tailor-made training programs, and keep the participants motivated (Heap and Thompson 2018; Burgstahler 2003; Murray et al. 2009; Pearson and Koppi 2003).
- [3] Involve students with disabilities (SWDs) while following ethical and privacy guidelines (Fraser and Sanders 2004; Hsiao et al. 2019).
- [4] Provide training on relevant legislation and regulations (Murray et al. 2009; Murray et al. 2014; Hsiao et al. 2019; Whiting 2018; Burgstahler 2003; Kontio and Radtke 2019; Pearson 2003; Fraser and Sanders 2004; Heap and Thompson 2018; Hope 2020a).
- [5] Provide training on accessibility standards and guidelines, particularly web content accessibility guidelines (WCAG) (Kontio and Radtke 2019; Heap and Thompson 2018).
- [6] Provide training on the universal design for learning (UDL) (Regadas and Ribeiro 2011).
- [7] Equip the participants with device knowledge by providing hands-on experienced with assistive technology (AT) (Pearson and Koppi 2003).
- [8] Provide hands-on practice (e.g. video captioning; remediating Word, PowerPoint, and PDF files) (Kontio and Radtke 2019; Pearson 2003; Pearson and Koppi 2003; Heap and Thompson 2018; Park, Roberts, and Stodden 2012).
- [9] Consider the knowledge levels and needs of the participants. Customise the contents when necessary/possible (Heap and Thompson 2018; Burgstahler 2003; Murray et al. 2009).
- [10] Use commonly accepted instruments (e.g. ITS1 questionnaire) and objective measures to assess training outcomes (Hsiao et al. 2019).

Conclusion

In this review, we identified 16 papers on training faculty members to increase their competence in providing accessible and inclusive digital learning environments in higher education. Most of the training programs and courses covered topics such as disability and awareness, legislation with regard to accessibility, and methods of producing accessible digital learning materials and providing inclusive digital learning environments. Surveys and interviews were used in most of the studies to evaluate training outcomes, but there is no commonly accepted instrument for this purpose. In addition, there is a lack of objective data on the evaluation of training outcomes. Future research should focus on the establishment of a common instrument and objective measures for assessing training outcomes.

We assessed and analysed the 16 relevant papers and identified lessons learned and future research opportunities. A list of recommendations was gathered based on our analysis (Box 1). We hope that this list can serve as rules of thumb for future training of faculty on digital accessibility. One limitation of this study is the search might have missed relevant studies although we have followed the recommendations for systematic literature review by Keele (2007) and Brereton et al. (2007). Other than US, UK, Australia and Portugal, we did not find studies conducted in other countries. In addition, some

studies mentioned accessibility training but focused on topics such as faculty attitudes toward training (Hatfield 2003) and general professional development (McDonald 2015). Such studies were not included in this review.

This review has implications for both research and practice. Researchers should critically examine training programs and courses and gather empirical evidence to identify possible limitations and methods of addressing them. This review can also be of interest to higher education institutions that intend to offer accessibility training for faculty members to enhance their general competence in digital accessibility. With this review, we hope to inspire further studies on the provision of accessible and inclusive digital learning environments in higher education.

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