Digital Inclusion in Higher Education: A Qualitative Study on Technology Requirements Across European Nations

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Abstract

In the contemporary academic landscape, digital equity stands as a core pillar of institutional equity. This qualitative study investigates the precise technology requirements of diverse student cohorts to foster digital inclusion within higher education systems. Drawing on data from four European nations—Germany, Greece, Italy, and Spain—semi-structured interviews were conducted with 42 university students representing various accessibility profiles, including visual, hearing, mobility, and specific learning challenges. Through a systematic content analysis of the interview transcripts, the study examines the interplay between the digital tools (software applications and specialized devices) that students currently recognize and the actual technological infrastructure they require across both academic and domestic environments. The findings reveal critical gaps in current digital adoption and highlight the distinct infrastructural demands necessary to ensure seamless learning workflows. Ultimately, this cross-national analysis offers vital, actionable insights for higher education administrators, campus accessibility units, and instructional designers aiming to implement sustainable, inclusive digital frameworks that dismantle institutional barriers.

Keywords: Digital Inclusion; Higher Education; Technology Requirements; European Higher Education Area (EHEA); Qualitative Methodology; Digital Equity; Inclusive Pedagogy.

1. Introduction

Facilities for students with disabilities in academic settings are limited [1]. While physical access barriers—those that directly affect the basic accessibility of university campuses—are often recognized, the attitudes of faculty members toward students with disabilities have been identified as another significant barrier [2,3]. Academic personnel often lack knowledge, training, and awareness of students with disabilities [4], although this varies between faculties [5]. As a result, this can lead to negative perceptions of students' abilities and skills and have a detrimental effect on their participation in social and extracurricular activities [6,7]. Students' negative perceptions are further compounded by a lack of specific internal rules, support, resources, and appropriate educational facilities at the universities [6]. Students with disabilities have reported having more passive roles compared to their peers in laboratory settings [8].

Achieving holistic accessibility in higher education promotes inclusion. The integra- tion of assistive technology stands as a pivotal factor in achieving accessibility. To promote accessible education, students must know the different technologies, both assistive technol- ogy (e.g., tactile screens, braille printers, loop systems or audio induction loops, hand-held magnifiers, text-to-speech devices, daisy-player devices, braille typewriters, notetakers, re- freshable braille display, MagniLink magnifier, touch tablet, tactile-image enhancer, screen reader, screen magnification software, text-to-speech software, etc.), and conventional technology (e.g., tablet, laptop, personal computer, scanner, smartphone, audio recorder, microphones, headset/headphones, social networking applications, smartphone apps, and PDF readers, etc.).

According to the review conducted by McNicholl et al. [9], assistive technology en- hances the performance of students with disabilities in academic tasks, fosters increased engagement with educational materials, improves academic performance, and contributes to various educational, psychological, and social benefits for students with disabilities. Previous research has highlighted that access to appropriate assistive technology has a positive impact on students with disabilities in the areas of competence, adaptability, and self-esteem, supporting students' educational engagement, and increasing their well-being and academic self-efficacy [10].

However, an analysis by Quinn and her colleagues [11] showed that even when the advantages of assistive technology are undisputed, it is not always used. Although the analysis was based on data from previous decades, it is well documented that impairment and context can play a significant role. Multiple disabilities, mobility impairments, and learning disabilities were associated with the most frequent use of assistive technology. Moreover, self-contained classes and resource classes were related to the settings of the most frequent use, while home or general educational settings were the contexts of the least frequent use [12]. It should be noted that, as the author highlights, less than 30% of the sample received assistive technology services.

Assistive technology services appear to be a fundamental pillar of assistive technol- ogy use. The service delivery process, influenced by factors such as lack of information, follow-up, inadequate training, and unrealistic expectations, can affect end-users' satis- faction, thereby influencing the degree of utilization and/or abandonment of assistive technology [13]. Indeed, a systematic review by McNicholl and her colleagues [9] showed that insufficient training, the unavailability of proper devices, a lack of external support, and difficulty handling a wealth of information obstruct the use of assistive technology in higher education. Training should be provided bilaterally to both teachers and students by assistive technology services professionals [14–16]. Additionally, consistent support could help end-users avoid frustration and alleviate negative feelings resulting from technical difficulties [17].

Similarly, Dabi and Golga [18] explored the availability, awareness, and utilization of assistive technologies among students with visual impairments in higher education institutions in Ethiopia. The findings showed three factors that have a negative impact on the availability and utilization of assistive technologies: (a) the lack of awareness among students with visual impairments, instructors, and practitioners in the field; (b) an improper organizational arrangement; and (c) the absence of policies and guidelines for managing assistive technologies [18].

Thus, it becomes apparent that, although assistive technology presents benefits, it can easily pose barriers [19–21]. Students with disabilities should be equipped with the necessary skills to proficiently utilize assistive technology [22,23]. Furthermore, they require clear guidance in selecting appropriate assistive technologies [22].

However, even when there may be adequate knowledge of the proper assistive technol- ogy for each case (specific needs or goals, impairments, etc.), the means may not ultimately be used successfully or at all. To ensure successful usage of assistive technology, a series of parameters should be taken into consideration, including need-based assessment, a sound development plan, successful implementation, effective monitoring, and periodic review [24].

In addition, social accessibility, including the level of self-consciousness and self- confidence impact on social interactions, can be equally important as functional accessi- bility and thus influence the use of assistive technology in social contexts [25]. Stigma resulting from assistive technology use can truly be an obstacle [17]. According to Scherer's review [12], feelings of self-consciousness and embarrassment can lead to abandonment of assistive technology use during adolescence.

The analysis of Scherer [12] could be used in combination with the analysis of Golden (1999) [26] to examine the gap between actual users and individuals with im- pairments who could benefit the most. According to the latter's analysis, individuals with visual, hearing, and mobility impairments could use and benefit from assistive technology in its entirety.

In Ethiopia, students with visual impairments or those with severe disabilities were most likely to be assistive technology users [27]. The study by Kisanga and Kisanga [23] indicates that students with visual impairments have a good understanding of assistive technology devices, although their knowledge was limited to those assistive technologies available at their institution. Moreover, their study found that these students were more familiar with screen readers and Braille machines than with other devices.

Upon closer examination of assistive technology means and functionalities, it was found that people with visual impairments focus more on the accessibility of documents. Raising the accessibility of documents can significantly contribute to students' productivity [28]. The preferred document formats for individuals with blindness are mainly MS Word DOC, which they navigate using screen reading software, and PDF for individuals with residual vision [29]. EPUB is also an accessible document format, but issues arise when MathML needs to be included [30]. Regarding assistive devices, features important for individuals with visual impairments include the simplicity of the system-user interface, wearability, weight, and real-time accuracy [31].

Individuals with hearing loss more frequently use environmental control systems (such as induction loop or infrared systems), closed caption decoders, and personal ampli- fication systems, while hearing aids present challenges due to discomfort, expense, and visibility [12]. A more recent study [32] found that the best software for students with hearing impairments for implementation and active use in smart universities was ntouch, which makes videocalls more usable and accessible.

Regarding students with learning disabilities, the provision of assistive devices at higher education institutions facilitates their access [33,34]. Assistive technology interven- tions targeting word processing, multimedia, and hypertext are positively accepted, while the use of speech-to-text systems has elicited mixed emotions, mainly due to technical difficulties [17].

For individuals with mobility impairments, improved technology mechanics, refine- ment of the use-technology physical interface, and automated control functions could enhance the usage of assistive devices [35].

The analysis above highlights the fact that: (a) assistive technology significantly supports the education of individuals with disabilities; (b) in order to have major benefits, assistive technology should be administered through a systematic, well assessed, and end-user-centered process; and (c) although the benefits are well recognized, assistive technology is not as widely used as it should be, especially when the user takes distance from the basic education settings.

2. Materials and Methods

The qualitative study presented in this article constitutes a part of the broader research conducted within the HEDforALL European project. HEDforALL is designed to enhance the inclusion of students with visual impairments, hearing impairments, physical/mobility impairments, and specific learning disabilities in higher education institutes. The present qualitative study aims to identify: (1) which assistive technology (software/apps and devices) students with disabilities are aware of, whether they have used them or not; and

(2) the assistive technology (software and hardware) that students with disabilities need at university and at home.

2.1. Participants

The aim of the present study was the recruitment of persons with visual impairments, hearing impairments, mobility impairments, and specific learning disabilities, studying or attending higher education institutes in the four countries (Germany, Greece, Italy, and Spain) participating in the European research project HEDforALL. The study comprised a cohort of forty-two participants with disabilities, consisting of 20 males and 22 females. Their ages spanned from 18 to 48 years, with a mean age of 27.64 years (SD = 7.49). Participants were sourced from four countries: Germany, Greece, Italy, and Spain.

In Greece, participant recruitment occurred through the accessibility office at the University of Macedonia, an institution dedicated to supporting students with disabilities. Both current and former students were invited to partake, along with engagement with local associations representing individuals with disabilities. In Spain, recruitment efforts were channeled through the Support Center at the University of Alicante, an entity established to aid students with disabilities. In Germany, recruitment strategies encompassed electronic communication modalities as well as direct interpersonal outreach. In Italy, accessibility advisors served as intermediaries, delineating the research objectives to students and facilitating connections with those expressing interest in participation.

Ten individuals with visual impairments participated in the study, comprising 5 males and 5 females, with ages ranging from 18 to 45 years (Mean = 25.9, SD = 7.61). Among the participants, 8 had congenital visual impairments, while 2 had acquired visual im- pairments, with onset occurring at 8 and 10 years of age, respectively. Six participants were undergraduate students, 3 were students in postgraduate/master's programs, and one participant was a Ph.D. student. Concerning the severity of their visual impairment, three participants reported total blindness, five indicated severe visual impairments, one reported moderate visual impairment, and one had low vision.

Eleven individuals with hearing impairments participated in the study, consisting of 7 males and 4 females, with ages ranging from 18 to 37 years (Mean = 26.35, SD = 6.52). Among the participants, 3 had congenital hearing impairments, while 8 had acquired hearing impairments. The onset of hearing loss occurred between the ages of 1 and 16 years (Mean = 6.38). Nine participants were undergraduate students, and 2 were students in postgraduate/master's programs. Regarding the severity of their hearing impairment, six participants reported profound hearing loss in both ears, two reported severe hearing loss in both ears, two had moderate hearing loss in both ears, and one participant had mild hearing loss in the left ear and moderate hearing loss in the right ear.

Eleven individuals with mobility impairments, comprising 5 males and 6 females, were enrolled in the study, with ages ranging from 19 to 46 years (Mean = 31, SD = 7.69). Among them, three participants had congenital mobility impairments, while the onset of mobility impairments occurred at an early age for three participants, during their teens for four participants, and in their forties for one participant. Eight participants were undergraduate students, and 3 were students in postgraduate/master's programs. The nature of their impairment varied, with 5 participants experiencing impairment solely in their lower extremities and 6 participants experiencing impairment in both their lower and upper extremities.

Ten individuals with specific learning disabilities, consisting of 3 males and 7 females, were involved in the study, with ages ranging from 21 to 48 years (Mean = 27, SD = 8.1). These participants presented with dyslexia either independently or in combination with other specific learning disabilities such as ADHD, dysorthography, dyscalculia, and dys- graphia. The age at which learning disabilities were diagnosed varied among participants, spanning from 7 to 29 years (Mean = 15.5). Eight participants were undergraduate students, and 2 were students in postgraduate/master's programs.

2.2. Instruments and Procedures

The study's instrument comprised two parts. The initial part encompassed demo- graphic and personal characteristics inquiries, including gender, age, place of residence, educational level, type of impairment, and more specific questions pertinent to the par- ticipants' impairments. The demographic queries varied based on the disability of the participant group. The second part of the instrument incorporated two questions from the semi-structured interview. The first question prompted participants to enumerate the types of assistive technology (software/apps and hardware/devices) that they know exist, regardless of whether they use them. In the second question, participants were asked to identify the assistive technology (both software and hardware) they required both at university and at home.

Semi-structured interviews were conducted with individuals with disabilities, either online or in person. Researchers provided participants with specific instructions on con- ducting the interview process. Prior to the interview, an introductory text was verbally communicated to participants, outlining the study's purpose and the interview proce- dure. Participants responded to the semi-structured interview questions orally, and the researchers recorded the entire interview via audio recording.

3. Results

Demographic and personal information of each participant was examined and coded, leading to the development of comprehensive individual profiles. The qualitative data collection process involved conducting interviews, recording them, and transcribing them meticulously. An initial comprehension of the collected data were obtained through a de- tailed review of the transcriptions. Subsequently, content analysis was utilized to organize the data into concepts and themes derived from the text. Assistive technology (including devices and applications) and mainstream technology used by the four groups of students with disabilities were identified based on the categorized concepts and themes. In the final phase of the analysis, each statement from the transcribed interviews was categorized, and the frequency of the mentioned devices and applications by the participants was quantified. To mitigate potential researcher bias affecting data interpretation, three of the authors collaboratively categorized each statement within the transcribed interviews.

Table 1 presents the results of the analysis of the answers given by the participants to the first interview question. In this question, the participants were asked to mention what kinds of assistive technology they are aware of. Moreover, Table 2 presents the results of the analysis of the answers given by the participants to the second interview question, concerning the assistive technology (software and hardware) that they need at university and at home.

Table 1. Frequency of occurrence of answers of students with visual impairments (VI), hearing impairments (HI), physical/mobility impairments (MI), or specific learning disabilities (LD) in the first interview question (objectives 1 of the study).

Assistive Technology Devices	VI	HI	MI	LD
Magnifier/magnifying glass/reading stone	3			
Hand magnifier	1			
Monocular (telescope)	1			
Victor reader (i.e., hand-held media player)	1			
Braille typewriter	1			
Touch tablet	1			
Video enlargers/zoomer	1			
Magnilink Magnifier (i.e., closed-circuits TV devices)	1			
Physical surface that works as a magnifier (connected to the computer)	1			
Portable video magnifier	1			
Refreshable Braille display	1			
Braille printer	1			
OCR scanner (i.e., optical character recognition)	1			
Fm systems (i.e., wireless assistive hearing devices that enhance the use of hearing aids)		4		
Adapted Keyboard			2	
Adapted Mouse			1	

Assistive Technology Devices	VI	HI	MI	LD
Cochlear Implant		2		
Hearing aid		1		
Light signaling devices with light and vibration signals		1		
Head stylus			1	
Assistive technology software apps	**VI**	**HI**	**MI**	**LD**
Screen reader	3			
Voice over (i.e., iOS screen reader)	2			
Text to speech software	1	1	2	
Teleo (i.e., Braille-to-speech software)	1			
Braille speak (i.e., notetaker)	1			
Microsoft windows magnifier	2			
Color inversion and magnification software	1			
NVDA (i.e., screen reader)	3			
Talkback (i.e., android screen reader)	1			
Voice dream software (i.e., conversion of files into audiobooks; text-to-speech reader)	1			
Text-to-Braille software	1			
Biblos—(i.e., Braille Translation Software)	1			
Odt2braille (i.e., OpenOffice plugin for print documents to a Braille embosser and to export documents as Braille files)	1			
Speech synthesizers	1		1	2
Software that modifies screen brightness (opaque, reflection)	1			
Text transcription systems (voice-to-text app for the deaf and hard of hearing)		4		
Voice dictation/recognition systems		1	1	
Automatic subtitles functions		1		
Sign language interpreters/translators		3		
Text translators/written language interpreters		3		
Connectclip (i.e., hardware that transform hearing aids into high-quality headphones and stream sounds to both ears)		1		
Tess services (i.e., telecommunication relay services—a communication assistant serves as a bridge between two callers)		1		
Communication assistants (i.e., personal support)		1		
ListenAll app (i.e., voice recognition software)		2		
TAL application (i.e., text transcript software)		1		
Voice control applications			1	
Alexa (i.e., Microsoft windows voice assistant)			1	
Dragon naturally speaking (i.e., speech to text software)			1	2
Read aloud software				3
Digital text enlarger				1
Cmap (i.e., concept map creation software)				1
Mind map creation software				1
ePico (i.e., automatic content summary software; software created for students with difficulties in reading, writing and numeric calculations)				1
ANASTASIS superMappe (i.e., software for creating conceptual maps)				1
Transcription software (speech-to-text applications)				1
Mainstream technology	**VI**	**HI**	**MI**	**LD**
Microsoft windows software	1			
Laptop/Personal computer	5	10	8	9
Scanner	1			
Smartphone/cell phone	1	5		
Tablet	1	2	3	3
Additional light sources (e.g., table lamp for strong additional light)	1			
FineReader OCR (i.e., optical character recognition)	1			
Sound recorders/note taking audio recorders		2	3	1
Microphone		3	1	

Soundproof rooms		1		
Microsoft Teams		1		1
Online lessons with virtual board		1		
Headphones		4		
OBS (i.e., video recording software/app)		1		
Monitor		1		
Pad and pen/paper and pen		3		1
Media players for videos with subtitles		1		
VLC media player for videos with subtitles		1		
Facetime		1		
Zoom Software		1		
lyricsFind (i.e., software for lyrics location and display)		1		
Writing extensions			1	
Video recorders			1	
Scanner pen (e.g., irispen)			2	
Mainstream technology	**VI**	**HI**	**MI**	**LD**
Online lessons (synchronous and asynchronous)			2	
Cortana on windows (i.e., virtual assistant)			1	
Email apps			2	1
Analog clocks with numbers (not lines or symbols)				1
Calculator				2
Digital reading software				1
Text editors				2
Apps for repeated reminders				1
Calendar with notifications				1
Spell checker software				5
Highlighting tools				1

Table 2. Frequency of occurrence of answers of students with visual impairments (VI), hearing impairments (HI), mobility impairments (MI), or specific learning disabilities (LD) in the second interview question (objective 2 of the study.

Assistive Technology Devices	VI	HI	MI	LD
Hand magnifier	1			
Braille typewriter	1			
Refreshable Braille display	1			
Braille printer	1			
OCR scanner (i.e., optical character recognition)	1			
Magnilink magnifier (i.e., closed-circuit TV devices)	1			
Physical surface that works as a magnifier (connected to the computer)	1			
Portable video magnifier	1			
Adapted keyboard			1	
Adapted mouse			1	
Cochlear implant		2		
Fm systems (i.e., wireless assistive hearing devices that enhance the use of hearing aids)		1		
Assistive technology software apps	**VI**	**HI**	**MI**	**LD**
Microsoft windows magnifier	2			1
Color inversion and magnification software	1			
Screen reader (e.g., NVDA)	3			
Talkback (i.e., android screen reader)	1			
Voice over (i.e., iOS screen reader)	1			
Voice dream software (i.e., conversion of files into audiobooks; text-to-speech reader)	1			
Text-to-braille software	1			
Odt2braille (i.e., OpenOffice plugin for for print documents to a Braille embosser and to export documents as Braille files)	1			
Biblos—(i.e., Braille Translation Software)	1			
Speech reader/synthesizer	1			1
Software that modifies screen brightness (opaque, reflection)	1			
Dragon naturally speaking (i.e., speech to text software)			1	2
Voice dictation/recognition systems			1	
Read aloud software				3
Mind map creation software				1
Cmaps (i.e., application for creating mind maps)				1
ePico (i.e., automatic content summary software; software created for students with difficulties in reading, writing and numeric calculations)				1
ANASTASIS superMappe (i.e., software for creating conceptual maps)				1
Transcription software (speech-to-text applications)				1
Text-to-speech software		1		
Text translators/written language interpreters		2		
Sign language interpreters/translators		2		
ListenAll app (i.e., voice recognition software)		2		

4. Discussion

Participants from every disability group were aware of common mainstream technol- ogy means such as laptops or personal computers and tablets, while participants with hear- ing impairments, mobility impairments, and specific learning disabilities were also aware of sound recorders or note-taking audio recorders. The assistive features of mainstream technology have already been recognized in previous research [9]. Access to mainstream technology devices is extremely important, as it allows individuals with disabilities to be included when specialized assistive technology is not available [36]. Indeed, the assis- tive technology provided at higher education institutions to students with disabilities is sometimes inadequate, despite the policies that have been voted for [33].

As for assistive technology, a few means were commonly mentioned by different disability groups. Participants with visual impairments, hearing impairments, and mobility impairments were commonly aware of text-to-speech software, while participants with vi- sual impairments, mobility impairments, and specific learning disabilities were commonly aware of speech synthesizers. It is obvious that different disability types need different types of assistive technology, especially if we take into consideration that even students with the same type of difficulty do not show a preference for the same assistive devices [17].

Concerning the equipment, both the software apps and devices they need at university and home, students mentioned various technological means. However, participants did not generally have common technological needs. The Microsoft Windows magnifier and the speech reader/synthesizer were common needs for participants with visual impairments and specific learning disabilities, while the Dragon naturally speaking software was a common need for participants with mobility impairments and specific learning disabilities. The difference in the needs of students with disabilities is expected, as different students have different needs based on the type and severity of their impairments, and as a result, certain features of one assistive device or a combination of features of various devices may be helpful to them [34].

The number of assistive technology components (software apps and devices) that participants know there are more (almost double) than the components they reported needing at home and at university. This finding was expected but should be interpreted carefully, as several factors may have an impact on it. For example, it is possible that in this interview question, participants chose to mention only the most necessary assistive technology devices and assistive software apps, as they know that it is difficult (mainly due to high purchase costs) to access a large number of assistive technologies. Also, some of the assistive technology devices and software apps that they know exist have similar uses to others (e.g., text-to-speech apps, speech-to-text apps, etc.), so they preferred to mention one of these as their preference.

The findings of this study hold significant practical implications for fostering inclusive and accessible education within higher education institutes. They offer valuable insights for both the staff working in accessibility units/offices and the teaching staff striving to accommodate the needs of students with disabilities. Notably, this study is pioneering in its detailed presentation of the types of assistive technologies known to students with disabilities, as well as the specific equipment required at university and home. It also sheds light on the potential disparity between awareness of assistive technology and actual usage among students with disabilities, highlighting a possible deficiency in assistive technology provision within higher education environments.

The comprehensive list of assistive technology hardware and software provided in this study serves as an invaluable resource for professionals and organizations in- volved in higher education. It has the potential to serve as a primary reference point for accessibility and assistive technology professionals, guiding investment decisions in technologies crucial for supporting students with disabilities. Continuous investment in assistive technologies by higher education institutions is essential to ensure that all programs and courses are inclusive and accessible to every student, eliminating barriers posed by technological limitations.

Furthermore, the list of mainstream technologies that can benefit students with disabil- ities offers a practical solution for making swift, cost-effective adaptations when resources or time constraints hinder inclusive course design. Mainstream technology can serve as a rapid response tool for teaching staff and students alike in unforeseen circumstances during lectures or other educational activities. Therefore, it is imperative for teaching staff to familiarize themselves with alternative uses of mainstream technology to effectively support students with disabilities as needed.

Although the sample is considered sufficient for a qualitative study, a potential limita- tion of this study is that the sample comes from four countries and does not fully represent global conditions. Future research would be useful to include a sample from more countries, including participants with disabilities from developing countries.

5. Conclusion

Participants across all disability groups demonstrated awareness of commonly used mainstream technology. However, when it came to assistive technology, only a few means were consistently mentioned across different disability groups. In terms of necessary equipment, including both software applications and devices used at the university and home, participants cited a variety of technological resources. Nevertheless, there was no overarching consensus regarding common technological needs among participants with different disabilities. Interestingly, the number of assistive technology components (both software applications and devices) known to participants exceeded the components they reported needing at home and university by almost double.

The findings of the present study bear significant practical implications for promoting inclusive and accessible education within higher education institutions. The exhaustive list of assistive technology hardware and software provided in this study serves as a valuable resource for professionals and organizations involved in higher education. Moreover, the compilation of mainstream technologies beneficial to students with disabilities presents a pragmatic solution for swiftly implementing cost-effective adaptations in cases where resource or time constraints impede inclusive course design.

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REFERENCES

1. Ari, I.A.; Inan, F.A. Assistive technologies for students with disabilities: A survey of access and use in Turkish universities. Turk. Online J. Educ. Technol. 2010, 9, 40–45.
2. Zhang, D.; Landmark, L.; Reber, A.; Hsu, H.; Kwok, O.M.; Benz, M. University Faculty Knowledge, Beliefs, and Practices in Providing Reasonable Accommodations to Students with Disabilities. Remedial Spec. Educ. 2010, 31, 276–286. [CrossRef]
3. Thurston, L.P.; Shuman, C.; Middendorf, B.J. Postsecondary STEM Education for Students with Disabilities: Lessons Learned from a Decade of NSF Funding. J. Postsecond. Educ. Disabil. 2017, 30, 49–60.
4. Bunbury, S. Disability in higher education—Do reasonable adjustments contribute to an inclusive curriculum? Int. J. Incl. Educ.
5. 2020, 24, 964–979. [CrossRef]
6. Weatherton, Y.; Mayes, R.; Villanueva-Perez, C. Barriers to Persistence for Engineering Students with Disabilities. Annu. Conf. Expo. Proc. 2017, 27650. [CrossRef]
7. Madriaga, M.; Hanson, K.; Kay, H.; Walker, A. Marking-out normalcy and disability in higher education. Br. J. Sociol. Educ. 2011,
8. 32, 901–920. [CrossRef]
9. Sachs, D.; Schreuer, N. Inclusion of Students with Disabilities in Higher Education: Performance and participation in student's experiences. Disabil. Stud. Q 2011, 31. [CrossRef]
10. Jeannis, H.; Goldberg, M.; Seelman, K.; Schmeler, M.; Cooper, R.A. Barriers and facilitators to students with physical disabilities' participation in academic laboratory spaces. Disabil. Rehabil. Assist. Technol. 2020, 15, 225–237. [CrossRef]
11. McNicholl, A.; Casey, H.; Desmond, D.; Gallagher, P. The impact of assistive technology use for students with disabilities in higher education: A systematic review. Disabil. Rehabil. Assist. Technol. 2021, 16, 130–143. [CrossRef]
12. McNicholl, A.; Desmond, D.; Gallagher, P. Assistive technologies, educational engagement and psychosocial outcomes among students with disabilities in higher education. Disabil. Rehabil. Assist. Technol. 2023, 18, 50–58. [CrossRef] [PubMed]

13. Quinn, B.S.; Behrmann, M.; Mastropieri, M.; Chung, Y.; Bausch, M.E.; Ault, M.J. Who is using assistive technology in schools?
14. J. Spec. Educ. Technol. 2009, 24, 1–13. [CrossRef]
15. Scherer, M.J. Outcomes of assistive technology use on quality of life. Disabil. Rehabil. 1996, 18, 439–448. [CrossRef] [PubMed]
16. Larsson Ranada, Å.; Lidström, H. Satisfaction with assistive technology device in relation to the service delivery process—A systematic review. Assist. Technol. 2019, 31, 82–97. [CrossRef] [PubMed]
17. Atanga, C.; Jones, B.A.; Krueger, L.E.; Lu, S. Teachers of students with learning disabilities: Assistive technology knowledge, perceptions, interests, and barriers. J. Spec. Educ. Technol. 2020, 35, 236–248. [CrossRef]
18. Fernández-Batanero, J.M.; Cabero-Almenara, J.; Román-Graván, P.; Palacios, A. Knowledge of university teachers on the use of digital resources to assist people with disabilities. The case of Spain. Educ. Inf. Technol. 2022, 27, 9015–9029. [CrossRef] [PubMed]
19. Pacheco, E.; Yoong, P.; Lips, M. Transition issues in higher education and digital technologies: The experiences of students with disabilities in New Zealand. Disabil. Soc. 2021, 36, 179–201. [CrossRef]
20. Perelmutter, B.; McGregor, K.K.; Gordon, K.R. Assistive technology interventions for adolescents and adults with learning disabilities: An evidence-based systematic review and meta-analysis. Comput. Educ. 2017, 114, 139–163. [CrossRef] [PubMed]
21. Dabi, G.K.; Golga, D.N. Availability, awareness, and utilization of assistive technologies among students with visual impairment: The case of Haramaya University, Ethiopia. Br. J. Vis. Impair. 2024, 42, 177–192. [CrossRef]
22. Bong, W.K.; Chen, W. Increasing faculty's competence in digital accessibility for inclusive education: A systematic literature review. Int. J. Incl. Educ. 2024, 28, 197–213. [CrossRef]
23. Seale, J.; Geogerson, J.; Mamas, C.; Swain, J. Not the right kind of 'digital Capital'? An examination of the complex relationship between disabled students, their technologies and higher education institutions. Comput. Educ. 2015, 82, 118–128. [CrossRef]
24. Williams, S.; Rooij, V.; Zirkle, K. Balancing pedagogy, student readiness and accessibility: A case study in collaborative online course development. Internet High. Educ. 2016, 28, 1–7. [CrossRef]
25. Clouder, L.; Cawston, J.; Wimpenny, K.; Mehanna, A.K.; Hdouch, Y.; Raissouni, I.; Selmaoui, K. The role of assistive technology in renegotiating the inclusion of students with disabilities in higher education in North Africa. Stud. High. Educ. 2019, 44, 1344–1357. [CrossRef]
26. Kisanga, S.E.; Kisanga, D.H. The role of assistive technology devices in fostering the participation and learning of students with visual impairment in higher education institutions in Tanzania. Disabil. Rehabil. Assist. Technol. 2020, 17, 791–800. [CrossRef]
27. Ahmad, F.K. Use of assistive technology in inclusive education: Making room for diverse learning needs. Transcience 2015, 6,
28. 62–77.
29. Shinohara, K.; Wobbrock, J.O. Self-conscious or self-confident? A diary study conceptualizing the social accessibility of assistive technology. ACM Trans. Access. Comput. (TACCESS) 2016, 8, 1–31. [CrossRef]
30. Edyburn, D.L. Assistive technology and students with mild disabilities. Focus Except. Child. 2000, 32, 1–24. [CrossRef]
31. Yilma, T.M.; Mekonone, S.T.; Alene, B.M.; Kibret, A.K.; Alemayehu, Z.; Addis, B.M.; Menna, D.W.; Davies, T.C. Assistive technology use and its associated factors among university students with disabilities: A case study in a developing country-mixed study design. Disabil. Rehabil. Assist. Technol. 2023, 19, 1748–1757. [CrossRef]
32. Arzola, R. Collaboration between the library and office of student disability services: Document accessibility in higher education.
33. Digit. Libr. Perspect. 2016, 32, 117–126. [CrossRef]
34. Leporini, B.; Buzzi, M. Visually-Impaired People Studying via eBook: Investigating Current Use and Potential for Improvement. In ICEEL '22: Proceedings of the 2022 6th International Conference on Education and E-Learning; Association for Computing Machinery: New York, NY, USA, 2022; pp. 288–295. Available online: https://dl.acm.org/doi/proceedings/10.1145/3578837 (accessed on 10 February 2024).
35. Kasdorf, B. Why accessibility is hard and how to make it easier: Lessons from publishers. Learn. Publ. 2018, 31, 11–18. [CrossRef]
36. Manjari, K.; Verma, M.; Singal, G. A survey on assistive technology for visually impaired. Internet Things 2020, 11, 100188. [CrossRef]
37. Bakken, J.P.; Putta, P.; Uskov, V.L. Smart Universities: Assistive Technologies for Students with Hearing Impairments. In Smart Education and e-Learning 2021. KES-SEEL 2021. Smart Innovation, Systems and Technologies; Uskov,

V.L., Howlett, R.J., Jain, L.C., Eds.; Springer: Singapore, 2021; Volume 240. [CrossRef]
38. Ndlovu, S. Provision of assistive technology for students with disabilities in South African higher education. Int. J. Environ. Res. Public Health 2021, 18, 3892. [CrossRef]
39. Yenduri, G.; Kaluri, R.; Rajput, D.S.; Lakshmanna, K.; Gadekallu, T.R.; Mahmud, M.; Brown, D.J. From assistive technologies to metaverse: Technologies in inclusive higher education for students with specific learning difficulties: A review. IEEE Access 2023, 11, 64907–64927. [CrossRef]
40. Cowan, R.E.; Fregly, B.J.; Boninger, M.L.; Chan, L.; Rodgers, M.M.; Reinkensmeyer, D.J. Recent trends in assistive technology for mobility. J. Neuroeng. Rehabil. 2012, 9, 1–8. [CrossRef] [PubMed]
41. Foley, A.R.; Masingila, J.O. The use of mobile devices as assistive technology in resource-limited environments: Access for learners with visual impairments in Kenya. Disabil. Rehabil. Assist. Technol. 2015, 10, 332–339. [CrossRef] [PubMed]