Enhancing Digital Access in Higher Education: Accessibility Tools and Training for All Students and Faculty in the Saudi Arabian Context

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24th May 2024

This thesis is submitted in partial fulfilment of the requirements for the degree of Doctor of Philosophy

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Abstract

Education is a fundamental human right that helps people overcome poverty, level out inequality, and promote sustainable development. However, due to social, economic, and cultural factors, 244 million children and teenagers around the world do not attend school (UNESCO, 2008). As online learning continues to grow and technology increasingly integrates into education, online learning also provides excellent opportunities to create an interactive and readily accessible educational environment. Yet, ensuring inclusivity for a wide range of learners, including those with disabilities, demands careful design of these learning environments (Walters, 2022). Therefore, a proactive approach towards learning environment design can help mitigate the potential challenges associated with content inaccessibility. The main purpose of this study is to measure the impact of embedding accessibility tools, specifically Ally, and the associated training on how to use it, to courses on a digital learning management system (LMS) such as Blackboard.

This research was conducted in two universities in Saudi Arabia. A mixed methods approach was adopted for this study, during which a survey of faculty members and students was conducted both before and after the training. Interviews and focus groups were also carried out with faculty members and students.

The integration of accessibility tools and tailored training for both faculty and students resulted in positive outcomes identified by the research study. The intervention had a positive effect on faculty members, by enhancing their technical proficiency in addressing three prominent accessibility challenges. This enhancement in technical skills empowered them to rectify accessibility issues, thereby leading to an overall improvement in the accessibility of digital course content. Furthermore, the training fostered a heightened awareness among faculty members about the importance of creating inclusive and accessible content. Similarly, the impact on students was noteworthy. There was an increase in downloading alternative formats, especially for course material among students.

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Acknowledgements

I would like to express my deepest gratitude to my family, my husband Anas and my sons, Tariq and Yahia—who have been unwavering pillars of support throughout this academic journey. Your understanding, patience, and encouragement have been instrumental in my success. My heartfelt gratitude extends to my devoted parents, whose endless love, encouragement, have been the bedrock of my academic journey. I am also deeply appreciative of my siblings for their continuous motivation and understanding during the challenging phases of my research. Their encouragement and willingness to provide support have been an immense source of strength.

I am deeply appreciative of Basel Abu Khiran, whose invaluable support and guidance were crucial in facilitating the complexities of this research. His dedication and expertise played an integral role, making this work achievable. Without his assistance, this endeavour would not have been feasible.

A heartfelt thank you to my supervisor Dr. Don Passey, for his continuous support and prompt responses. His guidance and mentorship have been invaluable, shaping the course of this research.

To everyone who played a part in this academic endeavour, I extend my sincere appreciation. Your contributions have left an indelible mark on this thesis and, by extension, on my academic journey. Thank you.

Author's declaration: I hereby declare that this thesis is the product of my own work and has not been submitted in a substantially similar form for the award of a higher degree elsewhere. The content within this thesis has not been previously published or submitted for a higher degree elsewhere.

Signature:

Chapter 1: Introduction and Background

The United Nations has identified “quality education” as one of its Sustainable Development Goals (SDG4). This objective strives to guarantee equitable access to education at all levels, including vocational training for marginalised groups such as individuals with disabilities, indigenous communities, and children facing vulnerable circumstances (UN, 2020).

Over the last two decades, the integration of information and communications technology (ICT) within higher education establishments has significantly increased. While this integration brought forth numerous advantages for both students and faculty, it also brought potential challenges concerning equitable access (Burgstahler, 2018). Thompson et al. (2010) explained this further: “Access alone does not provide adequate accommodations because poorly designed courses erect new barriers to equal participation in academics and careers” (pp. 61-62).

In addition, digital technologies, such as Learning Management Systems (LMSs) and digital learning materials, offer considerable advantages to both faculty and students. They have the potential to enhance conventional classroom settings, thereby increasing the efficiency of learning environments (Bond et al., 2021). However, research indicates a flip side, highlighting that these technologies can also erect obstacles and difficulties for students with disabilities. This is primarily due to lack of accessibility in digital tools and learning materials (Bong & Chen, 2021). Designing accessible content is an important step in ensuring that digital learning materials are accessible to all students. This involves adding captions to educational video resources to ensure equal access for students with hearing loss and includes using correct heading structure and providing image alternative text for students with vision impairments (Dunham-Sootheran, 2014).

Providing accessible content in online learning environments does not only help students with disabilities; it also offers advantages for various student groups, as students can engage with learning materials using different methods. For instance, while closed captions in a video primarily aid deaf or hard-of-hearing learners, they can also be

advantageous for other students. For instance, captioned videos enable English language learners to comprehend the content, which can be useful also for those studying in noisy environments (Walters, 2022). Providing accessible digital course content should not just be to meet legal requirements but also be considered from a social justice and equity perspective. It is a student-centred approach that proactively addresses accessibility as an inclusive practice for all students (Kezar & Posselt, 2020). In recent years, researchers have shown considerable interest in providing students with accessible and inclusive learning environments in higher education institutions (Gilligan, 2020).

1.1 Research Background

The researcher formerly held the role of an accessibility specialist in an educational institution in the Gulf area. Through her work there, she noted that the LMS being used complied with the Web Content Accessibility Guidelines (WCAG), thus ensuring that students with disabilities had access to the latest assistive technology devices, such as Braille devices. Nonetheless, it was apparent that the students with disabilities still faced challenges in accessing educational content when compared to their peers.

Furthermore, when the COVID-19 pandemic hit, ensuring the accessibility of digital content became a critical concern for students with disabilities seeking to access education. However, it is also important to note that even before COVID-19, creating accessible digital courses posed significant difficulties for both students with disabilities and disability service providers (Alsalem & Doush, 2018). This lack of accessibility had adverse effects on students' engagement with the curriculum (Bong & Chen, 2021). Consequently, these challenges amplified even further during the pandemic, impeding students from fully participating in higher education and effectively interacting with both their peers and instructors. The situation was then further exacerbated by the widespread adoption of digital platforms due to the pandemic (Walters, 2022).

This research builds upon the foundation of a prior study entitled "Toward Accessible Course Content: Challenges and Opportunities for Students of Determination in Higher

Education" (Obeid, 2018). The preliminary study aimed to investigate accessibility issues in digital content uploaded to the Blackboard (BB) LMS at a university based in the United Arab Emirates. This previous investigation helped shed light on the current state of accessibility in digital content.

The previous study conducted an analysis that focused on evaluating the accessibility of ten courses using BB. This technology-mediated environment facilitated content sharing and collaborative learning at a university. The accessibility assessment utilised five tools to evaluate 314 digital content files uploaded on BB, which consisted of Microsoft (MS) Word documents (43%), MS PowerPoint presentations (PPT) (33%), Portable Document Format (PDF) (14%), and HyperText Markup Language (HTML) (5%). Overall, the findings identified a total of 12 distinct accessibility errors, all of which could potentially hinder access to digital course materials. Among these errors, three were consistently prevalent across all 12 courses, with PDF files emerging as the least accessible file format.

In response to these results, the researcher developed a proposal aimed at improving the accessibility of course materials and addressing accessibility issues. The proposed actions included providing training to faculty members to raise their awareness about creating accessible content, as well as advocating for the integration of accessibility tools to bridge the gap between the identified accessibility needs and effective solutions.

As a result, two action points were introduced to the institution where the study was conducted:

1. A comprehensive training programme entitled "Creating Accessible Course Materials" was developed. The programme, executed between February and March 2021, aimed to equip faculty members with the knowledge and skills required to utilise diverse tools for generating accessible course materials, thereby fostering an inclusive learning environment. This training was also complemented by subsequent support sessions.
2. The implementation of Ally software into the university's Blackboard system was initiated. A pilot study involving a specific number of courses during the spring

semester of 2021 was conducted to assess the impact of Ally on students' learning outcomes. This tool offers an array of automatic accessibility enhancements, thereby potentially addressing the identified accessibility gaps within digital course content. The outcome of this pilot study guided the full integration of Ally across the university's Blackboard system following the spring semester of 2021.

Given these findings, the researcher opted to undertake the current research endeavour, aiming to quantitatively evaluate the influence of training sessions and the activation of the Ally tool.

1.2 Problem Statement

De Wit (2019) highlighted that along with increase in student enrolment in higher education, there has been an increase in the diversity of students coming from various geographic regions, socio-cultural backgrounds, socioeconomic statuses, and educational histories. Additionally, there has been a notable and increasing trend in the population of students with disabilities within higher education institutions (Fenlon et al., 2016). Poore-Pariseau (2011) reported that the demand for accessible course content, including online accessibility, was on a steady rise, mainly in the realm of online learning and uses of the World Wide Web. Walters (2022) indicated that the current research landscape concerning Web accessibility and online learning focused predominantly on technical aspects rather than exploring pedagogically effective practices linked to the utilisation of such technology. The existing literature underscores a notable emphasis on the technological dimensions, rather than pedagogical elements, within the realm of higher education, accessibility, and online learning. This has led to a gap in understanding potential areas of improvements when it comes to enhancing students' access to course content in online settings (Crow, 2008). Within the Florida College System, a study of 28 colleges cited that the following were the most frequent barriers endured by students with disabilities (Hong, 2015):

1. Attitudinal barriers of faculty members and staff.
2. Student advocacy skills.

3. Challenges in accessing learning platforms and learning materials in alternative formats due to accessibility barriers.

It is apparent that the format of digital material does not meet the needs of students with disabilities, such as not providing screen-readable text versions, interpreted graphics, or video captions (McGinty, 2016). Therefore, crafting accessible content acts as a crucial step in guaranteeing the inclusivity of web-based learning resources for all individuals. Distinct considerations arise regarding the assurance of accessibility for such materials. Therefore, a proactive approach towards learning environment design can help mitigate the potential challenges associated with content inaccessibility. Adopting the Universal Design for Learning (UDL) theory facilitates the creation of learning environments that cater to a wide range of learners including those with disabilities, which can help in ensuring accessibility of the content and meeting the needs of diverse learners (Grant & Perez, 2018; Nolin, 2019; Ortiz, 2014). However, ensuring the accessibility of web-based learning materials involves addressing various concerns and challenges.

Mancilla and Frey (2021) identified the key obstacles encountered when aiming to create accessible digital content, including: (1) inadequate faculty training and skills, (2) constrained resources and funding, (3) time limitations, and (4) lack of institutional policy and support. Many studies have also indicated that faculty members commonly exhibit positive attitudes towards inclusive education, which significantly impacts their willingness to engage in inclusive practices. Nonetheless, there is a lack of accessibility knowledge and technology skills among faculty members (Marquis et al., 2016; Walters, 2022).
Jackson (2023) extended this discussion, noting that educational institutions often struggle to comprehensively address all issues related to digital accessibility planning, implementation, and monitoring. This struggle is frequently due to a lack of knowledge on how to effectively approach and implement digital accessibility across a campus. Jackson asserts that an institution-wide approach should be considered and adopted. A reactive approach, as opposed to a proactive strategy, tends to result in more resource-intensive outcomes. Conversely, there is a notable absence in the literature addressing the significance of augmenting student awareness. The researcher's prior investigation

revealed that students generally lacked awareness about the availability of free accessibility tools that could assist in accessing digital content, additionally, Hayhoe et al. (2015), highlighted the importance for students to acquire the skills necessary for navigating and extracting information, data, and knowledge via technological means, standing as a pivotal factor in fostering social inclusion, however, limited evaluation has been undertaken regarding the utilization of these technologies. To address this issue, the researcher aimed in this research to incorporate an approach that fostered student awareness about the capabilities of accessibility tools, as well as their adept utilisation based on a student's specific needs, devices, and course materials.

To the researcher's knowledge, there has been limited emphasis on integrating accessibility training for both faculty members and students, while concurrently integrating the utilisation of accessibility tools. Additionally, there is a shortage of studies conducted on students' involvement in training and their awareness of the available tools. In the upcoming chapter, the literature review sheds light on the limited body of literature that currently focuses on both faculty and students simultaneously. This research will specifically focus on addressing this gap by prioritising the integration of accessibility training for both faculty members and students, along with the incorporation of accessibility tools.

1.3 Purpose of the Study

The primary objective of this research is to assess the impact of integrating accessibility tools, such as Ally anthology, as well as professional training on how to use these tools, within courses hosted on a digital Learning Management System (LMS) Blackboard. The central focus of the study lies in evaluating the perspective of both faculty members and all students on the impact of course content accessibility. This assessment will shed light on the efficacy of incorporating these tools to cultivate an all-encompassing learning atmosphere, catering to content presented in both English and Arabic.

Furthermore, this study aspires to identify avenues for enhancing the accessibility process. It is worth noting that, to the best of the researcher's knowledge, no prior research has delved into the ramifications of accessibility checker tools on enhancing digital accessibility within higher education institutions. Therefore, this research aims to bridge this gap and provide insights into the potential benefits and improvements that can arise from the strategic integration of accessibility tools and training within the realm of higher education. Additionally. the researcher intended to make this research accessible to all students, not just those with disabilities, as she believes that all students have diverse abilities and needs. This approach is particularly pertinent given the increasing number of diverse students enrolling in postgraduate programmes.

1.4 Research Questions

To determine the effectiveness of professional training and the utilisation of accessibility tools such as Ally in enhancing the digital accessibility of course content, this study explored the following research questions:

1. To what extent will the professional development delivered to the target faculty members raise awareness about accessibility issues and equip them with the skills to increase the accessibility of their digital course content?
2. To what extent will using the Ally software increase the accessibility of digital course materials?
3. In what way can faculty members' engagement with the Ally accessibility indicators contribute to enhancing their teaching practice for inclusive education?
4. To what extent does the use of alternative formats by students enhance their access to digital course content?

1.5 Significance of the Study

With the growth of online learning and the integration of educational technology into classroom settings, significant opportunities have emerged to create highly interactive and accessible learning environments. However, it is crucial to ensure that these

environments are designed to be accessible to a diverse range of learners, including those with disabilities (Walters, 2022). However, higher education institutions may lack a scalable organisation-wide approach to addressing digital accessibility comprehensively and including all elements such as technology and stakeholder (Jackson, 2023). Additionally, approaches and implementation strategies in higher education for digital accessibility often remain limited in scope, primarily operating within accessibility or disability services centres. Consequently, a reactive approach prevails, where accessible content is created only upon request or in the final stages, rather than integrating accessibility considerations from the outset. Literature supports that attempting to retrofit accessibility practices post-production incurs additional work, costs, and time delays, hindering student access (Axelrod, 2018; Bong & Chen, 2021; Das, 2022; Marquis et al., 2016).

It is important for educational institutions to support accessibility and inclusion at the institutional level for all students, regardless of their disabilities and needs. Therefore, institutions should encourage the creation of accessible online course materials by investing in resources to facilitate this process, as well as providing professional development and support to course instructors, instructional designers, and others involved in content creation such as accessibility tools (Bong & Chen, 2021; Francis et al., 2021; Nolin, 2019). Walters (2022) found a significant difference in the level of accessibility of course content between faculty members who participated in professional development and those who did not. Walters (2022) concluded that a qualitative study could examine faculty experiences with creating accessible content, focusing on areas of strength and weakness in implementing accessible course designs. Additional areas of interest could include the use of tools such as Blackboard Ally to measure course accessibility, as well as the conceptual framework of Universal Design for Learning (UDL). Jackson (2023) believes that accessibility training and communication are core components of any higher education digital accessibility initiative. Universities and postgraduate colleges must address the growing need for accessibility for economic, ethical, and legal reasons. This can be achieved by implementing regular faculty training on the principles of UDL. By taking this step, higher education institutions will not only

meet the needs of students more effectively but will also fulfil their broader responsibilities (Bong & Chen, 2021; Sanderson et al., 2022). Given that students are key stakeholders in accessibility initiatives, Walters (2022) concluded that an additional study is necessary to explore student experiences with course accessibility. The suggested study focuses on the barriers to accessibility encountered in courses, as well as students' uses of Blackboard Ally tools to generate alternative formats and their interaction with the content. Jackson (2023) suggested three primary recommendations to effectively improve digital accessibility in higher education. One of these recommendations is to "Avoid Technology-Only Solutions" (p. 113). She concluded that future studies should examine approaches to digital accessibility in higher education that include perspectives from faculty, institutional senior leadership, and students. Such a study could yield important insights regarding faculty perceptions, experiences, and attitudes towards digital accessibility. Additionally, a study's results could identify proactive and best practices to help faculty better understand how to make course materials accessible, thereby improving knowledge levels and effectively utilising accessibility tools.

This study seeks to provide valuable data for understanding best practices for digital accessibility, specifically in providing immediate access to alternative formats to enhance student learning and degree completion for all learners enrolled in higher educational institutions. The research aims to deepen the understanding of how institutions can effectively implement strategies to enhance digital accessibility for all users. Furthermore, this work may shed light on the challenges and opportunities associated with institutional change processes, offering valuable insights for policymakers, administrators, and educators seeking to promote inclusive practices in digital environments.

1.6 Researcher Philosophy and Positionality

1.6.1 Researcher Philosophy

“The only principle that does not inhibit progress is: anything goes” (Feyerabend, 1993, p. 23). “Accessibility, given this re-definition, is the ability of the learning environment to adjust to the needs of all learners. Accessibility is determined by the flexibility of the education environment… and the availability of adequate alternative-but-equivalent content and activities. The needs and preferences of a user may arise from the context or environment the user is in, the tools available (e.g., mobile devices, assistive technologies such as Braille devices, voice recognition systems, or alternative keyboards, etc.), their background, or a disability in the traditional sense. Accessible systems adjust the user interface of the learning environment, locate needed resources and adjust the properties of the resources to match the needs and preferences of the user” (Consortium, 2004, p. section 2).

(Seale, 2020) concluded that the increasing number of disabled students entering higher education necessitates a focus on their accessibility needs, which can no longer be overlooked. Additionally, equality and anti-discrimination legislation mandates that practitioners comply with accessibility requirements, including those related to e-learning. However, despite these drivers, accessibility practices are not improving. The solution to this issue lies in two key areas: training and the implementation of universal design.

These statements influenced the researcher’s philosophy for this study, which prioritises practical outcomes and real-world applications, aiming to produce actionable insights and effective solutions that can be implemented in educational settings. Moreover, the researcher believes that providing accessible educational content benefits all students.

In line with Feyerabend’s assertion that “the only principle that does not inhibit progress is anything goes” (Feyerabend, 1993, p. 23), the researcher seeks solutions that demonstrate efficacy in practice by following these principles:

1. Practical Outcomes: This research is driven by the goal of creating tangible improvements in accessibility within educational environments. The researcher is thinking beyond the research period and aims to support the institutions where the study was conducted by developing strategies and interventions that can be practically applied to enhance their learning experiences.
2. Methodological Approach: This research combines qualitative and quantitative methods to gather comprehensive data. This approach ensures that the most appropriate methods are used for addressing the research questions at hand.
3. Problem-Solving Orientation: Central to this research is a commitment to solving real-world problems. The research process includes testing the impact of utilising accessibility tools alongside training and adapting based on feedback from students and educators. This allows for continuous improvement and ensures that the solutions developed are both effective and sustainable.
4. Integration of Theory and Practice: This research bridges the gap between conceptual frameworks such as UDL and practical application. By grounding these studies in both academic theory and practical considerations, the aim is to produce findings that are not only academically rigorous but also directly applicable to improving accessibility in educational contexts.

1.6.2 Researcher Positionality

The researcher is working as an Accessibility Manager and is a member of several international and national accessibility community groups, such as the International Association of Accessibility Professionals. Additionally, she volunteers within her community to bridge the digital divide for marginalised groups, recognising that everyone has specific needs and the right to equal access. The researcher approached this study from this positionality, motivated by a commitment to equitable access for all students and support for faculty. The researcher's philosophy and her strong commitment to social justice and equitable access to education for all students underpin this study on creating accessible digital content in higher education. She emphasises the imperative to develop inclusive educational environments that cater to the diverse needs of every student, not

just those with disabilities. By ensuring that digital content is accessible to all, higher education institutions can dismantle barriers that perpetuate inequality and exclusion. This approach aligns with the principles of social justice (Geith & Vignare, 2008), advocating for fair and equitable access to educational resources. The research underscores the necessity of institutional commitment to accessibility, highlighting the role of practical solutions such as comprehensive training and the implementation of advanced accessibility tools (Bong & Chen, 2021). By prioritising these measures, the study advocates for a more just and inclusive higher education system, where every student can succeed. Having acknowledged this positionality, the researcher has endeavoured to exercise reflexivity throughout this study and to clarify its potential impact on her research and the knowledge it produces. Reflexivity in mixed methods research involves the critical examination of the researcher's positionality, values, and biases throughout the study. It entails self-awareness and transparency about how the researcher's background and perspectives may influence data collection, analysis, and interpretation. Although commonly associated with qualitative research, reflexivity can also enhance quantitative research by promoting thoughtful reflection on the research process. In mixed-methods studies, it contributes to a deeper understanding of the broader context in which research occurs, including social, political, and historical factors. Overall, reflexivity serves as a valuable tool for improving research quality and researcher integrity (Walker et al., 2013).

1.7 Research Context

It is important to note that this research has been conducted in the context of Saudi Arabia. In the past, Saudi Arabia's perception of disability has been shaped by the broad perspectives of medical models and the constrained perspectives of social models, resulting in a restricted comprehension of the condition (Alsalem, 2023). This resulted from how the concept of impairment is framed by the International Classification of Functioning, Impairment, and Health (World Health Organization, 2001). The medical model places emphasis on the limitations and incapacity of individuals with disabilities to perform various tasks due to their medical conditions. On the other hand, the social model

views disability as the outcome of people with disabilities and an inaccessible environment, whether related to physical, attitudinal, communication, or social barriers. Removing these barriers enables people with disability to engage more effectively with society, which implies that changes in the physical, attitudinal, communication, and social environments are necessary to promote equal participation in society (Alsalem, 2023; Iacovou, 2021). Through the concepts of equality, general access, and universal design, the social model reframes disability to accommodate people with disabilities everywhere, starting from schools to workplaces, instead of excluding or restricting them based on their medical conditions (Barnes & Mercer, 2004; Levesque & Malhotra, 2019; Robertson & Jaswal, 2024). The rights of people with disabilities (PWDs) in Saudi Arabia were limited until 1980 when the first regulation was introduced, especially following the enactment of the Basic Regulations for PWDs Rehabilitation Programs (Bureau of Experts at the Council of Ministers, 2024a). This regulation marked the first step towards ensuring that PWDs received coverage for rehabilitation services, diagnosis, and accommodations (Alsalem, 2023). In 2000, the government passed the Disabilities Code, developed by the King Salman Center for Disability Research (KSCFDR), which broadened the understanding of PWDs' needs across government and private sectors. The code addresses health, education, employment, and complementary services through public agencies and ministries (King Salman Center for Disability Research, 2024). On June 24, 2008, Saudi Arabia ratified the United Nations Convention on the Rights of Persons with Disabilities (CRPD), marking a significant turning point in the country's history and creating new guidelines for promoting equality for people with disabilities (UN, n.d.a). Since the Saudi government signed the CRPD in 2008, all ministries and organisations have received copies of the convention, highlighting the specific articles that need to be addressed. Additionally, an annual report is required to monitor the progress towards meeting the CRPD's objectives. This has led to the large-scale implementation of the convention's provisions across various sectors (Alsalem, 2023; GOV.SA, 2023; UNESCO, 2021).

Article 9(1) of the CRPD imposes specific duties on States Parties, including Saudi Arabia, primarily related to the removal of barriers concerning the physical environment, transportation, information and communications, including information and communications technologies and systems, and other facilities and services open or provided to the public (United Nations, 2006). Both the CRPD and the Saudi Arabian Disability Code provide comprehensive intervention and prevention policies and procedures aimed at ensuring these obligations are met. In Saudi Arabia, these frameworks work together to promote accessibility and inclusivity, thereby enhancing the rights and opportunities for persons with disabilities across various sectors, including education, healthcare, and employment (Alsalem, 2023).

One of the milestones towards equality was the announcement of the Sustainable Development Goals (SDGs) 2030 in 2015, which outlined 17 goals aimed at achieving a world with equitable and universal access to quality education at all levels, explicitly addressing disability (Arkorful et al., 2020; United Nations, n.d.d). Accessibility and equality were particularly highlighted in goals 4 (quality education), 8 (economic growth), 10 (reduced inequality), 11 (sustainable cities and communities), and 17 (partnerships for the goals). Subsequently, Saudi Arabian policy has increasingly focused on ensuring inclusive and equitable quality education for all, including people with disabilities. This led the Ministry of Economy and Planning to establish a department responsible for tracking the SDGs and their key performance indicators across all ministries, as well as in the government, private, and non-profit sectors (United Nations Saudi Arabia, 2024). It is important to mention that equality is guaranteed in Saudi Arabia by the ‘Basic Law of Governance’. Article 8 states that governance is based on justice and equality, and Article 26 protects human rights (Bureau of Experts at the Council of Ministers, 2024b).

A major transformation began with the release of the Saudi Vision 2030 in 2016, a strategic framework for the country that includes strategic objectives and initiatives for

persons with disabilities (Saudi Vision 2030, n.d). This vision began to reshape national policies to align with international policies, conventions, and treaties by focusing on various objectives, projects, and programmes aimed at enhancing the inclusion and rights of persons with disabilities (Alsalem, 2023).

For deeper exploration of access to education, particularly in the context of fostering inclusive environments within Saudi Arabia, pertinent information can be found in section 2.3.1.1.2: Access to Education in Saudi Arabia. Additionally, it is noteworthy to highlight the researcher's positive experiences during the study conducted across two universities in Saudi Arabia. Observations unveiled an obvious interest among participants in understanding and implementing methods to establish accessible environments, catering not only to students with disabilities but to all learners. Furthermore, the researcher's provision of office hours elicited inquiries and requests, with some participants attending multiple sessions. This observation suggests a potential shift towards a new paradigm for enhancing quality within Saudi Arabia.

1.8 Conceptual and Practical Frameworks

The two conceptual frameworks used in this study are Universal Design for Learning (UDL), and Web Content Accessibility Guidelines (WCAG). These frameworks are essential for understanding the impact of digital accessibility in higher education in Saudi Arabia when following a comprehensive approach.

1.8.1 Universal Design for Learning (UDL)

The term Universal Design (UD) was first coined by architect Ron Mace. The term UD discusses the design of products and environments to be usable for all users, to the greatest extent possible, without the need for adaptation or specialised design (Grant & Perez, 2018). The concept of universal design was then extended to the education setting and the term "learning" was added, resulting in remodelling universal design in education environments to universal design for learning (UDL) (Meyer et al., 2014). UDL is an

approach to instructional design that advocates providing students with choices from the outset, rather than retrofitting options. This involves giving students options in how they: (a) access information; (b) engage with course material; and (c) express what they have learned (CAST 2018a). Seale (2020) extended this conversation and highlighted the Universal Design in Higher Education (UDHE) that was adopted by the University of Washington (UW). UDHE builds upon ten principles derived from Universal Design (UD) and Universal Design for Learning (UDL), allowing for a wide range of applications in higher education. These applications include not only teaching and learning but also other functional areas such as physical spaces, administrative websites, and services (Burgstahler, 2015). The goal of these proactive practices is to ensure access for everyone at all levels. The UDHE framework clarifies that while applying UD and UDL principles campus-wide, it does not eliminate the need for accommodations, but it may minimise their necessity, thereby reducing the need for students with disabilities to make special requests. The researcher provides more information about the UDL framework in Chapter 2 of the literature review under Theme 1: 2.3.1 Digital Accessibility in Higher Education and 2.3.3.3 Accessibility Guidelines.

1.8.2 Web Content Accessibility Guidelines (WCAG)

WCAG is a set of guidelines developed and recommended by the W3C (World Wide Web Consortium) explaining how to make web content accessible for all learners, particularly students with disabilities (W3C, 2019). WCAG is the most recognised conceptual framework used in achieving digital accessibility. WCAG 2.1 is organised under four main principles of accessibility, which assert that web content must be perceivable, operable, understandable, and robust. Under each of these principles are specific success criteria for making web content accessible. These success criteria are divided into three priority levels: Levels A, AA, and AAA. Each successive level achieves a higher degree of accessibility than the one preceding it. When setting digital accessibility goals, institutions often target Level AA, depending on the application and end-user needs (White, 2019). Regarding the accessibility of digital content, the success criteria are set forth by WCAG

2.1 and stated standards. The researcher provides more information about the WCAG in Chapter 2 of the literature review under Theme 3 Conceptual Framework.

1.9 Organisation of the Study

In the first chapter, the thesis commenced by outlining the research problem, the study's purpose, and the research questions. The second chapter provides a thorough examination of existing literature and research endeavours. The third chapter expounds upon the research methodology, including discussion of variables, methods of data collection, and techniques for data analysis. Chapter four is dedicated to presenting the study's findings. The fifth and final chapter offers an in-depth discussion of the research outcomes, suggests potential directions for future research, and provides the conclusion and limitations of this study.

Chapter 2: Literature Review

2.1 Literature Review Introduction

The aim of this literature review is to examine the existing literature on accessibility in higher education, with a focus on how educational institutions can ensure inclusivity and support for all students. This review encompasses faculty knowledge, attitudes, and practices related to creating an inclusive learning environment and providing accessible digital content (Bong & Chen, 2021). Additionally, it is aimed to determine whether any awareness has been considered for students.

This literature review comprehensively examined prior research studies pertaining to accessibility and inclusivity in higher education, along with the accessibility tools and training that underpin this study. The first section encompassed relevant publications and studies concerning access to education in a broader context, including international legal frameworks. It specifically addressed the legal landscape in the Gulf area, where this study was conducted, with a primary emphasis on ensuring equal access to education for all. Within this context, the section highlighted the efforts made by countries to broaden participation in higher education and outlined the institutional requirements necessary to ensure equitable access. This section also delved into international laws concerning access to education, both in a general context and specifically in relation to inclusive education. It examined whether ensuring accessible content is mandated by law, providing a lens for the argument regarding the necessity of accessible digital content. If mandated, it will further shed light on the measures that institutions need to consider.

The second section delved into the role of educational technology and its pivotal role in ensuring the accessibility of digital content, ultimately enhancing the educational experience for all students. It further investigated how technology can enable the realisation of the principles laid out in Universal Design for Learning (UDL), which advocate for the development of flexible curricular content tailored to the diverse needs of students. This section provided a comprehensive view of the benefits and challenges associated with technology in education, emphasising the importance of training and

awareness for faculty and staff. This aspect aligns closely with this study's focus, shedding light on the critical role of faculty and staff in achieving accessibility goals.

The final section outlines the conceptual framework that grounds this study, which includes UDL as both a theory and conceptual framework. It also discusses the practical framework of digital accessibility. This section includes an evaluation of accessibility standards, such as those outlined in the Web Content Accessibility Guidelines (WCAG) and explores best practices in accessibility standards. Understanding these international standards provides a foundational understanding of what is expected of accessible digital content. This section addresses the study's background by grounding it in established accessibility standards and practices.

2.2 Literature Selection Strategy

While searching for literature on digital accessibility in higher education, the researcher adopted the literature review model "A Six Step Process for Conducting a Literature Review" developed by Creswell and Guetterman (2019). By doing so, the researcher systematically searched multiple online bibliographic databases, including EBSCO Host, Academic Search Ultimate, ERIC (Education Resources Information Center), Lancaster University's OneSearch, ScienceDirect, Web of Science, and Google Scholar, to gather the needed information and understanding around digital accessibility in higher education.

The literature search followed a broad-to-narrow approach, in which the author first searched for several general keywords - digital accessibility, inclusive education, accessible digital content, faculty, higher education, accessibility, and universal design for learning (UDL). The search results were then refined towards the higher education domain and further narrowed to accessible course content and alternative formats.

It is important to note that there were several key considerations when selecting papers for this literature review. The primary concern was their relevance to the research topics (Creswell & Guetterman, 2019), as the included literature had to be related to digital accessibility, especially in the higher education context. Another consideration was the

recognised importance of the study, which was gauged by the publication source and the frequency with which any article was cited by other works. When selecting the papers, the researcher focused primarily on peer-reviewed articles. Additional resources such as books, book chapters, industry reports and conference proceedings were also included. The included literature covered both empirical studies and systematic reviews.

A total of 459 articles and books were selected through the keyword search process. The author skimmed through these articles and then further narrowed the selection to 250 papers based on each article's subject, keywords, abstract, subject headings, and conclusion. Subsequently, a further content analysis was carried out based on these articles.

2.3 Themes of Interest

There were three recurring central themes throughout the literature as follows:

1. The first theme concerned education, particularly higher education, and how a new era of education was unleashed with online learning and the modern aspects of digital learning at home. This theme helped the researcher think of a pivotal question when it comes to accessibility to education, which was how to ensure that all students have equitable access in today's environment. This question then directed the narrative to the importance of knowing how to create accessible course content as well.

2. The second theme concerned technology, which was stated to have the potential to transform access to education curricula and content. Using modern and advanced technology systems in conjunction with an institution's Learning Management System (LMS), such as Anthology Ally, makes it possible for faculty members to create accessible educational experiences for all students. Furthermore, technology can help ensure that digital content is accessible and

even make educational content more accessible to all students. In fact, the principles of Universal Design for Learning (UDL) are promoting the creation of curricular content that is flexible enough to meet the needs of students with diverse needs, including those with disabilities and for second language students. This approach can be made possible with technology.

3. The third central theme concerned accessibility, particularly digital accessibility. While the Internet has helped make access to educational institutes and information easier for the learner, there are still many factors that limit the access to digital content on the Internet for students and students with specific needs. For instance, students with disabilities may encounter barriers and thus be unable to have equal access to online services that are otherwise accessible to others. In the educational context, creating web-accessible learning materials is a requirement that many faculty members can be unaware off. Not only that, but many faculty members do not have the technical knowledge required to create accessible learning material.

2.3.1 Theme 1: Access to Education

Education is a fundamental human right that helps people overcome poverty, levels out inequality, and promotes sustainable development (UNESCO, 2008). It is not just a means to acquire knowledge; it is a pathway to empowerment and improved life prospects. The significance of education is underscored by research showing that university graduates are two to three times more likely to access employment opportunities compared to those without higher education qualifications (David et al., 2009).

The importance of ensuring access to quality education for all is firmly enshrined in the Universal Declaration of Human Rights and various international legal instruments (UNESCO, 2019). These legal frameworks emphasise two critical principles: first, that

primary education should be free, compulsory, and universally accessible, and second, that secondary and higher education should be made accessible to all students based on their individual capacity and progress (Ngwenya, 2019; ViŞAn, 2019).

In recent years, there has been a remarkable global effort to make education more accessible. For instance, in 2013, the number of people enrolled in post-secondary education reached 210 million, a figure nearly three times higher than what it was two decades earlier. This trend is expected to continue, with projections indicating that by 2025, approximately 260 million students will be enrolled in post-secondary education worldwide (OECD, 2022). This rapid expansion in enrolment has transformed the landscape of higher education. As institutions strive to accommodate an increasingly diverse student body, they are faced with new challenges and opportunities (De Wit, 2019). The complexity of educational environments has grown, accompanied by the pressing need to ensure equal access to education for all students (May & Bridger, 2010). Addressing these challenges is imperative, given the diverse abilities and needs of students. It has drawn the attention of various stakeholders, international entities, and governments to promote inclusive education, characterised by innovative approaches and accessible materials that engage students with diverse abilities, skills, and cultural backgrounds (Bong & Chen, 2021; Roh, 2004).

While the task of managing diversity in education comes with its own set of challenges, it also offers unique opportunities (Bong & Chen, 2021; Sanger et al., 2020). Diversity in the classroom enriches the learning experience by enhancing critical thinking, communication, problem-solving skills, and creativity. However, realising these benefits hinges on the awareness and skills of faculty members in effectively managing diverse classrooms. Ineffectively meeting the needs of diverse students can negatively impact engagement, participation, and ultimately, equal access to education, potentially undermining overall learning outcomes (Cohen, 1994; Trotman, 2005).

This brings us to one of the central challenges in modern education – how institutional leaders formulate policies that address students' needs, wants, and concerns, and how faculty members implement strategies that cater to these issues in teaching and learning

(Hoffman et al., 2018). To effectively manage diversity, institutions must embrace inclusivity, equity, and individualisation, fostering a flexible and inclusive learning environment (Shahriar & Syed, 2017). Achieving this entails implementing inclusive education and universal design for learning (Moriña, 2017).

Inclusive education, which views diversity as an advantage rather than a problem, is not only a basic human right but also the foundation of equal access (OECD, 2022; UNICEF, n.d). It transcends merely supporting students with disabilities within regular education settings; it extends to responding to diversity among all students (Ainscow et al., 2006; Alghamdi, 2015). As educational institutions grapple with the complexities of diversity, the principles of inclusivity and accessibility become more critical than ever. The key challenge now is translating these principles into institutional policies, faculty practices, and accessible learning environments, ensuring that every student, regardless of their abilities and backgrounds, can access and benefit from quality education.

2.3.1.1 Access to Education International Laws and Standards

International laws and standards serve as a framework to ensure that educational institutions adhere to legal requirements related to accessibility (Tomaševski, 2001). Highlighting these laws emphasises the importance of compliance with regulations to avoid legal consequences (Walters, 2022). In the research, the aim of addressing Education International Laws and Standards is to gain an understanding of these laws and standards, which is crucial for ensuring that educational content complies with legal requirements related to accessibility. Furthermore, these international laws and standards establish a foundational framework for expectations regarding accessibility in education. By referencing them, researcher can evaluate the degree to which training programmes align with established accessibility guidelines. This examination helps gauge the extent to which current training programmes align with the established guidelines set by these international regulations.

The right to education has been acknowledged in many international and regional legal instruments, including treaties (conventions, covenants, and charters) and soft law items

(non-binding guidelines) as general comments, recommendations, declarations and frameworks for action (Geith & Vignare, 2008). However, the human right to education was not fully proclaimed under international human rights law until after World War II under the auspices of the United Nations (UN) (Hodgson, 2012). Consequently, after its recognition as a human right, international entities and activities have worked towards improving access to quality education. Two important calls to action initiatives, which are the Education for All initiative and the Millennium Development Goals which were developed by the UN and World Bank (World Bank Group, 2020), have helped improve the rates of primary education worldwide. Despite this improvement, many countries are still trying to increase participation in higher education. The necessity for continuous education has been acknowledged by many organisation, including the United Nations Educational, Scientific and Cultural Organization (UNESCO), and is expected to continue rising as jobs, technology, and knowledge are continuously and quickly changing (Chataika et al., 2012; Hodgson, 2012).

Further discussion in this section draws from the literature related to the right to education, international standards, and policy. The literature provides a required base to describe the scope of education for those in higher education, as well as identifying standards and laws that ensure digital access in higher education. Most of the data reported aims to reflect worldwide information. It is also important to note that by the end of this section, most of the research and review will focus on the Gulf Area, where this study was undertaken.

. The literature related to international law and standards was analysed using a thematic analysis, and three main themes were highlighted (A. The right to education in general, B. The right of specific groups, and C. Access to education in Saudi Arabia).

2.3.1.1.1 Education as a Human Right

While some treaties ensure the general right to education as a human right for everyone, others pertain to specific groups or contexts. Legal rights are often the starting point when thinking about human rights. Hence, the right to education should ensure that individuals are placed at the core of the education framework (UN, n.d.c). The following are the characteristics of education as a human right (UNESCO, 2019):

1. It is a right: education is impervious to the influence of political or charitable considerations.
2. It is universal: every individual, regardless of age, has the right to education without any form of discrimination. This encompasses children, adolescents, young adults, and the elderly.
3. It is high priority: education stands as a primary focus for the state. The responsibilities to safeguard the right to education cannot be readily disregarded.
4. It is a key right: education plays a pivotal role in enabling the exercise of all other human rights, encompassing economic, social, cultural, civil, and political dimensions.

In 1948, the international community adopted the Universal Declaration of Human Rights (UDHR), a landmark document that proclaimed human rights for the first time. Among its 30 articles, the UDHR recognises the right to education in general for all people as a fundamental human right (UNESCO, 2019). It states (in Article 26, n.p.):

"(1) *Everyone has the right to education. Education shall be free, at least in the elementary and fundamental stages. Elementary education shall be compulsory. Technical and professional education shall be made generally available and higher education shall be equally accessible to all based on merit*.

"(2) *Education shall be directed to the full development of the human personality and to the strengthening of respect for human rights and fundamental freedoms. It shall promote understanding, tolerance, and friendship among all nations, racial or religious groups, and shall further the activities of the United Nations for the maintenance of peace.*

"(3) *Parents have a prior right to choose the kind of education that shall be given to their children."*

The right to education is affirmed in a minimum of 48 international legal instruments, which include regional agreements, as well as 23 non-binding soft law instruments. For example, the International Covenant on Economic, Social and Cultural Rights (ICESCR) was adopted by the UN General Assembly in 1966 (UNESCO, 2019). Article 13 represents the most comprehensive provision regarding the right to education. It not only acknowledges the universal entitlement to education without any form of discrimination but also outlines a framework for realising this right fully:

"*The States Parties to the present Covenant recognize the right of everyone to education… They further agree that education shall enable all persons to participate effectively in a free society, promote understanding, tolerance, and friendship among all nations and all racial, ethnic, or religious groups*." (n.p.)

The ICESCR framework encompasses several crucial elements, including:

- The provision of free, mandatory primary education.
- The gradual introduction of free and accessible secondary education.
- Ensuring equal access to higher education based on an individual's capacity.
- Implementing measures to enhance literacy and improve education quality.

Additionally, Article 13 guarantees parents the freedom to select the type of education they wish for their children and the freedom to establish and manage educational institutions, provided they comply with the minimum standards set by the State.

Article 14 pertains to the State's responsibility to develop an action plan aimed at securing free compulsory primary education if it is not already in place (UN General Assembly, 2016).

Conversely, some treaties are directed towards groups or individuals, including children, women, individuals with disabilities, refugees, and migrants, or they pertain to specific

scenarios like education during armed conflicts and child labour. For instance, The Convention on the Rights of the Child (CRC) which was adopted on 20 November 1989 pertains to individuals identified as children, as defined by the CRC, encompassing all those under the age of 18 years. Article 28 within the CRC acknowledges education as a legal entitlement for each child, grounded in the principle of equal opportunity. The substance of Article 28 closely aligns with the provisions of Article 13 in ICESCR concerning responsibilities associated with educational standards (UN, n.d.b). Additionally, the Convention on the Elimination of All Forms of Discrimination against Women (CEDAW), established in 1979, interprets and implements the right to education with a focus on addressing the unique requirements and situations of women and girls (UNESCO, 2019).

The Convention on the Rights of Persons with Disabilities (CRPD), established in 2006 and relevant to this study, provides an interpretation of existing human rights law that considers the unique circumstances of individuals with disabilities. It offers clarification and adjustments regarding how all types of rights relate to persons with disabilities, outlining areas requiring adaptation to enable effective exercise of their rights. Additionally, it identifies instances of rights violations among this group and underscores the need for strengthened rights protection (Della Fina et al., 2017).

Article 24 of the CRPD acknowledges the entitlement of individuals with disabilities to receive education, free from discrimination, and founded on principles of equitable access. It places the responsibility on the state to guarantee the establishment of an inclusive education system encompassing all educational tiers, as well as opportunities for lifelong learning. Article 9 of the CRPD addresses the matter of accessibility, encompassing both physical and information technology aspects (UN, n.d.a):

“1.b Information, communications, and other services, including electronic services and emergency services.

“2.g Promote access for persons with disabilities to new information and communications technologies and systems, including the Internet.”

The right to education involves not only the right to obtain education but also the right to receive a high-quality education (UNESCO, 2019). The Committee on the Rights of Persons with Disabilities emphasises that accessibility within the education system extends beyond physical school structures. It encompasses various aspects, such as information and communication, assistive technologies, curriculum, educational materials, teaching methodologies, assessment procedures and support services. The overarching goal is to ensure an inclusive environment that promotes the inclusion of students with disabilities and upholds their equality throughout their educational journey (UN, 2016). As a directive, the Committee on the Rights of Persons with Disabilities urges states to pledge their commitment to implementing Universal Design. Universal Design, as defined in the CRPD, "means the design of products, environments, programmes, and services to be usable by all people, to the greatest extent possible, without the need for adaptation" (UNESCO, 2019, p. 103).

2.3.1.1.2 Access to Education in the Saudi Arabia

As this research was conducted in Saudi Arabia, this section delves deeper into how Saudi Arabia addresses the right to access and the legal frameworks they have established to ensure equitable access to education.

The government of Saudi Arabia has highlighted that education should be accessible to everyone and supports the idea of "Education for All". The laws of the Kingdom of Saudi Arabia guarantee all citizens the right to education without any discrimination and without being required to pay any fees. Article 30 of the Basic Law of Governance demands that "*the State provides public education and is committed to combating illiteracy"* (GOV.SA, 2023, p. n.p.). In addition, Article 13 of the Basic Law of Saudi Arabia states that "*Education shall aim to instill the Islamic creed in the young, impart knowledge and skills to them, and prepare them to be useful members in the building of their society, loving their homeland, and taking pride in its history*" (GOV.SA, 2023, p. n.p.).

The Educational Policy Document, issued by the Council of Ministers Resolution No. 779 of 17 December 1969, has also served as the primary source for information on the

foundations, purposes, and aims of education (UNESCO, 2021, p. 3). This comprehensive document underscores the importance of aligning with Islamic principles while also facilitating significant advancements in science and technology. Its overarching goal is to enhance human dignity and foster prosperity. There are four organisations responsible for educational policies, which are, the Ministry of Education (MoE), the General Presidency of Girls' Education, the Ministry of Higher Education, and the General Organization for Technical Education and Vocational Training.

The Ministry of Education, founded in 1953, replaced the Directorate of Education and aims to create and implement policies for both general and higher education. In the current general education system, there are four main stages which are pre-primary (ages 3-5 years), primary (ages 6-11 years), intermediary (ages 12-14 years) and secondary school (ages 15-18 years). Vocational training and tertiary education typically comprise of students between the ages of 18 and 22 years. The Technical and Vocational Training Corporation (TVTC) oversees technical and vocational training (Alghamdi, 2015). Finally, the Ministry of Higher Education was established in 1975 to supervise the implementation of the Kingdom's policy in the field of higher education, including teacher training in colleges and girls' colleges (UNESCO, 2021)

In 2020, the National eLearning Center adopted E-Learning standards for higher education in the Kingdom of Saudi Arabia. The main goal of the implementation was to provide a guide to quality control standards for e-learning (GOV.SA, 2023). These standards have been divided into two levels as follows:

1. A fundamental level which is mandatory to grant the license for e-learning programmes.
2. An advanced level which is optional.

Regarding digital accessibility within the e-learning standards for higher education in the Kingdom of Saudi Arabia, these standards are divided into two main sets. The first set is intended for entities and consists of three principles, each with its checkpoints. The

second set is designed for programmes and includes four principles, each with its checkpoints. Out of a total of 66 checkpoints, 13 are specifically related to digital accessibility and alternative formats. This alignment is of relevance to this study, as highlighted in Table. 2.1.

Table 2-1: E-Learning Standards for Higher Education in the Kingdom of Saudi Arabia.

Standards (for Entities)			
1.2	**Technology** Provide high-quality systems used for e-learning, including admission and registration systems, electronic learning systems, and any tools or systems used for this purpose.	Mandatory	Optional
1.2.6	The provision of data analysis systems and the ability to track the interaction of learners with their peers, content, and faculty members.	x	x
1.2.7	It supports different types of devices, regardless of their operating systems and screen sizes, including smartphones and tablets.	x	x
1.2.10	The systems provide the search feature for various types of digital content.	x	x
1.2.11	The systems provide accessibility for people with disabilities.	x	x
1.3	**Rehabilitation and Support** Practices related to the development and training of faculty members and learners to enable them to carry out their tasks in the field of e-learning.		
1.3.6	Empowering individuals with disabilities to access all e-learning and training services.		
Standards (for programmes)			
2.1	**Design** The practices for designing electronic courses and utilising licensed courses prioritise accessibility and inclusivity, ensuring individuals with disabilities can fully engage with educational content and activities.		

2.1.3	Adherence to Universal Design for Learning (UDL) standards in design.		x
2.1.5	Ensure compliance with the rules of Web Content Accessibility Guidelines (WCAG 2.0) or their updated versions.		x
2.1.7	Provide digital content in various forms (text, audio, and visual materials) that accommodate diverse learner needs and preferences.	x	x
2.1.8	Provide design, media, and fonts in various sizes, colours, and formats to facilitate readability and reduce strain.	x	x
2.1.9	Ensure the quality of educational and training media, with the capability for textual transcription.	x	x
2.1.12	Present digital content in an organised manner that facilitates navigation between its parts.	x	x
2.3	**Equity and accessibility** Practices related to accessibility, learning, and the use of e-learning software, tools, and technologies applied within the university or educational institution, including the sharing of educational resources, knowledge exchange, interaction, and communication.		
2.3.2	Ensuring equitable access to the programme for all learners, regardless of their abilities.	x	x
2.3.4	Presenting content in multiple auditory and visual formats.		x

2.3.1.2 Widening Participation in Higher Education

Many countries around the globe (the United Kingdom (UK), Canada, Europe, Brazil) are working on widening participation in higher education to accommodate and match the needs of all students and make education accessible to everyone (Shah et al., 2015). By increasing participation in higher education, countries and leaders aim to improve

learning, increase participation in post-compulsory and higher education in the twenty-first century, accelerate the process of achieving more equitable educational participation and ensure that education is accessible to all students (David et al., 2009; Lambert, 2020). More specifically, the goal is to increase the involvement among a diverse group of people, especially those who are underprivileged in terms of poverty or socioeconomic class, as well as in terms of age, ethnicity or race, and gender (David et al., 2009). It is anticipated that by ensuring that a wider range of students are supported into and through higher education, the benefits of health, welfare, and prosperity that result from successful graduate employment will be spread more equally throughout society.

It is important to also note that policies and frameworks to increase widening participation are also referred to as “Widening Access”, “Fair Access”, “Social Inclusion”, and “Student Equity”, “Inclusive Education”, and “Universal Design for Learning” in various parts of the world (David et al., 2009; Shah et al., 2015). The term “Inclusive Education” is used in the context where the research was conducted and will be used in this study to describe equitable access to higher education. The terms “Universal Design for Learning” and “Social Inclusion” are sometimes used interchangeably with student equity to discuss equal access to educational materials (Naylor & James, 2016; Nolin, 2019; Reinle, 2020).

Even though the term “social inclusion” is more commonly used to refer to welfare policies aimed for unemployed adults who are excluded from society, it can also be applied to efforts to bring marginalised or excluded societies back into society. This can be done by addressing food, housing, and basic health concerns as a foundation to achieve stability, training, and employment (Taket, 2014). In a time when the world is rapidly turning to digital services, which was further accelerated by the COVID-19 pandemic, government services, education, health care, and banking are being digitalised. With this shift to digital services, the term “digital inclusion” now plays a key role in promoting social inclusion and facilitating access and participation in higher education (Basit et al., 2012). In this study, the term “digital inclusion” will be used to refer to equal access to digital educational materials and content.

2.3.1.3 Inclusive Education

Inclusive education has become a crucial part of countries' educational policy agendas worldwide, as well as in both research and professional practices (Amor et al., 2018; Booth & Ainscow, 2002). The concept of inclusive education has been theorised and reviewed across various disciplines, including psychology, special education, and pedagogy and has been part of the initiatives that appreciate diversity in education (Amor et al., 2018). In policy development, there has been movement taken to systemise the right to inclusion for all students by ensuring that all stakeholders are involved (UNESCO, 2008).

Opertti et al. (2014) proposed four core ideas internationally that relate to the continually evolving journey towards inclusion: the 1948 Universal Declaration of Human Rights, a response to children with special needs (1990), a response to marginalised groups (2000), and transforming education systems (2005). As a result, various notions of inclusion and approaches to promote inclusive education have been considered in this regard. For instance, some consider it a matter of replacing the former term 'integration' with inclusion. These approaches concentrate on conventional methods to address the requirements of students facing various challenges within regular education classrooms (Amor et al., 2018). Nevertheless, defining inclusive education just in the context of a setting or a set of practices is controversial because such definitions can be influenced by changes in educational practice, environment, culture, and circumstances that soon make these factors useless and out of date (Forlin et al., 2013). Consequently, it is necessary not only to consider practices that foster inclusive education, but also the implied theoretical aspects that define inclusion in education.

In this sense, (Ainscow et al., 2006) summarised the conceptualisations given to inclusive education in six main categories, which is beneficial in reflecting the various ways in which inclusion has been conceptualised:

- "Inclusion as concerned with disability and special educational needs": unfortunately, this is seen as the most common approach. Viewing inclusion as concerned with disability and special educational needs can act as a barrier to the development of the broader understanding of inclusion. Additionally, this approach

draws attention to the weakness of individuals rather than addressing the more important factors that might cause barriers to people's participation.

- "Inclusion as a response to disciplinary exclusions": inclusion here is associated with children with specific needs or behavioural issues that lead them to be excluded from education.
- "Inclusion as about all groups vulnerable to exclusion": like the first perspective, this frame of reference focuses on a specific group of students, such as ethnic minorities and refugees who are seen as vulnerable to exclusion.
- "Inclusion as the promotion of the school for all": this method relates to what is called the comprehensive school in England, which refers to the development of a school for all, rather than selecting students based on academic achievement or readiness.
- "Inclusion as 'Education for All'": this is a reference to UNESCO's "Education for All" agenda, which aims to increase the access to education and participation globally by establishing a set of objectives.
- "Inclusion as a principled approach to education and society": the presentation of inclusive values, such as equity, participation, community, and respect for diversity, is regarded as a crucial step in directing overall policies and practices.

Since the different definitions of inclusion hold different values, it is important to be clear about such values in any research. The notion of inclusion that informs the present study is that inclusion involves all students, in line with the idea of 'Education for All'. It also follows the key factors of inclusive education for all students that were described by UNESCO (2008), including: (a) enhancing student participation and limiting exclusion from and for education; and (b) the presence, participation, and achievement of all students, but most importantly of those who are excluded or at risk of marginalisation. This study is based upon the following beliefs: "all individuals, regardless of exceptionality, are entitled to the opportunity to be included in regular classroom environments while receiving the supports necessary to facilitate accessibility to both environment and information" (Shyman, 2015, p. 351).

The development and progress of inclusive education continues to be one of the most difficult tasks facing those working to improve education for all students, including those with a disability (Farrell, 2000). According to Nilholm (2021), the lack of knowledge of how to create inclusive classrooms, the ongoing use of segregated educational methods and the various points of views of teachers, professionals, and parents about the implementation impacts its appropriateness.

2.3.1.4 Inclusive Education in Higher Education

Inclusive education was developed and implemented within schools' educational settings prior to that in higher education. Following the international agreements concerning human rights, such as the UNESCO Salamanca Statement (1994), UN Sustainable Development Goals (2015), and UNESCO Education 2030 Framework for Action (2015), inclusive principles and practices have been considered in the agendas, policies, teaching and learning practices in higher education institutions in many countries over the past thirty years. Inclusion is often associated with disabilities and special education (as discussed in a previous sub-section); however, some countries conceptualised inclusion in broader terms, as pertaining to equity and social justice for all groups (Stentiford & Koutsouris, 2022). In the UK, such principles have become firmly embedded in higher education following the introduction of equality, which aims to shed light on how "protected characteristics" in higher education are treated (i.e., age, disability, gender reassignment, marriage and civil partnership, race, religion or belief, sex, sexual orientation) (GOV.UK, 2013). Similar movements have also been seen in other countries including Australia, where social inclusion became more prominent in higher educational policies after declaring the *A Fair Chance for All* in 1990 (Naylor & James, 2016).

In the context of Saudi Arabia, where the study has been conducted, the country's education strategy includes essentials and fundamentals that are related to inclusive practices under the umbrella of special education such as Article 188: "the country should focus on education for physically and mentally disabled persons as per its abilities and create special cultural curriculum and diversified training in confirmation with their situation" (Economist Intelligence Unit, 2008, p. 2). Additionally, the national strategy

emphasises the need to develop general education in such a way as to provide inclusive learning opportunities and support systems for all students (UNESCO, 2021).

However, providing an inclusive learning environment for all students through the traditional approaches of inclusion (special education) are not expected to be effective in creating inclusive environments for diverse students. That is because these approaches focus on students with specific needs and disabilities only, rather than shifting the focus to remove the barriers that create exclusion not only for students with disability but also for other students (Doughty & Allan, 2008). Therefore, and because all students are considered to have common and unique needs and abilities, the aim is to develop a wider range of approaches that focus on meeting the needs of all students, and not just those with special needs or disabilities (Stentiford & Koutsouris, 2022).

2.3.2 Theme 2: Technology and Education

2.3.2.1 Technology's Impact on Higher Education

It is argued that the evolution of technology has fundamentally changed the education system and pedagogical practices (Anders, 2018; Eaton & Pasquini, 2020). Advances in technology paired with the need to improve educational systems have resulted in an increase in the use of information and communications technology (ICT) in higher education institutions over the past 20 years. The implementation of ICT in the education system includes adopting learning management systems (LMSs), electronic textbooks, instructional software, and distance learning programs (Njoku, 2015). The use of ICT is a major step forward since studies have shown that the use of LMSs and digital learning materials have a positive impact on traditional classroom environments, thus making learning environments more effective and engaging (Bong & Chen, 2021).

However, this movement towards educational technology can bring with it its own challenges when it comes to the accessibility of education. Therefore, concerns need to be expressed regarding campus physical accessibility, as well as accessibility to all courses and learning materials to students with disabilities (Woodfine et al., 2008). This

includes activities inside and outside classrooms and access to electronic resources (Alsalem & Doush, 2018). In this context, accessibility to higher education would be incomplete without access to related websites and LMSs (Woodfine et al., 2008). Another important factor that helped accelerate the adoption of technology and digital services was the COVID-19 pandemic. In fact, the COVID-19 pandemic helped increase the use of ICT by higher education institutions more than ever before (Walters, 2022). That was largely because when the pandemic hit, most of the teaching activities were conducted online and all educational content switched to digital format. The significant impact of COVID-19 led to the broad adoption of digital platforms and online learning, creating a new educational trend. With this shift to digital learning, it is now imperative that digital learning environments provided by higher education institutions are accessible and inclusive for all students (Bong & Chen, 2021; Das, 2022).

2.3.2.2 Online Learning Management Systems (LMSs)

Over the past ten years, there has been a significant advancement in digital processing and communication (Burrell-Ihlow, 2009). By using LMSs, most universities are introducing elements of online learning into their traditional classrooms (Govender, 2010). The leading methods of education in universities are face-to-face, online learning or a blend of the two, depending on the instructor's structuring of the course (Massengale & Vasquez, 2016). LMSs can be used as technology-mediated environments to share content and activities for collaborative learning (Duval et al., 2017). The use of LMSs provides the user with the ability to network and learn anytime, anywhere. The most well-known LMSs are Moodle, Canvas, and Blackboard, which are all commonly used to deliver online courses, as well as hybrid courses. Most of the LMSs mentioned previously were developed according to the standards established by the internationally renowned Web Content Accessibility Guidelines (WCAG) 2.0 Level AA (Kurt, 2019). The content of LMSs contains a diverse range of resources and materials, such as forum postings, tests, timed quizzes, embedded videos, and downloadable documents in various formats (Govender, 2010; Kurt, 2019). According to Govender (2010), the utilisation of LMSs will have the following benefits:

1. Students will become more responsible for their learning.
2. More support will be given to diverse students.
3. The quality of teaching will improve.
4. It encourages peer co-operation and evaluation.
5. It provides a standard communication tool.

2.3.2.3 The COVID-19 Pandemic, Remote Learning and Accessibility

The COVID-19 pandemic brought about significant changes across all aspects of our lives, including social aspects, institutional structures, and political priorities. Education has not been exempt from these changes, undergoing a pedagogical transformation to facilitate remote teaching and learning (Gamage et al., 2022). COVID-19 forced universities around the world to increase their online courses and to move to remote learning at the beginning of the pandemic for most higher education institutions (Bong & Chen, 2021; Das, 2022). This shift to remote learning has produced mixed results, presenting both opportunities and challenges, particularly for students with disabilities as well as for all students and faculty (Sintema, 2020; Wilkens et al., 2021).

For example, digital teaching suddenly became crucial, without providing alternative methods. Instructors who had previously used learning management systems primarily for filing presentations now had to organise all learning activities via LMS and other digital tools. Students were also unfamiliar with many of the tools and features of LMSs (Wilkens et al., 2021). Additionally, the number of students experienced in using digital tools in various settings increased. At the same time, this shift posed challenges for those inexperienced in digital teaching or studying, as they were given little time to familiarise themselves with the tools (Scott & Aquino, 2020). This was particularly challenging for students with disabilities who relied on assistive technologies, such as screen readers, but were not adequately equipped at home or the LMS activities were not accessible (Wilkens et al., 2021).

On the other hand, remote learning enabled students to access course materials more easily at any time, attend live and recorded lectures, and reduced the necessity for

students with physical disabilities or those who are immunocompromised to commute to in-person classes (Walters, 2022).

Linder et al. (2015) stress the need to ensure accessible online learning for all students as student engagement and success are negatively impacted by inaccessible content. For example, the Weber State University (WSU) moved many courses online that had not previously had an online element. Faculty highlighted that they were trying to develop online materials as much as possible, and, for many of them, accessibility was not a priority for them (Francis et al., 2021). The reasons for this are many:

1. lack of technical expertise and professional development for faculty to provide accessible content (Bong & Chen, 2021; Francis et al., 2021).
2. Many faculty and educators are unaware that their materials should be accessible (Bong & Chen, 2021; Jackson, 2023).
3. The lack of sufficient support services to create accessible materials (Alsalem & Doush, 2018; Francis et al., 2021).
4. According to one of the surveys, faculty members stated that it was the students' responsibilities to let them know about any accommodation needs, so a faculty role related to accessibility is based on reactivity (Coleman & Berge, 2018; Guilbaud, 2019; Poore-Pariseau, 2011).

Digital teaching and learning formats have the potential to promote equal participation for previously disadvantaged and marginalised groups, particularly for students with disabilities. Learning materials can be designed to be accessible for students with sensory impairments, allowing them to work at their own pace (Wilkens & Buhler, 2022). However, this necessitates adherence to the principles of UD and accessibility in the selection and design of digital platforms, programmes, and tools. Unfortunately, "new educational ICT services are seldom fully accessible" (Wilkens et al., 2020, p. 129). Therefore, ensuring the accessibility of digital learning environments is only the first step. Learning materials and teaching methods must also be appropriately accessible for all students considering diverse learning conditions (Das, 2022; Dunham-Sootheran, 2014; Wilkens et al., 2020).

2.3.2.4 LMS Accessibility and Education

While a LMS has many benefits, it is still important that students with disabilities can make use of information on a LMS and other educational platforms. In fact, studies show that students are still facing obstacles accessing educational platforms such as LMSs (Alsalem & Doush, 2018). One way that students with disabilities are trying to make use of the information on LMSs is by utilising assistive technology devices (AT) (Kurt, 2019; Massengale & Vasquez, 2016). However, for optimal and equal access to education for all students, including those with disabilities, the following should be considered: (1) LMSs should be able to be used with assistive technology devices such as screen readers; and (2) online course material should be created in an accessible format.

2.3.2.5 Digital Educational Materials and Accessibility

Access to educational content in the classroom can be a major obstacle to the success and engagement of students. For example, printed text is relatively inflexible and might be a barrier for some students who struggle with printed text. On the other hand, digital text offers more flexibility to adjust the text size, colour and can be read by text-to-speech to suit diverse access needs (Seale et al., 2018). However, it should be created in an accessible format to allow this flexibility and adjustment (Dunham-Sootheran, 2014). This difficulty in providing the appropriate kind of content to all students is why thoroughly designing educational materials and accessibility is important.

With the option of learning face-to-face or digitally that is present in many universities, it is more important than ever before to design accessibility content in a way that aligns with the method of education. Designing accessible content is an important step in ensuring that the digital learning materials are accessible to all students regardless of whether the content is uploaded on a specific LMS for face-to-face or for distance learning. According to (Walters, 2022), some of the challenges that come with ensuring accessibility of digital learning materials include: (1) the availability of captions for audiovisual resources to ensure equal access for deaf and hard-of-hearing populations, as well as for those who have a learning difficulty and are non-native language speakers; (2) the use of appropriate

heading styles and image descriptions for students with vision impairment; and (3) ensuring sufficient colour contrast.

The provision of accessible content represents a legal obligation in some countries, for example, in the United States. IDEA 2004 and the NCLB mandate educational entities to ensure that students with disabilities have access to the general curriculum and the accessible materials used within them (IDEA, 2004; NCLB, 2001; Stanley, 2013). With the reauthorisation of IDEA 2004, the National Instructional Materials Accessibility Standard (NIMAS) was developed. The main goal of Accessible Instructional Materials (AIM) is to remove barriers for students with disabilities. AIM aims to achieve that by including books in braille form or large print, as well as electronic text that can be accessed in a variety of ways, including text converted to speech (PACER Center, 2011).

Designing accessible educational content offers benefits for all students, as students can interact and engage with learning materials in a variety of ways based on their needs and the environment. For example, captions for videos are essentially intended to help deaf and hard-of-hearing students to access educational visual auditory materials. However, captions can also benefit all students. For instance, non-native English speakers can benefit from captioned videos to better understand the presented content. Moreover, if students are working in a noisy atmosphere, such as on public transportation, they will benefit from the caption as well.

The provision of accessible digital content in educational environments helps improve the teaching and learning process for students with and without disabilities (Walters, 2022). According to Hashey and Stahl (2014, p. 71): “The decisions educators make regarding online instructional resources are perhaps more critical to students’ success than decisions about print-based materials because learning occurs exclusively through and within this environment”. Consequently, accessibility should be considered at the very beginning when developing digital educational content courses.

Considering the accessibility of educational content is not only related to accessibility tools and LMSs, but it is also related to the role of faculty members. With faculty members

being the first liners in dealing with students, they should also be trained to create accessible content and skilled in assessing the accessibility of online content so that students can benefit from a more inclusive learning environment (Walters, 2022).

One example of an accessibility tool that is improving digital accessibility is Ally Anthology, which is an anthology based on the Web Content Accessibility Guidelines (WCAG) 2.1 AA Standards (Anthology, n.d). Ally is a tool that supports faculty members in creating accessible learning materials and provides guidance for improving its accessibility rating within LMSs. Additionally, Ally also provides students with alternative formats of the content uploaded by faculty members. Accordingly (Ally Anthology, 2023, p. 1), Ally helps “Create more inclusive learning environments by making digital course content more accessible for all. Improve the experience of every student and instructor by giving them the ability to tailor that experience to their specific needs and preferences”. It also helps faculty members and educational content creators make their digital course materials more accessible for all students.

Another important benefit of using Ally is that it integrates easily with LMSs like Blackboard, Canvas, and Moodle to provide accessibility feedback and recommendations. It also provides suggestions to fix any accessibility issue for course materials. Ally also provides faculty members with accessibility indicators next to file attachments, images, and other media that show how accessible the content is. If a faculty member clicks on an indicator, they can view the details of the accessibility issue and a step-by-step guide on how to fix it. For example, Ally indicator shows if a document is missing alternative or poor colour contrast. In addition, Ally provides students with immediate access to accessible alternative file formats. Figure 1.1 shows the Ally indicator for a MS PowerPoint file. (For more information on Ally, see Appendix One.)

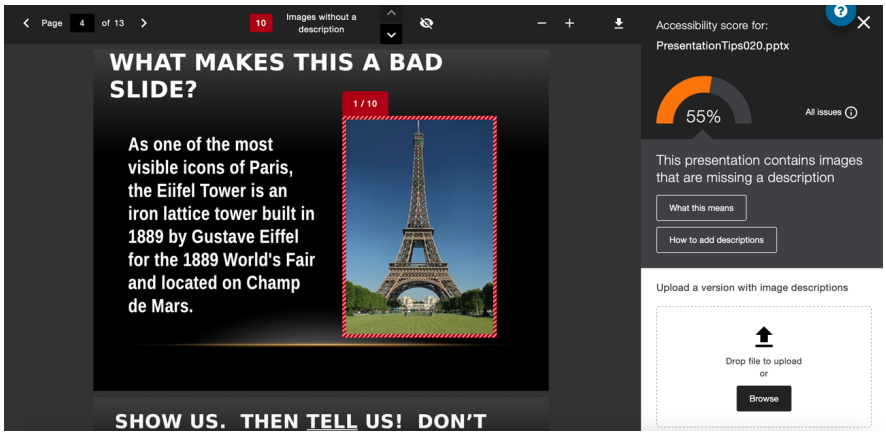


Figure 2-1. Ally Indicator for a MS PowerPoint File.

An additional component of developing accessible course content is the use of the Microsoft accessibility checker tool. The Accessibility Checker is a free tool available on Microsoft Word, Excel, Outlook, OneNote, and PowerPoint. It identifies a majority of the accessibility concerns, delves into the potential difficulties they might present for students with disabilities, and offers remedies to address these issues (Microsoft, 2023).

However, according to Hashey and Stahl (2014), the availability and ease of access of these tools are not enough, as faculty members should be skilled in identifying and assessing the accessibility of digital content, as well as knowing how to utilise accessibility tools in order to create an inclusive learning environment that is beneficial to all users. Gordon et al. (2009, p. xii) state that, “The law on the books calls for access to the general curriculum for students regardless of ability or disability but realizing that vision requires more than simply telling people what the law requires”. This emphasises the importance of supporting faculty members in translating this law to action and implementation by offering professional development and accessibility tools.

2.4 Conceptual Framework

2.4.1 Theoretical Foundations

A. Universal Design for Learning (UDL)

This research study on the use of professional development and accessibility to enhance the digital accessibility of course content is grounded in the theoretical foundations of Universal Design for Learning (UDL). UDL is itself based on the principles of Universal Design (UD), which was developed to promote universal accessibility in the built environment, first coined by architect Ron Mace. The term UD discusses the design of products and environments to be usable for all users, to the greatest extent possible, without the need for adaptation or specialised design (Grant & Perez, 2018). The philosophy of UD is rooted in the broader civil rights movement, which focused on social justice and achieving equality for all (Grant & Perez, 2018; Walters, 2022). Steinfeld and Maisel (2012) extended to this discussion: “The barrier-free design movement actually began in the late 1950s in the United States as advocacy groups found that universities were not accessible to returning war veterans and young adults who had contracted polio during the postwar epidemic” (pp.35-36).

An example of the universal design concept is curb cuts, as shown in Figure 2.2, which were initially intended to provide wheelchair users with full street and sidewalk access. But nowadays, everyone uses curb cuts to provide easy access to individuals who use bicycles, strollers, rollerblades, and other devices that make full curbing difficult to navigate (Poore-Pariseau, 2011).

Figure 2-2. An Example of the Universal Design Concept is Curb Cuts.

The concept of universal design was then extended to the education setting and the term "learning" was added, resulting in remodelling universal design in education environments to universal design for learning (UDL) (Meyer et al., 2014). UDL is a fundamental theory and design principle aimed at creating learning environments that are accessible to a wide range of learners (Walters, 2022). The Center for Applied Special Technology (CAST) defines UDL as a "framework to improve and optimize teaching and learning for all people based on scientific insights into how humans learn" (Grant & Perez, 2018, p. 15). In the context of higher education, UDL could be defined as "a set of principles for curriculum development that give all individuals equal opportunities to learn. UDL provides a blueprint for creating instructional goals, methods, materials, and assessments that work for everyone - not a single, one-size-fits-all solution but rather flexible approaches that can be customized and adjusted for individual needs" (UDL ON CAMPUS, 2023).

UDL supports the idea that students should be given the right to choose from the beginning rather than retrofitting them based on how they: (1) access information; (2) interact with the course content; and (3) share what they have learned (Poore-Pariseau, 2011). In addition, UDL has three principles, which are: multiple forms of representation for recognition; multiple means of action and expression for cognitive strategy; and multiple means of engagement (CAST 2018a). Figure 2.3 illustrates the three UDL principles.

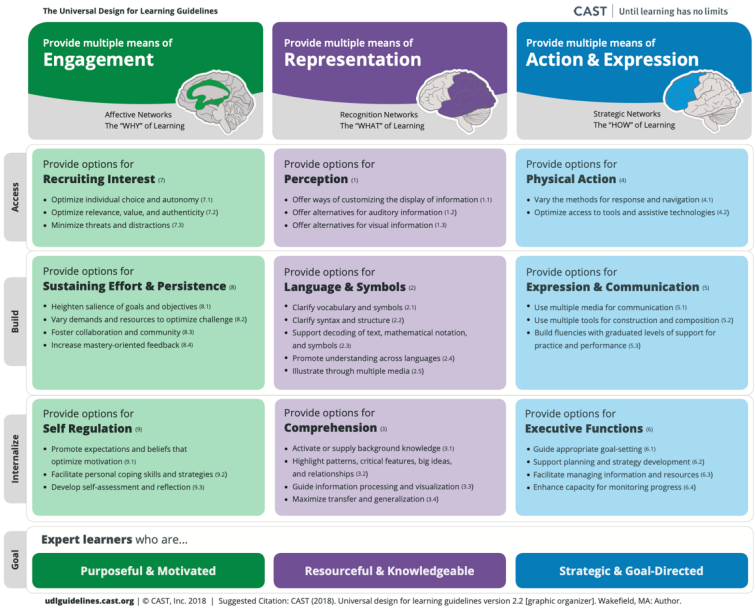


Figure 2-3. Universal Design for Learning Guidelines Version 2.2. (CAST, 2018).

Each of these principles provides specific guidelines for educators on how to provide different options to accommodate different learning approaches (CAST 2018a). For example, providing multiple means of representation offers different ways of presenting materials. Some examples include e-books, textbooks, graphics and text for the same content, and audio for printed text. Multiple means of expression include options for students to express what they have learned and know. Some examples include written

or oral presentations, a Microsoft (MS) PowerPoint presentation or creating a video. Multiple means of engagement provide different ways to engage students' interests. Increasing students' engagement could be accomplished by introducing them to various activities and sources of information that are personalised and contextualised based on the students and their preferences and interests, such as their lives, cultural, social aspect, age, and ability. When introducing these activities, it is critical to realise whether or not they are suitable for various racial, cultural, ethnic, and gender groups based on the UDL principles and guidelines (UDL ON CAMPUS, 2023).

UDL provides more flexibility in educational content design and creation, to make it inclusive and more accessible for students with different abilities and needs (Dunham-Sootheran, 2014). Compared to present methods, this is significantly different, as usually students with disabilities must disclose their disability before they have the option to receive an accommodation or accessible educational content (Fenlon et al., 2016). While this practice is important to ensure that students with disabilities are accessing education based on their individual needs, it is often an inefficient and insufficient approach when trying to meet the needs of diverse students and students with disabilities. The reason is that this practice limits the access to accessible formats of course materials only to students with disabilities and leaves behind other students who might benefit from accessing course materials in accessible formats. Not only that, but some students with disabilities may not disclose their disability out of fear of stigma, consequently preventing them from receiving the accessible format that would allow them appropriate access to the educational content. Moreover, the process of retrofitting material after it has been developed is expensive and often requires time to be recreated in an accessible format, and thus this limits the access of students (Cory, 2011; Dunham-Sootheran, 2014; Fenlon et al., 2016).

Additionally, UDL is rooted in the principles of neuroscience, which examines how neural networks in the brain interact as part of the learning process. According to CAST (2018): "UDL was inspired by such advances in cognitive neuroscience research and offers a

framework that integrates what we know about the learning brain to inform the design of environments that support all learners" (p.1).

Butterworth et al. (2014) clarify that: "The goal of educational neuroscience is to work out how all learners can be helped to achieve their learning potentials and to make learning more effective for all learners" (p.2). Butterworth et al. (2014) emphasise that the two main problems that education seeks to address are: what causes individual learning inequality and in what settings are learners most likely to succeed? By addressing individual differences in learning and building basic contexts for learning, these two questions are in line with the research of UDL.

Human differences in activity engagement, perception and comprehension of information, learning environment navigation, and knowledge expression can be explained by neuro-variability (CAST 2018a; Meyer et al., 2014). To enable neuro-variability among and between learners, the UDL framework, which is founded on three principles, offers multiple modes of engagement, representation, action, and expression (Meyer et al., 2014; Walters, 2022). The three principles also offer insights into learner variability across nine key areas, including interest, effort and persistence, self-regulation, perception, language and symbols, comprehension, physical action, expression and communication, and executive function. Drawing from research in these domains, CAST (2018b) developed the UDL Guidelines, comprising nine guidelines and 31 associated checkpoints. These guidelines feature detailed descriptions and examples demonstrating how they can be implemented in instructional and learning environment designs.

B. Students Developing Self-determination to Succeed in Personalised Environments

Another crucial aspect of implementing UDL in any learning setting involves actively involving the learner in the learning process, empowering students to become proficient in understanding their own learning methods. The objective is to engage with the learning journey, persevere through challenges or setbacks, and continually enhance self-awareness, encouraging students to articulate their preferences and requirements for

learning, and involving them in the co-creation of improved learning environments (CAST 2018a; Zhang, 2020).

Personalised learning (PL), or more broadly within educational systems, fosters learner autonomy, collaborative ownership, and adaptability in how students attain their learning objectives. In theory, a PL environment crafted in accordance with UDL offers support and options regarding what to learn, how to learn, and how to demonstrate learning (Nolin, 2019). Prioritising personalisation by offering multiple choices and pathways integrated into the learning environment should prompt a shift from educators solely designing the environment to co-designing with students. This collaborative process will engage all students in sharing control of their learning and developing skills such as self-advocacy, self-regulation, self-evaluation, and other self-determination skills necessary for making informed choices, setting goals, and taking actions to achieve those goals. Hence, an ideal PL environment based on UDL should strike a balance between providing choices and fostering students' decision-making and agency (Zhang, 2020).

Self-Determination Theory (SDT) explores individuals' inherent tendencies for growth and their motivation to satisfy three fundamental psychological needs: autonomy, competence, and relatedness (Ryan, 2023; Ryan & Deci, 2000). SDT is firmly rooted in research on motivational psychology, which has demonstrated that providing choices, acknowledging emotions, and offering opportunities for self-direction contribute to a greater sense of autonomy, leading to increased intrinsic motivation (Zhang, 2020). All learners require equitable opportunities to engage in activities such as choice-making, problem-solving, decision-making, goal setting and attainment, self-regulation, self-advocacy, and self-awareness. These activities are essential for cultivating self-determination skills across various social and contextual contexts (Opertti et al., 2014; Shogren et al., 2015). Several studies have highlighted the connections between improved self-determination abilities and successful academic outcomes (Ryan, 2023; Zhang, 2020). For all learners to succeed in a PL setting, the self-determination skills mentioned previously are extremely important. Since the integration of a wide range of supports, such as tools, resources, and methods, is a fundamental aspect of a

professional learning environment, all learners must be provided with increased autonomy over the creation of their educational programmes (Opertti et al., 2014).

C. UDL Status in Saudi Arabia

While the Kingdom of Saudi Arabia has made significant progress in advancing its education system, challenges remain in providing inclusive and equitable education for students with diverse learning needs (UNESCO, 2021). The UDL concept is relatively new in Saudi Arabia. Studies suggest that the Kingdom of Saudi Arabia (KSA) lacks transition courses for universal design, executes transitions poorly, and lacks familiarity with the concept of universal design in education for students with special needs (Almutairi & Alsuwayl, 2023).

Mubarak S. Aldosari (2024) sheds light on the current understanding and implementation of Universal Design (UD) principles within the KSA special education system. Despite a noticeable lack of awareness and training among educators and administrators, there is a significant level of engagement and interest in the subject. This underscores the educational community's emphasis in KSA on integrating UD into special education practices.

The main challenges behind the implementation of UDL in Saudi Arabia are lack of awareness, insufficient training, limited knowledge of UD principles, and administrative constraints. These issues highlight the need for targeted interventions. Cultural considerations did not emerge as a prominent obstacle, suggesting that while cultural factors may play a role, they may not be the primary barrier to UD adoption in this context (Almutairi & Alsuwayl, 2023; Alsalem, 2015; Mubarak S. Aldosari, 2024).

While the adherence to Universal Design for Learning (UDL) standards is mentioned in the e-learning standards for higher education in the Kingdom of Saudi Arabia, it remains optional for institutions to implement (see Table 2.1).

2.4.2 Practical Foundations

Digital accessibility in higher education functions as a bridge, facilitating access for students with disabilities and ensuring equitable access for all students to online technology and digital information (Jackson, 2023). Research indicates that organisational approaches to digital accessibility are more successful in post-secondary education when institutions adopt a proactive, rather than a siloed, reactionary response and to be limited for students with disability (Coleman & Berge, 2018; Guilbaud, 2019; Poore-Pariseau, 2011).

In this research study, digital accessibility is defined as the approaches and practices aimed at reducing access barriers to digital content for all students, ensuring compliance with the Web Content Accessibility Guidelines (WCAG). The driving force behind creating inclusive online content that meets WCAG standards is to cater to all students, including those using assistive technology to access university online services, information, and programs (W3C, 2019). Essentially, digital accessibility promotes equal access to content and mitigates barriers for students relying on assistive technology to engage with online course materials (Brophy & Craven, 2007; Jackson, 2023).

Beyond the legal requirements for digital accessibility, implementing such practices across the university is fundamentally ethical. From a social justice and equity perspective, it represents a student-centred approach that proactively addresses accessibility as an inclusive practice (Kezar & Posselt, 2020). By prioritising accessibility, universities not only comply with legal requirements but also ensure that all students have equitable opportunities to succeed in their academic pursuits.

A. Accessibility Guidelines

The Web Content Accessibility (WCAG) rules from the World Wide Web Consortium (W3C) are a source of standards that many organisations utilise when considering digital accessibility (Seale, 2020). The WCAG has “a goal of providing a single shared standard for web content accessibility that meets the needs of individuals, organizations, and

governments internationally" (W3C, 2019, p. para 1). The WCAG applies to both web page content (e.g., text, images, and videos) and the underlying source code.

In 1999, the first WCAG standard was published by the W3C. WCAG 1.0 included 14 guidelines, extending from providing text equivalents to considering clarity and simplicity on the web. Each guideline had between one to ten supporting checkpoints (Walters, 2022). In 2008, the W3C recommended a new and updated content use of WCAG 2.0, which broadened the application of WCAG 1.0 and introduced the four guiding principles of accessibility which state that content must be perceivable, operable, understandable, and robust. WCAG 2.0 is also supported by a success criterion for meeting those principles and was supplemented with WCAG 2.1 in June 2018 (Poore-Pariseau, 2011).

Poore-Pariseau (2011) stated that WCAG 2.1 success criteria are sufficiently detailed to outline steps that can and should be completed to ensure accessible digital content. For example, creating course content with the WCAG 2.1 guidelines in mind, the content creator should ensure that the digital content is perceivable, operable, understandable, and robust. Some examples arising from following these guidelines include (Brophy & Craven, 2007; Poore-Pariseau, 2011; Seale et al., 2018):

2. An example of perceivable digital content is providing alternative text for non-text content so that the content is perceivable for screen-reading users. In addition, perceivable digital content also consists of providing alternative formats, such as large print and Braille.
3. Offering the option to use the keyboard for those who are unable to control a mouse is an example of implementing the operable principle.
4. Using an appropriate language for students is an example of the understandable principle.
5. Ensuring compatibility with assistive technology such as switches and screen readers, additionally requires the need to be consistent and error-free as well as providing an example of a robust use of digital content end educational technology.

B. Evaluating Digital Accessibility

Testing websites for accessibility has a long history, Including testing pages from universities. Casey (1999) discussed the application of the new WAI criteria to digital resources at libraries, and Flowers et al. (1999) assessed the accessibility of university special education programmes' home pages. In 1995, the Centre for Applied Special Technology introduced Bobby, one of the first automated tools for checking web accessibility (Cooper, 1999). Up to its formal retirement in 2008, Bobby was one of the most widely used free web tools and the foundation base was UD. Evaluating digital accessibility encompasses two primary approaches: automated and manual.

- Automated testing:

Recently, numerous tools have been proposed for conducting various types of web accessibility assessments, and they are available for free use (W3C n.d). Every existing web accessibility evaluation tool (WAET) shares a singular objective: to ensure that all users can access and utilise the web. Typically, automatic WAET presents its findings in two forms: errors and warnings. Errors pinpoint specific accessibility barriers or issues discovered in the code, whereas warnings draw attention to sections of the code that may have potential accessibility barriers requiring further assessment by an expert (Abu Doush et al., 2023). A Checker and WAVE are commonly used and well-regarded open-source tools recommended by organisations and post-secondary institutions. These tools, along with similar ones, evaluate the accessibility of websites against web accessibility guidelines such as the WCAG and report known and potential barriers. The results are presented either in a standalone report or as annotations on the evaluated website (Kumar & Owston, 2016).

- Manual testing:

Automated testing of web accessibility cannot replace human judgement. While tools like A Checker and WAVE efficiently identify many common accessibility issues by scanning content against established guidelines, they are limited in scope (Kelsey Adkins, 2023).

Several websites rely on automatic web accessibility evaluation; however, the results from automated evaluations alone are fallible and require human review to assess the impact of the violated success criteria on users. Automated tools can efficiently detect many common issues by scanning content against accessibility guidelines, but they often miss more complex problems that affect the user experience. Therefore, human judgement is crucial to interpret the results, understand the real-world implications for users, and ensure comprehensive accessibility compliance (Abu Doush et al., 2023; Kumar & Owston, 2016) .

C. Digital Accessibility Status in Saudi Arabia

Saudi Arabia has been making efforts to enhance digital accessibility, but the status may vary across different sectors and regions. While there is no comprehensive nationwide assessment available, initiatives have been underway to improve accessibility in government websites, educational institutions, and public services. The Saudi government has shown a commitment to digital accessibility by aligning with international standards such as WCAG (Communications Space & Technology Commission, n.d; GOV.SA, 2022).

From 2010 to 2016, Al-Khalifa et al. (2017) monitored the development of e-government accessibility in Saudi Arabia. The findings indicate a significant enhancement in the accessibility of government websites, suggesting the presence of standards that advocate for web accessibility within the Saudi e-government domain. Nonetheless, the authors recommend several measures to further enhance the accessibility of Saudi e-government websites. These include promoting government assistance by offering necessary training to meet website accessibility standards and strengthening governmental oversight to ensure compliance with website accessibility regulations.

Alnahari and Chakraborty (2019) contribution expands the understanding of digital accessibility in Saudi Arabia by highlighting the limited accessibility tools specifically designed to measure the accessibility of Arabic websites. This deficiency poses

significant challenges, particularly for individuals with disabilities, in navigating online content effectively.

In the education sector, there has been a push to integrate accessibility features into e-learning platforms and digital learning materials. Educational institutions are encouraged to adopt technologies and tools that support students with disabilities, ensuring equal access to educational resources and opportunities (GOV.SA, 2023). However, the adherence to WCAG 2.1, mentioned in the e-learning standards for higher education in the Kingdom of Saudi Arabia, remains optional for institutions to implement (see Table 2.1). E-Learning standards for higher education in Saudi Arabia have been previously discussed in section 2.3.1.1.2: Access to Education in Saudi Arabia.

D. Evaluation of Accessibility in Educational Institutions

Previous and current research concerning digital accessibility in higher education has primarily focused on testing university webpages, including those offering services or library resources. Most of these studies have utilised automated tools to evaluate accessibility. While these tools efficiently identify common issues by scanning web content against established guidelines, they often rely on automated evaluations without incorporating the necessary human review to fully assess the impact of accessibility barriers on users (Abu Abu Doush et al., 2020; Akram et al., 2023; Alnahari & Chakraborty, 2019; Kelsey Adkins, 2023).

Limited research has explored the accessibility of Learning Management Systems (LMS). For example, Kelsey Adkins (2023) examined the perceptions of students with disabilities regarding the use and accessibility of LMSs, identifying both benefits and barriers in e-learning while attempting to access university websites, libraries, and LMSs. Meanwhile, Calvo et al. (2014) evaluated Moodle from the perspective of two visually impaired users accessing content through screen readers, in addition to performing evaluation based on the W3C Authoring Tool Accessibility Guidelines. Another study conducted by Iglesias et al. (2014) employed both automated and manual testing techniques to assess the accessibility of content created directly within the LMS. However, there is a noticeable

gap in the literature regarding the testing and measurement of accessibility for uploaded files, such as MS Word documents, and how students access alternative formats.

One of the available free tools that can measure the accessibility of MS Word documents, MS PowerPoint presentations, and other Microsoft applications is the MS Office Accessibility Checker. This tool helps users identify and fix accessibility issues within their documents, ensuring that content is accessible to all users, including those with disabilities (Microsoft, 2023; Singleton, 2017). Adobe Acrobat Pro provides various accessibility tools that can be used while creating a Portable Document Format (PDF) document to check accessibility against standards such as PDF/UA and WCAG 2.0. Additionally, it generates an accessibility report to assist in identifying and addressing any accessibility issues (Adobe, 2023).

Anthology Ally (previously Blackboard Ally) is a tool designed to enhance the accessibility of digital course content within an LMS, such as Blackboard. It automatically checks the accessibility of course materials uploaded by instructors and provides guidance on how to improve them. Ally generates alternative formats for content to better suit the needs of diverse learners, such as audio versions for text-heavy documents or tagged PDFs for screen reader compatibility (Anthology Ally, 2023). Additional information about Blackboard Ally has been covered in section 2.3.2.5: Digital Educational Materials and Accessibility.

E. Issues Impacting the Accessibility of Digital Content for Course Development Processes

Even with the efforts of organisations and leaders, more work is still necessary to overcome the issues that can limit the accessibility of digital content. For instance, while many learning management platforms such as Blackboard, Canvas and Moodle have been developed following international accessibility standards, the content uploaded on the platforms by faculty members may not be accessible. This means that unless there is an institutional commitment and faculty members intend to ensure that accessibility issues are addressed, there is no guarantee that digital content will be accessible.

Another major challenge is that the digital materials development process is not well defined in most universities (Dunham-Sootheran, 2014). To be more specific, there is no one set standard for how courses should be developed and what elements need to be prepared in advance, such as document templates, document structure, video platforms and accessibility features that are required for accessible course content.

Brophy and Craven (2007) also further highlighted the impact of accessibility issues on students with disabilities. In fact, research shows that students with disabilities often have the least access to web-based technology, and even when they do, the software and other web-based resources utilised for online learning are frequently inaccessible.

Edmonds (2004) added another dimension to the accessibility discussion. He defined accessibility as first- and second-generation accessibility. Edmonds described first-generation accessibility issues as issues that are linked with Hypertext Markup Language (HTML). First-generation accessibility issues were covered under Section 508 standards. The standards address issues such as the rate of screen flickers that may cause seizures, images or other visuals without labels that might impact screen readers, and the timing of responses. Whereas, Edmonds (2004) described second-generation accessibility issues as those representing non-HTML elements that are often uploaded to LMS by faculty members, such as MS PowerPoint, MS Word, Portable Document Format (PDF), and videos. These elements can be inaccessible if the accessibility is not considered while creating the content. Second-generation accessibility is a much more challenging task for faculty members when compared to first-generation accessibility. Edmonds suggests that the reason is that first-generation accessibility is easier to maintain and the responsibility for ensuring first-generation accessibility is generally in the hands of LMS developers or web designers. On the other hand, the responsibility for ensuring second-generation accessibility is commonly the responsibility of the faculty members as they must be equipped to create accessible content before uploading it to the LMS system.

It is important to highlight that Poor-Pariseau (2011) noted that previous research on online learning, accessibility, and higher education emphasised the technological aspects rather than pedagogical aspects of the instructional design process. This has led to a gap

in the literature when it comes to the potential methods and strategies of increasing digital accessibility for all students to course material.

F. Best Practices for Promoting Accessibility

While legal and policy aspects are important for institutions to follow and maintain, this represents a segment of creating a culture of accessibility; more must be done to ensure inclusive and equal access to education (Poore-Pariseau, 2011). For example, Vollenwyder et al. (2019, pp. 353-356) stated that: “Despite the availability of the second edition of the WCAG since 2008 and their incorporation in legal obligations, Web Accessibility often remains at an unsatisfactory level”.

To promote accessible design, it is crucial for institutions to commit to ensuring accessibility and create an accessible culture. One successful and key strategy is applying universal design, which helps reduce accessibility issues that may impact everyone (Steinfeld & Maisel, 2012). Steinfeld and Maisel (2012) have identified seven essential organisational elements for fostering an accessible culture as follows:

1. Adopting a social model of function and ability
2. Establishing the support of top-level administration
3. Prioritising inclusivity
4. Taking a proactive approach to accessibility
5. Making accessibility a shared task
6. Ensuring the availability of organisational resources for promoting accessibility
7. Providing expertise in accessible design and practice

In the context of organisational culture and diversity, Steinfeld and Maisel (2012, p. 85) extended that: “[the organization] must recognize that every aspect of its operations and its products and services needs to accommodate differences in function and ability as well as gender, race, sexual orientation, religion, ethnic background”.

Gronseth (2018) proposed the second recommended best practice as “Instructors and course designers should reflect on possibilities for how course content can be

communicated through multiple format options. For instance, content delivered through readings could be similarly communicated via multimedia resources, such as infographics, podcast episodes, and video clips" (p.20).

In this context, accessibility in higher education would be incomplete without considering digital accessibility. For universities to achieve a fully accessible education at both a digital and environmental level, it is imperative that they make reasonable adjustments to their practices, policies and procedures and mainstream accessibility in all fields (Alsalem & Doush, 2018). Seale (2020) also added that it is important that educational institutions present a website compliance statement and provide a method for end users to submit accessibility problems, as well as a link to file complaints.

G. The Inclusion Argument: UDL, Digital Accessibility, and Technology in Higher Education

UDL promotes the creation of learning environments that are accessible to a diverse range of learners (Ortiz, 2014; Poore-Pariseau, 2011). Learner variability is a central focus of UDL (Grant & Perez, 2018), and web accessibility represents a crucial outcome of designing learning spaces that are responsive to the needs of learners, as well as to the environmental and cultural factors influencing the learning context (Walters, 2022). Gronseth (2018) explains the relationship between UDL and accessible web content, stating: "Inclusive design for online and blended courses connects the Web Content Accessibility Guidelines (WCAG) and the Universal Design for Learning (UDL) framework to address learner variability as an intentional part of course design" (p.14).

Both UDL and web accessibility aim to reduce barriers for learners and promote universal access. For instance, Gronseth (2018) elaborates, "Designing for all learners from the outset is at the core of the Universal Design for Learning (UDL) framework, a set of curricular principles and guidelines that identify how to incorporate flexibility in the design and delivery of instruction" (p.15). Similarly, Ableser and Moore (2018) highlight, "While UDL targets a broad range of learners, digital accessibility focuses on those with specific needs related to sensory, physical, and/or cognitive impairments" (n.p.).

UDL and web accessibility are complementary; UDL provides the theoretical framework, and web accessibility offers the tools and skills necessary to make content accessible to a diverse learner population. By integrating these approaches, educational institutions can ensure that their learning environments are inclusive and supportive of all students.

Rogers-Shaw et al. (2018) added to this discussion, saying that: “The use of Universal Design for Learning (UDL) is effective in enhancing a learner’s ability to acquire, generate, and use new knowledge. Its coincidence with technological developments and advances has afforded the opportunity for greater inclusivity” (p.20). The study reported in this thesis examined the integration of the Universal Design for Learning (UDL) framework to support digital accessibility compliance in online courses within a post-secondary setting. It utilised the Ally tool for automated accessibility testing and provided alternative formats to support UDL principles for students.

2.4. Summary

This chapter started with an overview of general access to education. It then delved into a detailed exploration of International Laws and Standards, with a specific focus on Saudi Arabia, where the research was conducted. Subsequently, it examined inclusive education in higher education and introduced the concept of Universal Design for Learning (UDL), an educational framework known for its flexibility in content presentation, student engagement, and assessment methods.

The chapter also discussed technology’s role in higher education and its impact on accessibility, while highlighting the available technology solutions designed to offer accessible content. Additionally, it delved into best practices and strategies for implementing accessibility in higher education.

Successful teaching and learning in inclusive classrooms hinge on teachers’ expertise in accessibility, subject matter, pedagogy, and technology, as well as a positive attitude towards inclusive education (Stanley, 2013). Looking ahead, this research will advocate for a mixed methods explanatory study in the field of accessibility in higher education,

specifically focusing on the creation of accessible digital educational content. This study will aim to examine the impact of accessibility tools that provide immediate feedback to faculty on the accessibility of their digital content. It will also assess the effectiveness of training programmes for both faculty and students, addressing a current gap in the literature. By combining accessibility tools with training and awareness initiatives, this research aims to enhance digital accessibility scores and ensure equitable access to education.

Chapter 3 will outline the research design and methodology, covering research questions, the target population and sample, instrumentation, and data collection procedures.

Chapter 3: Methodology

3.1 Introduction

The purpose of this study is to evaluate the impact and effectiveness of embedding accessibility tools, such as Ally Anthology, into a digital Learning Management System (LMS) like Blackboard, from the perspective of both faculty members and students. The study also aims to assess the impact of specialised training on using these tools for both groups of participants, and their effectiveness in improving accessibility and inclusivity in online learning environments.

This chapter discusses philosophical orientation, addressing ontological and epistemological considerations. Additionally, it examines the appropriateness of the research design and method of study, including the research questions, the population and sample, and the instrumentation used. The data collection procedures are also described, followed by an outline of the data analysis procedures and a summary.

3.2 Philosophy

3.2.1 Ontology

This study aims to understand and evaluate the impact and effectiveness of integrating accessibility tools, such as Ally Anthology, into a digital Learning Management System (LMS) like Blackboard. This evaluation will be conducted from the perspectives of both faculty members and students, incorporating specialised training for both groups. The research is grounded in the pragmatism paradigm, focusing on practical approaches to solving real-world problems. The paradigm of pragmatic research opens possible options for a researcher, which can position it as more favourable compared to other research philosophies (Maarouf, 2019).

Morgan (2007) further explained that pragmatic research is “intersubjective”, meaning it is both subjective and objective simultaneously. It acknowledges the existence of a

singular reality while accepting that individuals may have multiple interpretations of this reality. Pragmatism suggests that reality is both external and multiple at the same time, and a researcher chooses the perspective that best serves the research aims and goals (Maarouf, 2019; Saunders et al., 2012). Dewey (1958) considered this conversation by focusing more on the human experience than on abstract concepts. Constructivists maintain that our ideas produce the reality, while post-positivists maintain that the world exists regardless of our understanding of it. Dewey asserted that both viewpoints make equally significant statements about the nature of human experience. He elaborated further, that our experiences in the world are necessarily constrained by the nature of that world, while our understanding of the world is inherently limited to our interpretations of our experiences. We are not free to believe anything we want about the world if we care about the consequences of acting on those beliefs. Within Dewey's pragmatism and its emphasis on experience, ontological arguments about either the nature of the external world or the world of our conceptions are merely discussions about two sides of the same coin (Dewey, n.d.).

The forms of knowledge that are possible are determined by the presumptions on the nature of reality. But in pragmatism, experience is emphasised as the ongoing interplay of beliefs and deeds, replacing this abstraction. Knowledge is an active process of inquiry that involves a constant interplay between beliefs and acts rather than an abstract link between the knower and the know (Morgan, 2007). This study''s pragmatic approach was taken by the researcher, who acknowledged the value of comprehending the viewpoints and experiences of social actors, particularly the teachers and students, while seeking practical solutions to actual problems.

3.2.2 Epistemology

Knowledge is based on experience. One's perceptions of the world are influenced by our social experiences. Each person's knowledge is unique as it is created by her/his unique experiences. Nevertheless, much of this knowledge is socially shared as it is created from socially shared experiences (Dewey, 1958; Morgan, 2007, 2014). Therefore, all

knowledge is social knowledge (Maarouf, 2019; Morgan, 2014). Pragmatist epistemology does not view knowledge as reality, rather, it is constructed with a purpose to better manage one's existence and to take part in the world (Dewey, n.d.; Kaushik & Walsh, 2019). For many leading scholars, pragmatic epistemology is rooted in Dewey's concept of inquiry, which connects beliefs and actions through a process of inquiry (Morgan, 2014). Dewey's philosophical interests were primarily centred on what is traditionally known as "epistemology". However, he rejected this term and explicitly preferred the term "theory of inquiry" (Kaushik & Walsh, 2019; Maarouf, 2019). For Dewey (1958), inquiry is an investigation aimed at understanding some part of reality and creating knowledge to effect change in that area. The creation of knowledge with the aim of change and improvement is the main goal of Dewey's inquiry (Morgan, 2007). Dewey described inquiry as the methodical approach of resolving a problematic situation by means of knowledge or reasoned action (Ormerod, 2006). Pragmatists offer a distinct perspective on knowledge acquisition, contrasting with the stances of positivistic researchers and constructivists. While positivists assert that objective knowledge stems from rigorous examination of empirical evidence and hypothesis testing, and constructivists posit the relativity of knowledge considering the intricate nature of reality, pragmatists perceive the process of acquiring knowledge as a continuous journey. Unlike the binary opposition of objectivity and subjectivity advocated by others, pragmatists recognise the interconnectedness of these dimensions (Kaushik & Walsh, 2019; Maarouf, 2019; Morgan, 2007). Therefore, pragmatism occupies a central position along the paradigm continuum regarding modes of inquiry (Maarouf, 2019). Postpositivism traditionally aligns with quantitative methods and deductive reasoning, while constructivism prioritises qualitative approaches and inductive reasoning (Kaushik & Walsh, 2019). However, pragmatism diverges from this dichotomy, embracing both ends of the spectrum and advocating for a flexible and reflexive approach to research design (Morgan, 2007, 2014). By adopting this stance, this study collects interpretations of knowledge through evidence gathered from both quantitative and qualitative methods. Consequently, the design of this study is characterised by its dual nature, incorporating both quantitative and qualitative methodologies.

Many researchers have highlighted pragmatism as a philosophical foundation for the mixed research approach (Maarouf, 2019). Denscombe (2008) and (Mitchell, 2018) have articulated that pragmatism serves as the “philosophical partner” of mixed research, with its underlying principles facilitating the integration of research methods. Similarly, Johnson et al. (2007) concur that pragmatism represents an advanced philosophy that furnishes the epistemological framework and rationale for blending quantitative and qualitative approaches and methodologies. Furthermore, Creswell (2017b) underscores pragmatism as the philosophy that enables the amalgamation of paradigms, assumptions, approaches, and methods of data collection and analysis.

3.2.2 Axiology

Axiology refers to researcher values, beliefs and morals in research (Kaushik & Walsh, 2019). These shape the researcher’s worldview, research practice and knowledge creation. As Cherryholmes (1992, p. 13) stated:

“For pragmatists, values and visions of human action and interaction precede a search for descriptions, theories, explanations, and narratives. Pragmatic research is driven by anticipated consequences. Pragmatic choices about what to research and how to go about it are conditioned by where we want to go in the broadest of senses”.

In this section, the researcher reiterates the axiological positioning based on Section 1.6.2: Researcher Positioning. The researcher previously explained her background and her belief that everyone has specific needs and that we should create inclusive and accessible environments that embrace diversity (Hall & Imrie, 2001). Specifically, regarding education, the researcher shared her standpoint that accessibility and inclusivity should be provisions for all students, not only for those with disabilities (David et al., 2009; Lambert, 2020). The main aim of this research is to find solutions for accessibility in educational content and develop practical approaches.

This perspective contrasts with the traditional view of accessibility provision within the educational setting which focuses on inclusion and accessibility for students with disability

(Gunderson, 2015; Hurst, 1990). The researcher emphasises her interest in practical research, foregrounding participants' experiences and making an impact by taking action to solve real problems. This positioning aligns with the pragmatic paradigm by providing practical solutions, including training and utilising accessibility tools to improve the digital accessibility of course content.

There is a strong alignment between pragmatism and the advocacy of social justice (Morgan, 2014). Pragmatists have always possessed a profound sense of justice. They are acutely aware of the suffering individuals endure and the necessity of building just institutions. They are consistently engaged in a search for a tolerant and non-discriminatory culture that regards all people with equal concern and respect. This also aligns with the researcher's beliefs and values, as her focus is to ensure that students are not discriminated against in accessing accessible content based on their disability, without requiring them to register through accessibility or disability services to obtain these resources.

In the subsequent sections, the researcher delves deeper into the design of this study, illustrating how her philosophical orientation has shaped the methodology, as well as addressing ethical concerns and limitations.

3.3 Research Questions

- To what extent will the professional development delivered to the target faculty members raise awareness about accessibility issues and equip them with the skills to increase the accessibility of their digital course content?
- To what extent will using the Ally software increase the accessibility of digital course materials?
- In what ways can faculty engagement with the Ally accessibility indicators contribute to enhancing their teaching practice for inclusive education?
- To what extent does the use of alternative formats by students enhance their access to digital course content?

3.4 Research Design and Methodology

As explained in Section 3.2, this study's design aligns with the pragmatic mixed methods approach. Methodologies within this paradigm include both quantitative and qualitative data. A mixed methods explanatory design was used for this research to measure the impact of using accessibility tools in the LMS for faculty members and students. The study included specialised training on accessibility and equitable access targeted for faculty, as well as awareness sessions for students to share the availability of the attentive format and how they could select the best format based on their needs.

Tashakkori and Creswell (2007) defined mixed methods research as "research in which the investigator collects and analyses data, integrates the findings, and draws inferences using both qualitative and quantitative approaches or methods in a single study or a program of inquiry" (p.4).

A mixed methods approach was adopted for this study, during which a survey for faculty members and students was conducted both before and after the training. This approach was used to help determine the effect the training had on improving the accessibility of courses and increasing the students' awareness around the availability of alternative formats and how to choose the most appropriate format based on their needs. Interviews and focus groups were then carried out with faculty members and students, respectively, to investigate the participants' experiences and opinions after the intervention. According to Creswell and Guetterman (2019), researchers tend to use mixed methods to provide better understanding of the research problem. That is because a mixed methods approach helps provide a rich and comprehensive picture, as each method (qualitative research and quantitative research) sheds light on different pictures, or perspectives, and has its own limitations. For instance, if qualitative data are based on a small group of individuals, then applying the results to a bigger population will be difficult. Similarly, relying only on quantitative data can mean that the perspective of participants might not be considered (Creswell, 2017a). Additionally, combining and integrating different kinds

of data can enhance research investigations by using the strengths of one method to balance the shortcomings of another method (Scoles et al., 2014). This helps provide a more robust and comprehensive understanding of the research topic. Fetters and Freshwater (2015) also added that mixed methods can achieve a sum greater than the individual qualitative and quantitative parts on their own, which is equivalent to the equation 1 + 1 = 3. Furthermore, Jick (1979) added that the researchers can validate findings through a triangulation technique, which involves contrasting and comparing data from several sources to make sure the findings are credible and consistent. This could be achieved by using multiple approaches such as mixed methods.

To gain a greater understanding of the chain of evidence that links the impact of using accessibility tools and professional development training on the digital accessibility score of digital content, to increase faculty awareness about accessibility issues, and improve students' access, the researcher conducted a mixed-methods sequential explanatory study. This approach involved collecting quantitative data (through a survey and Ally reports) followed by collecting qualitative data (through interviews and focus groups). The research method used is illustrated in Figure 3.1. It is also important to note that the quantitative phase of the research established the linkages, whereas the qualitative phase highlighted the individual perspectives of participants, the context, and understanding of each link in the chain.

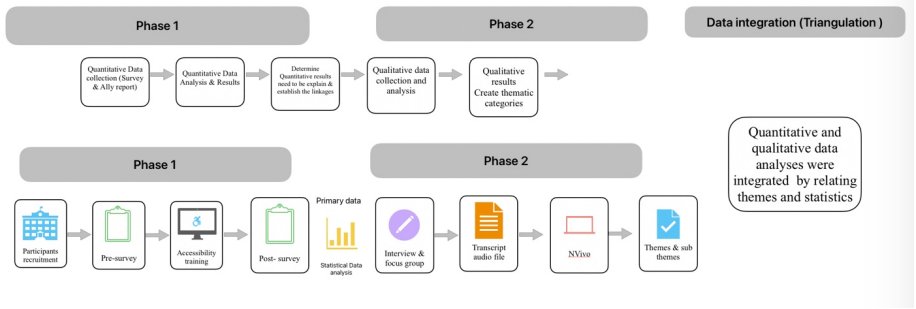


Figure 3-1. Study Research Method.

This approach placed an initial priority on the quantitative data (QUAN) as they provided a general understanding of the awareness of both faculty members and students and the impact the training had on improving the score of digital accessibility and students' access. Subsequently, more analysis was made through qualitative data collection, which was used to refine, extend, or explain the general quantitative understanding (Creswell & Guetterman, 2019).

3.5 Study Sample

The study sample consisted of faculty members and students from two universities in Saudi Arabia. The inclusion criteria in the study focused on universities that utilised Blackboard Learn, hosting course materials with activation to Ally software, as well as participants who never received accessibility training, particularly on Ally software.

Participation was on a voluntary basis, in which interested participants contacted the researcher or attended the training. Moreover, the researcher created a virtual office to respond to any inquiry immediately. According to Creswell and Guetterman (2019), with a convenience sample, the researcher selects participants according to their availability, willingness to participate in the research, and possessing specific characteristics that are of interest to the researcher.

Snowball sampling was used by asking participants to forward the research invitation to their colleagues. According to Creswell and Guetterman (2019), snowball sampling "is a sampling procedure in which the researcher asks participants to identify other participants to become members of the sample" (p. 628). For this research, the main purpose of using a snowball approach was to increase the study reach and achieve the sample target for this study. This was important as, unfortunately, digital accessibility in higher education has received little attention in the Middle East in the past years and many faculty members do not show much interest in the topic due to different factors that will be highlighted in the coming chapters.

For students, participation was also on a voluntary basis, and two methodologies were used to approach and encourage students to participate. The first one involved campus-wide announcements sent to all students at both universities, providing information about different training sessions and their timings. However, the turnout of students for this method was extremely low. As a result, the option of virtual class visits based on faculty requests was offered.

3.6 Setting/context

This research was conducted in Saudi Arabia, specifically in the higher education sector, and offered an opportunity to explore and understand the different experiences of both faculty members and students within the context of the study. One of the main reasons why Saudi Arabia was chosen as the country for the research is because the Kingdom's higher educational system is rapidly growing and improving (Alghamdi, 2015). Higher education in Saudi Arabia is categorised into three primary sectors: 1) state universities, 2) private universities and colleges, and 3) technical and vocational education. The landscape encompasses over 30 public universities, 38 private universities and colleges, and 6 institutions dedicated to technical and vocational education. These educational establishments are dispersed across various geographical regions (Alghamdi, 2015; Economist Intelligence Unit, 2008; MOE, 2022).

Two universities were included in this study, from which participants were selected. The selection of these universities was based on inclusion criteria and their willingness to participate in the study.

3.7 Instrumentation

In this study, the instrumentation used to collect data was originally developed in English. To ensure that the instrument was appropriate and effective for use in the target population, it was translated into Arabic after finalising the tools and after ethical approval from the University of Lancaster was granted. The use of a translated instrument allowed for a wider range of participants to be included in the study and helped to ensure that the data collected were accurate and reliable.

- **Survey**

Two surveys with closed questions were conducted to measure the impact of the training and the addition of Ally on the LMS (see Appendix Two).

1. Student survey: pre- and post-training sessions

The student's pre-survey included four parts. The first part consisted of general information related to the degree that they were completing, their status, and whether they had any type of disability or specific learning needs. The second part involved questions revolving around the students' preferred devices and study habits, whereas the third and fourth parts were concerned with the main accessibility issues that students faced when accessing digital course content, and how aware they were about the availability of alternative formats at their university. It is worth mentioning that the second and fourth parts were both modified based on the survey instrument developed by Ally Research SIG (Ally Anthology, 2018).

Consequently, the post-survey then measured the students' feedback after the training and the impact of having immediate access to alternative formats.

2. Faculty survey: pre- and post-training sessions

The faculty survey instrument included questions related to the faculty's knowledge, practices, attitudes toward accessibility for all learners, and professional development. The pre-survey instrument included three parts. The first part consisted of general information related to methods of teaching and years of experience. The second and third parts of the survey were adapted from the survey instrument developed by Ally Research SIG (Scott, 2018), and asked participants to evaluate their level of awareness around accessibility and highlighted the importance of ensuring accessibility for everyone. The last part inquired about the accessibility issues that faculty members faced and the required skills to create accessibility for everyone.

In the post-survey, general information was collected again, noting that the second section of the survey asked participants about their feedback after the training and use of the Ally tool. The third section was focused on measuring the impact of the necessary skills to create accessible documents.

- **Interview**

Two types of interviews were conducted to help understand and elaborate on the quantitative results (see Appendix Three).

1. Faculty interviews – post-intervention: The researcher conducted 12 faculty interviews.

Faculty interview questions focused on capturing the experience of faculty members in using accessibility tools and the new skills that they had learned during the provided training to create accessible content.

2. Student focus groups – post-intervention: The researcher conducted two focus groups, with each group consisting of 5-6 students.

The focus group questions were adapted from the shared Ally researcher group document (Scott, 2018). These questions comprised of student's experiences accessing

alternative formats based on their needs and how the use of the Ally tool that is represented by an alternative format can help them overcome accessibility issues.

It is worth mentioning that all the interviews for this research were conducted online. Online interviews have grown in popularity, particularly during the COVID-19 pandemic, when in-person interactions were limited. This shift allowed researchers to continue their work using digital platforms like Zoom and Teams, offering benefits such as reduced travel time, lower costs, and the ability to reach participants across broader geographical areas. This was particularly relevant in this research, as the researcher is based in the UAE, while the participants are in different cities in Saudi Arabia. According to Lobe et al. (2022), online interviewing has challenged the traditional preference for in-person methods by providing logistical advantages and expanding the pool of accessible participants, which is especially beneficial when studying diverse or hard-to-reach populations. However, the study also highlights the challenges of online interviews, including the absence of non-verbal cues like gestures and facial expressions, which are crucial for conveying empathy and understanding. While some argue that online interviews lack the depth of face-to-face communication due to these missing social cues, others suggest that meaningful connections can still develop online, with rapid increases in intimacy even among strangers (Mann & Stewart, 2000). This evolving landscape suggests that online interviews will continue to reshape qualitative research, offering both opportunities and challenges for data collection in the future.

- **Reports**

Two types of accessibility reports were generated by Ally. These reports were primarily used to gain a deep understanding of how the institution/university is performing before and after the intervention. The average accessibility score was noted prior to, during, and after the training session. An increase in the accessibility score could suggest a positive outcome resulting from the intervention. Moreover, this report also helped track the progress during the intervention and highlighted accessibility problems, and thus helped in tailoring the training sessions. The following Ally reports were used during the research:

1. Institution Report Overview: This report shows the digital course content in the institution. (See Appendix Four for more details.)
2. Ally Usage Report: This report shows details about how students and faculty members are using Ally. (See Appendix Four for more details.)

Once the researcher received the Ally reports, the following data analysis was conducted and indicated:

1. The overall accessibility score before and after the intervention at the general level.
2. The main accessibility issues that were observed.
3. Engagement with the alternative formats and the feedback of faculty members without the course ID or code.
4. The usage of alternative formats among students, and which types of alternative formats were downloaded the most.

3.8 Intervention

The researcher delivered tailored training sessions for faculty members and students based on the accessibility score report provided and alternative format usage by Ally and the need of the institution. To develop a customized training program that catered to the specific needs of both universities, the researcher conducted an extensive review of the Ally report to identify the most frequently reported accessibility issues in the institutional reports. Drawing upon her prior experience in creating accessibility training for a pilot study focused on Ally and accessibility tools at a university in the United Arab Emirates, the training sessions for faculty were thoughtfully structured as follows:

1. Accessibility Fundamentals: This session covered the essential principles of accessibility and familiarized participants with Accessibility Checker Tools designed for academic course materials.
2. Create Accessible Documents: Participants were guided on how to create accessible documents, ensuring that their course materials met

accessibility standards, with the focus on the three major accessibility issues that have been reported in Ally and are also the most common.

3. Introduction to Ally and Alternative Formats: This session introduced participants to Ally and provided insights into the usage of alternative formats.

For students, the sessions were designed to be interactive, offering hands-on experience with alternative formats. Students gained a practical understanding of when and how to utilize these formats, depending on the specific learning environments.

The researcher ensured different ways to deliver the training were offered, including virtually, in person or a hybrid approach. The chosen method of training was chosen depending on the location of the university, which is also the place where the study took place, as well as the preferences of the university.

3.9 Data Collection

This study was initially conducted at three universities as shown in Table 3.1.

Table 3-1: Information about the Universities Where the Study was Initially Conducted.

University	Location	Learning and teaching methods	Estimated number of students	Recruitment process of participants
University S	Saudi Arabia - different locations	Mixed, but mainly online	37,833	Faculty: 5 schools participated. The dean of each school nominated 10 faculty members. In collaboration with the disability centre, an email was

University	Location	Learning and teaching methods	Estimated number of students	Recruitment process of participants
				sent to all the nominated faculty members. Students: Class visits were conducted for all students. Interested students then filled out the survey on a voluntary basis before and after the training sessions.
University T	Saudi Arabia (Jeddah & Riyadh)	In person with some online classes	220,705 (only two colleges participated)	In collaboration with the departments who are supervising LMS, an email was sent to all faculty members in the Riyadh campus and 12 participants were nominated from the campus in Jeddah. Students: Class visits were conducted for all students. Interested students then filled out the survey on a voluntary basis before and after the training sessions.

A two-phase data collection process took place for both universities S and T. First, an initial quantitative survey was distributed to all the faculty members interested in joining

the study and training sessions. To generate a greater response, the survey was also included at the beginning of the accessibility training sessions. The researcher (accessibility specialist) was also present to assist faculty members with any questions or challenges related to fixing accessibility issues or Ally software. Following the training sessions after one week, the post-training survey was distributed via email. A part of the email was intended to encourage faculty members to allow the researcher to visit a class and deliver a quick training session to students on how to use the alternative formats and Microsoft literacy tools. In addition, a campus-wide announcement was made to all students about the survey. The pre-training survey for students was included in the beginning of the accessibility training sessions as well, during which students who were willing to participate filled out the survey. The post-training survey was sent to faculty members to share with their students.

The second phase of the data collection process consisted of qualitative methods. The aim of this phase was to investigate the participants' experiences and opinions after the intervention. For faculty members, the researcher conducted recorded sessions of one-on-one interviews where each participant was asked to describe their experience with using accessibility for their course materials before and after the training. According to Creswell and Guetterman (2019), individual interviews are the preferred method for conducting interviews with participants who express themselves clearly, are confident in expressing their thoughts, and feel comfortable sharing their ideas.

For students, the researcher conducted online focus group sessions to yield the most detailed information about students' experiences using alternative formats and to encourage them to share their thoughts.

3.10 Data Analysis

Once all the necessary data were collected, the data analysis process began, and was a lengthy process for both phases of the research. This study employed two types of quantitative data collection methods to obtain comprehensive insights. The first method used was a pre- and post-survey to gauge the impact of delivering accessibility training

sessions to faculty members. Descriptive statistical analysis tools were employed to understand the extent to which the training enhanced faculty members' awareness of digital accessibility and their utilisation of Ally software. Descriptive statistical analysis was also applied to examine the impact of using alternative formats on students' abilities to access digital course content.

The second type of quantitative data utilised was the Ally report. This report encompassed various components, including institutional accessibility reports, alternative formats usage, and instructor feedback.

The purpose of using the questionnaire in phase 1 was not only to provide descriptive analysis of the findings, but to also provide comparisons, contrasts, and possible unexpected trends and characteristics raised throughout the study. Given the researcher's experience in the field, she was aware that the participants' levels of knowledge, understanding, and experience of digital accessibility and alternative formats would range widely. As a result, the questionnaire included descriptions, images and videos of accessibility issues, alternative text and formats, and Ally icons. This adaptation of different description methods was used to assist participants in understanding the questions, especially in cases when they were aware of the action but did not understand the translation.

SPSS calculation features were employed to generate the descriptive statistics for the pre- and post-surveys, such as generating tables, charts, and graphs, for both students and faculty. Table 3.2 shows the relationship between the research questions, variables, evaluation instruments, scoring, and statistical analysis methods. Table 3.2 also outlines the specific analyses conducted for each research question using various statistical tests such as Mann-Whitney U tests, ANOVA, and Cronbach's Alpha Reliability scores.

Table 3-2: Research Questions and Corresponding Analyses.

Research question	Independent Variable	Dependent Variable	Instrument	Measurement	Statistical Tests used
RQ1	Accessibility training participation	Faculty awareness and skills	Adapted from Ally Research SIG (Ally Anthology, 2018)	Likert-style, multiple-choice and rating scales questions	Mann-Whitney U tests Cronbach's Alpha Reliability score
RQ2	Accessibility training participation	Online course accessibility	Anthology Ally report	Institution accessibility score # Of Alternative text # Of Heading presence # Of tagged and Ocred PDF	ANOVA Mann-Whitney U tests
RQ3	Accessibility training participation	Faculty engagement attitudes	Adapted from Ally Research SIG (Ally Anthology, 2018)	Likert-style, multiple-choice and rating scales questions	Mann-Whitney U tests

Research question	Independent Variable	Dependent Variable	Instrument	Measurement	Statistical Tests used
			Anthology Ally report	Instructor feedback launches	
RQ4	Accessibility training participation	Students' access	Adapted from Ally Research SIG (Ally Anthology, 2018) Anthology Ally report	Likert-style, multiple-choice and rating scales questions Alternative formats and download	Mann-Whitney U tests

Visual representations were utilised to present the descriptive data in terms of frequencies and percentages. The focus was placed on faculty members' attitudes towards accessibility before and after the intervention, as well as the impact of training on their technical skills in addressing accessibility issues. For students, attention was directed towards increasing their awareness of alternative formats and the benefits of immediate access to accessible content.

Regarding the qualitative data, interviews with faculty members and focused group discussions with students were conducted in Arabic. All audio content was transcribed into text and subsequently translated into English. The initial translation was carried out using Microsoft's translation feature and was then verified by the researcher. Another validation method for the translation conducted by the researcher involved listening to the Arabic audio and comparing it with the English transcript. The translated text was imported into NVivo for further analysis. The coding process resulted in thematic categories, which were then integrated with the quantitative data analysis by relating themes and statistics. This integration aimed to provide a deeper understanding of the

research findings and offer insights into the underlying factors that explained the observed numerical patterns.

In the subsequent chapter, visual representations are used to demonstrate the integration of quantitative and qualitative data analyses, emphasising the role of qualitative follow-up in explaining the quantitative results. These visuals enhanced the understanding of the research findings and facilitated the exploration of underlying factors through the combination of themes and statistics.

3.11 Data Collection Methods and Triangulation

In this study, two primary data collection methods were utilised: a quantitative survey, and qualitative focus group and individual interviews. Using multiple data collection methods can provide a more comprehensive view of the research subject and provide better understanding of the research problem (Creswell & Guetterman, 2019). For example, in a case study examining user interaction with a web-based system, one might observe user behaviour, collect digital logs, conduct interviews about user experiences, and distribute an evaluation questionnaire (Oates et al., 2022). This multi-method approach not only enriches the dataset but also allows for cross-verification, improving the reliability and depth of the findings. When results from different methods are consistent, it enhances the credibility of the conclusions, indicating that they are not dependent on a single method alone (Creswell, 2013; Gatewood, 2020; Iniesto, 2020; Oates et al., 2022).

This approach of employing multiple data collection methods to verify findings is known as methodological triangulation (Creswell, 2013). Triangulation strengthens research by offering multiple perspectives on the research question. It can take various forms, including (Easterby-Smith et al., 1991; Oates et al., 2022):

- Theoretical Triangulation: The study incorporates multiple theoretical perspectives instead of relying on a single framework.
- Methodological Triangulation: When data collection is used from both quantitative and qualitative sources.

- Investigator Triangulation: Involving multiple researchers to compare results.
- Data Triangulation: Data are gathered from various sources or at different times to examine a phenomenon.

This study adopts a pragmatic approach, aiming to understand diverse truths. Initially focused on gathering quantitative data, this approach was then expanded to include perspectives from qualitative data.

This approach aligns with a longstanding trend in educational and social sciences, where researchers have increasingly gathered multiple types of data to enhance the validity of their findings (Creswell, 2013). This integration, or triangulation, has become a key aspect of mixed-methods research. By combining and aligning different types of data on the same subject, researchers can leverage the strengths of each method while compensating for their respective weaknesses (Allamki, 2013; Creswell, 2017b; Tashakkori & Creswell, 2007).

Therefore, in this study, triangulation is not just a means of improving validity but a critical strategy for capturing the complexity of the research subject.

3.12 Ethical Considerations

Ethical approval was obtained from both the University of Lancaster Ethics Committee and the Ethical Committee of the universities where the research was conducted. According to Newby (2010), three areas of ethics must be considered for any research:

- Informed consent.
- Confidentiality.
- Consequences of participating in the study, and what happens with the collected information.

The above considerations were closely adhered to during the study as follows:

1. Participation was on a voluntary basis; only interested participants contacted the researcher. Once the participants showed interest in taking part in the study, the

researcher sent the participant information sheets (PIS) and consent forms (see Appendix Five). The participants also needed to indicate their approval prior to answering any questions in the survey or interview. Participants also had 2 weeks to withdraw from the study after the pre- or post-survey, the interview date, and focus group.

2. All collected data were stored in a dedicated, password-protected computer folder/iPhone, noting that the researcher's iCloud account is only accessible by the researcher themselves.

3. For the survey, participant ID codes for pre- and post-survey were used to maintain the confidentiality of all participants. All data collected from faculty interviews and student focus groups were de-identified during the interpretation and analysis process. Regarding the virtual interview, Zoom was used to record the interview with an option to record audio only without video or images. Face-to-face interviews/focus groups were recorded using the Voice Memos app on the researcher's iPhone. After collecting the recordings on the iPhone, the researcher immediately moved them to a password-protected computer folder and ensured correct removal of the data on the iPhone. All data were anonymised during data analysis, for presentation of findings and publications.

Individuals who participate in a study have certain rights. Before participating in any research, individuals need to know the purpose and aim of the study, how the results will be used, and the likely social consequences the study will have on their own lives (Creswell & Guetterman, 2019). Accordingly, participants in this research study were given informed consent forms to complete, explaining the purpose of the study, potential social impact of the study, if any, as well as their right to refuse to participate. Participants were also assured of the confidentiality of their responses and were made aware that all collected data would be saved on a universal serial bus (USB) drive, labelled accordingly, and kept safe in the researcher's home for no more than 10 years.

Finally, those participating in the study were given an opportunity to request the results of the study. The results of the data analyses are presented in Chapter 4.

3.13 Assumptions and Limitations

Several assumptions were made in this study. The first assumption was that for both participants (students and faculty) there would be a very high percentage who would respond to the pre- and post-survey. The second assumption was that the digital content was the main means of educational content. The third assumption was to conduct the study for one semester to give time for faculty to practice and to give a longer period to check the improvement of the accessibility score. Participants consisted of faculty members teaching at two universities in Saudi Arabia, as well as students. Given that this was a convenience sample, the results might not extend beyond this specific group and context. Another constraint is that participation was voluntary, which could lead to a selection bias if those who chose to participate are not representative of the entire population, potentially skewing the results. More details regarding these limitations are discussed in the study limitations section in the conclusion chapter.

3.14 Summary

In conclusion, Chapter 3 addressed the steps of how the research was conducted using a two-phase, mixed–methods data collection process. Next, detailed descriptions were given of the research design, multiple research sites, and the participant selection process which was undertaken on a voluntary basis for both groups of participants. The subsequent section focused on data collection methods and procedures. These included pre- and post-survey, interviews, and students' focus groups. Detailed descriptions of the study research methods were presented in Figure 3.1. The data analysis methods used and the rationale for selecting a mixed-methods explanatory design were discussed, along with the procedures implemented during phases I and II.

Chapter 4 will discuss the post-training results for both faculty and students, in addition to impact of the training and the use of Ally anthology on the accessibility score and alternative format usage.

Chapter 4: Results

4.1 Introduction

The purpose of this study was to evaluate the impact and effectiveness of embedding accessibility tools, such as Ally Anthology, into digital Learning Management Systems (LMS), like Blackboard. The study also evaluated how effective training was, in the opinion of faculty members and students. To achieve this, a mixed data collection approach was utilised. Initially, a pre-survey was conducted prior to the training sessions. A post-survey was then administered after the training. In addition, quantitative data were also gathered from Ally reports, and provided insights into the digital accessibility score, instructor feedback Launches (clicking on the accessibility indicator opens the Instructor Feedback Panel), and student engagement with alternative formats. The Ally reports were assessed both before and after the intervention, which allowed the research to compare the results of both. The second phase of the data collection process included collecting qualitative data, which consisted of interviewing faculty members and conducting focus groups with students.

Chapter Four presents the findings and results of the research study; wherein descriptive statistics were employed to analyse and present the results obtained from both explicit and implicit main measures for quantitative data. Descriptive statistics (means, percentages, and standard deviations) are reported at both the category and subcategory levels. Cronbach's Alpha was used to check the internal consistency of the responses to the survey items. Additionally, paired question comparison in both surveys was conducted using the Mann Whitney U test. This statistical test was used to determine if there were significant differences in the responses before and after the intervention. The test allowed for a rigorous evaluation of the effectiveness of the intervention and the impact of integrating accessibility tools in the study. Charts and tables were used as visual aids to effectively portray and interpret the results.

Additionally, qualitative data analysis was conducted using NVivo software to establish thematic outcomes. The identified themes were subsequently integrated with the quantitative data analysis by establishing connections between the themes and statistical findings. This integration aimed to provide a comprehensive understanding of the research findings, shedding light on the underlying factors that elucidated the observed numerical patterns.

4.2 Faculty Survey

This section presents descriptive findings that were obtained from the survey measures designed specifically for faculty members. The findings encompass both pre-survey and post-survey results, which are reported separately for each participating university, along with aggregated findings. These descriptive findings offer insights into the characteristics and trends observed among faculty members before and after the intervention.

Training sessions were provided to all faculty members who expressed interest in learning about accessibility in three different universities. It is important to note that participation in the study was voluntary for all participants. Table 4.1 presents the total number of participants who responded to the survey question for both the pre-survey and post-survey.

Table 4-1: Total Number of Participants Who Responded to the Survey Question for Both the Pre-Survey and Post-Survey.

University	Pre-Survey Responses	Post-Survey Responses
T	26	30
S	21	9
Total	62	39

4.2.1 Pre-Survey

For the first phase, the data collection instrument used was a pre-survey questionnaire. The questionnaire consisted of 15 questions. The survey employed a tripartite structure, including demographic, attitudinal, and digital skills questions.

4.2.2 Post-Survey

Following the training sessions, participants were given a period of 2-3 weeks to complete the post-survey. The survey consisted of 25 questions, encompassing the same demographic information gathered in the pre-survey, as well as inquiries regarding participants' experiences with using the Ally software, their level of satisfaction, and the perceived helpfulness of the training. Furthermore, the survey captured participants' attitudes towards accessibility. Various question formats were employed, including Likert scale items and multiple-choice questions.

4.2.3 Questionnaire Reliability

The internal reliability consistency of the questionnaire was tested by calculating a Cronbach's Alpha coefficient based on the responses of all questionnaire questions, except for one multiple-choice question that asked participants about how they learned

to use Ally. According to Pallant and Julie (2010), reliability statistical testing is necessary, depending on the nature and purpose of the scale, with Cronbach Alpha being suitable for both binary-type and wide-scaled data. Table 4.2 shows Cronbach's Alpha values for the four surveys.

Table 4-2: Cronbach's Alpha Values for the Faculty Pre- and Post-Surveys.

Cronbach's Alpha	T University	S University
Pre-Survey - Faculty	0.621	0.610
Post-Survey - Faculty	0.707	0.708

The Cronbach's Alpha values for the pre-survey were 0.621 (T University) and 0.610 (S University) as shown in Table 4.2 , which is considered to be less than the recommended scale (Bland & Altman, 1997; Pallant & Julie, 2010). According to Tavakol and Dennick (2011), a low alpha value might be attributed to various factors, including a limited number of questions, weak interrelatedness among items, or the presence of heterogeneous constructs. For this research, the survey items included heterogeneous measures encompassing demographic information, attitudes, beliefs, and digital skills. In addition, the translation of the survey into Arabic could have potentially influenced the results. This is because many accessibility terminologies may not have direct equivalents in Arabic, leading to possible confusion or unfamiliarity among participants. The potential impact of these factors on the survey responses should be considered when interpreting the results of the research. The Cronbach's Alpha values for post-survey were 0.707 (T University) and 0.708 (S University) as shown in Table 4.2, which is considered to be acceptable (Bland & Altman, 1997; Pallant & Julie, 2010). Appendix Six shows the item total statistics for the analysed data.

4.2.4 Results

The results obtained from the two universities were analysed separately. The analysis focused on examining and interpreting the findings specific to each university individually. The research was primarily aimed at achieving the required number of participants, with less emphasis on directly comparing the two universities. Moreover, the two institutions had different structures, learning environments, and teaching methods, which may not be conducive to direct comparisons. Instead, by conducting the research in two universities with distinct contexts, the study aimed to capture a broader range of perspectives and experiences. The analysis and discussion of the results revolved around understanding the impact of the interventions within each university independently, considering their unique characteristics. This approach allowed for a more comprehensive understanding of the research findings and their implications within the respective institutional contexts.

4.2.4.1 Demographic Results

Around 134 faculty members attended the training sessions from both universities. However, only 47 completed the pre-survey (26 from T University and 21 from S University). The participants were asked to describe the following demographic characteristics: learning delivery methods, years of experience, and the courses they were teaching. The breakdown of participants by delivery methods are visually represented in Figures 4.1 to 4.4.

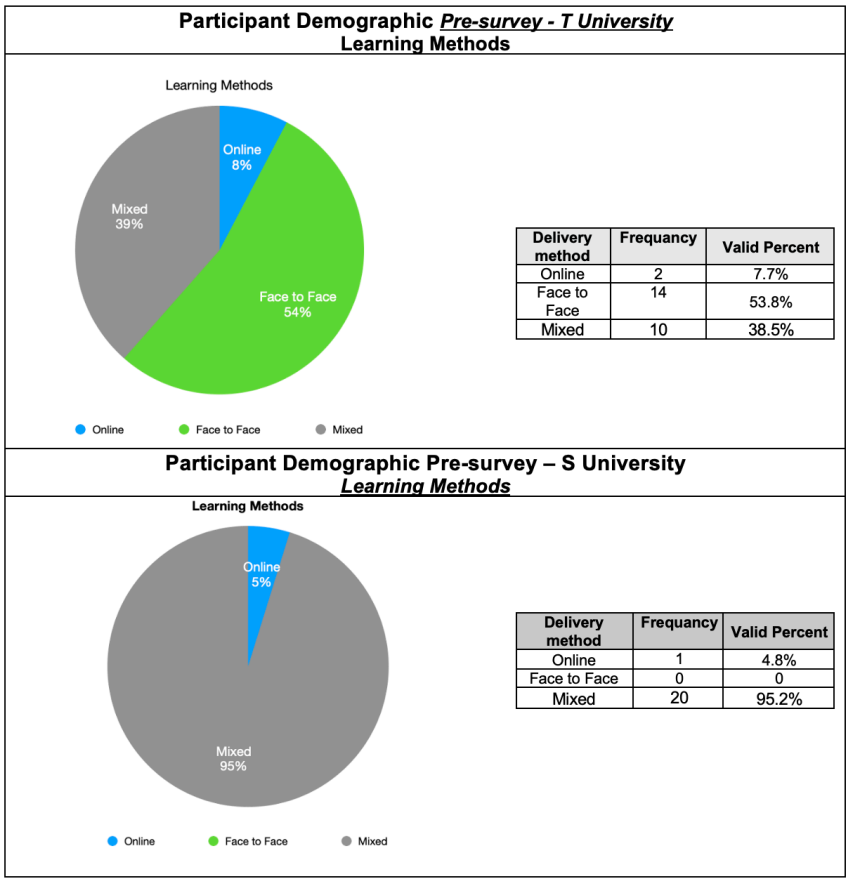
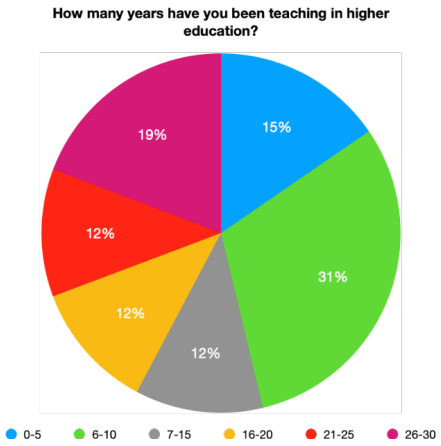


Figure 4-1. Participant Demographic- Learning Methods Pre-Survey (T University & S University).

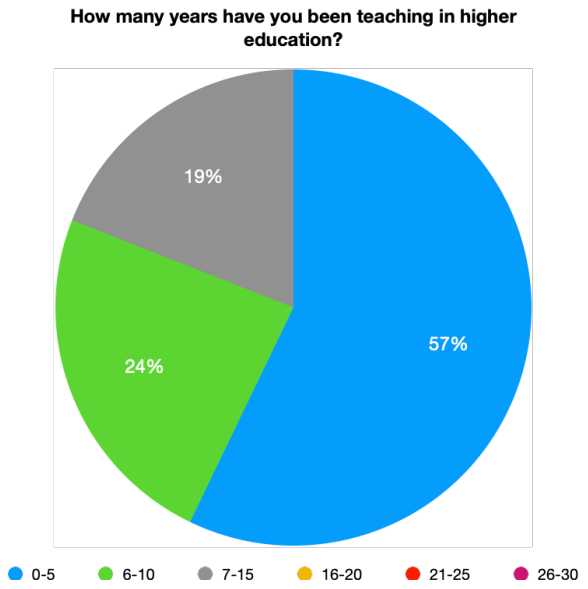
For T University, face-to-face learning was the main teaching method, accounting for 53.8% of the respondents, followed by mixed learning at 38.5%. On the other hand, it is evident that mixed methods were the primary learning approach at S University. Participants were also asked about their teaching experience in higher education. Figure 4.2 shows descriptive statistics related to this value, including percentages and frequency.

Participant Demographic *Pre-Survey - T University*
Teaching Experience in Higher Education



Teaching Experience in Higher Education	Frequency	Percentage	Valid Percentage	Cumulative Percentage
0-5	4	15.4%	15.4%	15.4
6-10	8	30.8%	30.8%	46.2
11-15	3	11.5%	11.5%	57.7
16-20	3	11.5%	11.5%	69.2
21-25	3	11.5%	11.5%	80.8
26-30	5	19.2%	19.2%	100.0
Total	26	100.0	100.0	

Participant Demographic *Pre-Survey - S University*
Teaching Experience in Higher Education



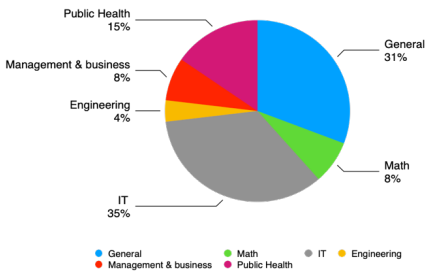
Teaching Experience in Higher Education	Frequency	Percentage	Valid Percentage	Cumulative Percentage
0-5	12	57.1	57.1%	57.1
6-10	5	23.8	23.8%	23.8
11-15	4	19.0	19.0%	19.0
Total	21	100.0	100.0%	100.0

Figure 4-2. Participant Demographic- Teaching Experience in Higher Education Pre-Survey (T University & S University).

The teaching experience of the faculty members who responded to the pre-survey from T University was predominantly within the range of 6-10 years (31%), followed by 26-30 years (19%). In contrast, for participants from S University, the majority had teaching experience between 0-5 years (57%), followed by 6-10 years (24%).

Other demographic information collected from participants included courses that they taught. Figures 4.3 and 4.4 display participant responses to these items.

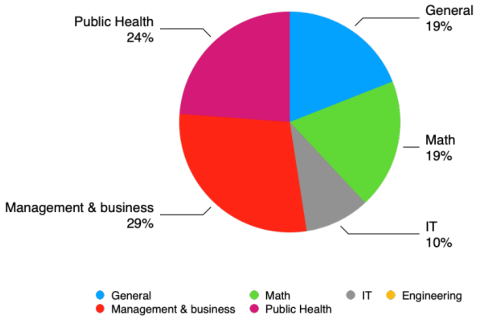
Participant Demographic *Pre-Survey - T University*
The Course that They are Teaching.



Course	Frequency	Valid Percent
General	8	30.80%
Math	2	7.70%
IT	9	34.60%
Engineering	1	3.80%
Management & business	2	7.70%
Public Health	2	15.40%
Total	26	100

Figure 4-3. Participant Demographic- Teaching Experience in Higher Education Pre-survey (T University).

Participant Demographic *Pre-Survey - S University*
The Course that They are Teaching.



Course	Frequency	Valid Percent
General	4	19%
Math	4	19%
IT	2	9.5%
Engineering	0	0
Management & business	6	28.6%
Public Health	5	23.8%
Total	21	100

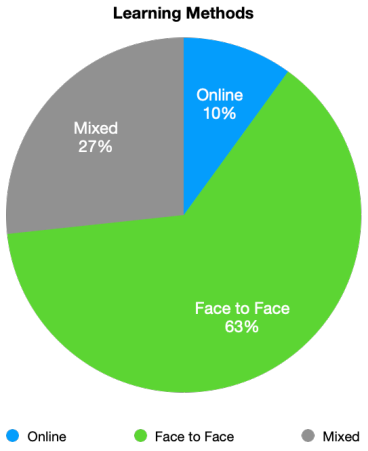
Figure 4-4. Participant Demographic - Teaching Experience in Higher Education Pre-Survey (S University).

Participants from T University were mostly teaching information and technology courses (35%), followed by general courses (31%). On the other hand, participants from S University were primarily teaching management courses (29%), followed by public health courses (24%).

For the post-survey, from 39 faculty members who attended the training session from both universities, 30 faculty members completed the survey from T University, while 9 faculty members completed it from S University. The difference in response for the post-survey between the two universities might be attributed to the timing of when the survey was conducted. For S University, the post-survey was administered during the final examination period, and as a result, most of the faculty members were occupied with their examination-related responsibilities.

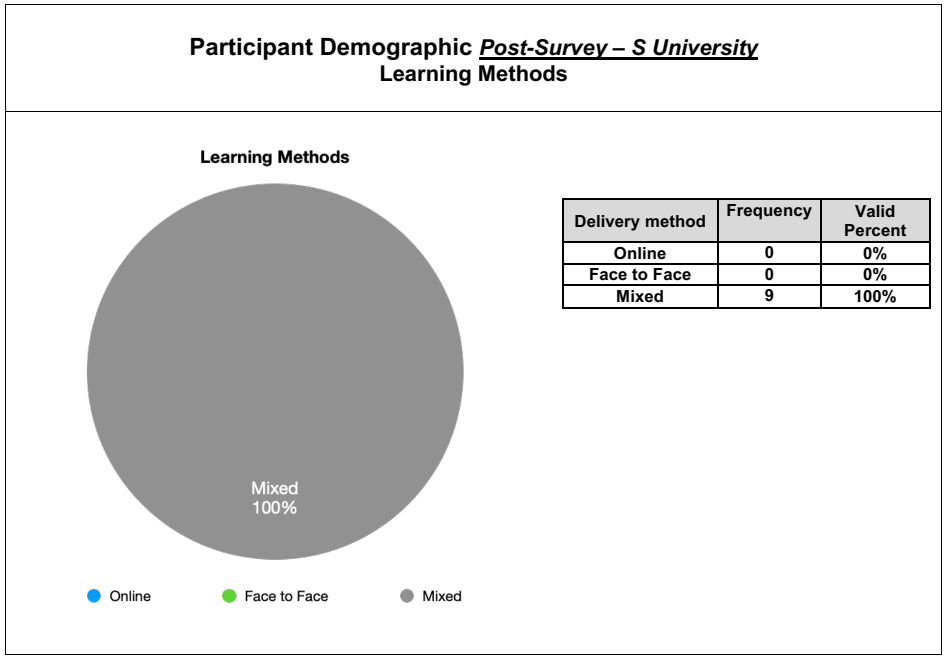
For the post-survey, participants were requested to provide the same demographic information as collected in the pre-survey, which included learning delivery methods, years of experience, and the courses they were teaching. Figures 4.5 to 4.10 represent the breakdown of participants by delivery methods, years of experience and courses they taught.

Participant Demographic *Post-Survey - T University*
Learning Methods



Delivery method	Frequency
Online	3
Face to Face	19
Mixed	8

Figure 4-5. Participant Demographic - Learning Methods Post-Survey - T University.



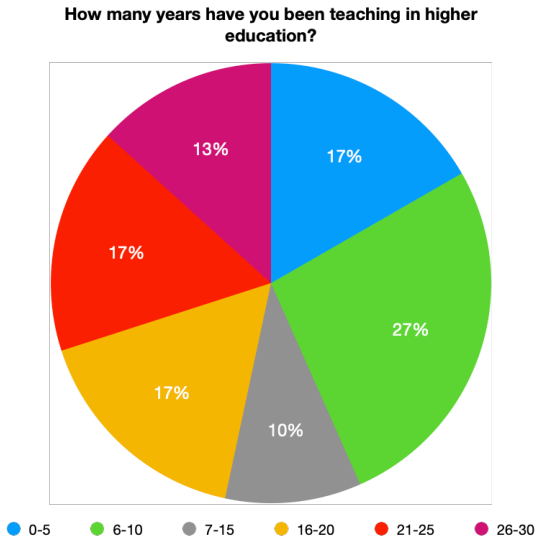
Delivery method	Frequency	Valid Percent
Online	0	0%
Face to Face	0	0%
Mixed	9	100%

Figure 4-6. Participant Demographic - Learning Methods Post-Survey - S University.

For T University, face-to-face learning was the main teaching method, accounting for 63% of the respondents, followed by mixed learning at 27%. All nine faculty members who completed the post-survey from S University indicated that their learning delivery method was mixed.

Participant Demographic *Post-Survey - T University*

Teaching Experience in Higher Education

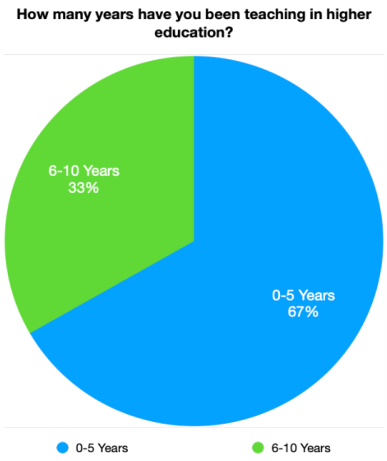


How many years have you been teaching in higher education?	Frequency	Percentage	Valid Percentage	Cumulative Percentage
0-5	5	16.7	16.7	16.7
6-10	8	26.7	26.7	43.3
11-15	3	10.0	10.0	53.3
16-20	5	16.7	16.7	70.0
21-25	5	16.7	16.7	86.7
26-30	4	13.3	13.3	100.0
Total	30	100.0	100.0	

Figure 4-7. Participant Demographic - Teaching Experience in Higher Education Post-Survey - T University.

Participant Demographic *Post-Survey - S University*

Teaching Experience in Higher Education



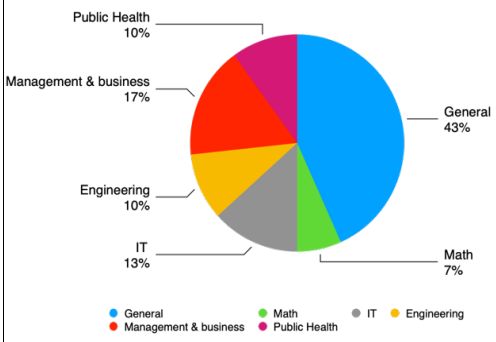
How many years have you been teaching in higher education?	Frequency	Percent	Valid Percent	Cumulative Percent
0-5	6	66.7	66.7	66.7
6-10	3	33.3	33.3	100.0
Total	9	100.0	100.0	

Figure 4-8. Participant Demographic - Teaching Experience in Higher Education Post-Survey - S University.

The teaching experience of the faculty members who responded to the post-survey from T University was predominantly within the range of 6-10 years (27%), followed by 0-5, 16-20 and 21-25 years (17%). The teaching experience of the faculty members who responded to the post-survey from S University ranged from only 0 to 10 years, with the majority having between 0 and 5 years of experience (67%), followed by 6 to 10 years (33%).

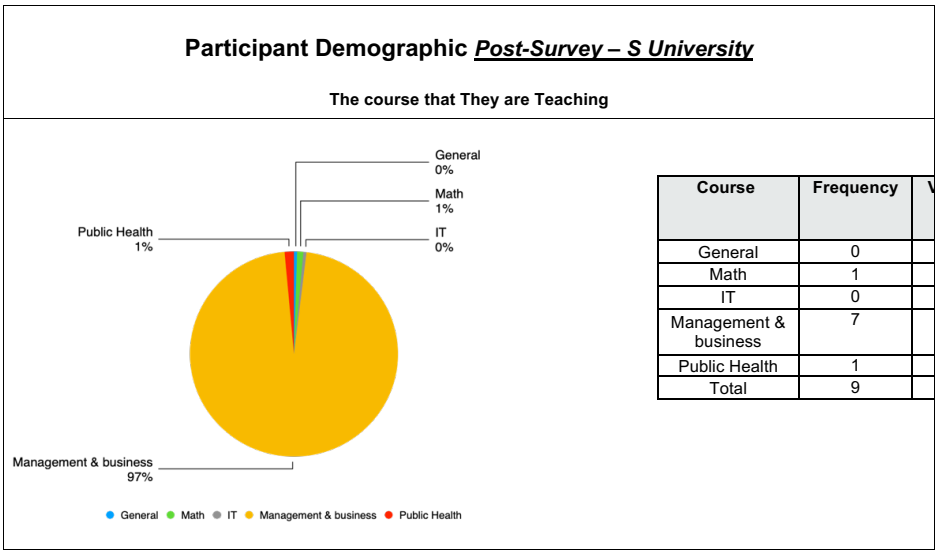
Participant Demographic *Post-Survey - T University*

The Course that They are Teaching.



Course	Frequency	Valid Percent
General	13	43.3%
Math	2	6.7%
IT	4	13.3%
Engineering	3	10%
Management & business	5	16.7%
Public Health	3	10%
Total	30	100

Figure 4-9. Participant Demographic - The Course that they are Teaching Post-Survey - T University.



Course	Frequency
General	0
Math	1
IT	0
Management & business	7
Public Health	1
Total	9

Figure 4-10. Participant Demographic - The Course that they are Teaching Post-Survey - S University.

Participants from T University who responded to the post-survey were mostly teaching general courses (43%), followed by management and business courses (17%). Furthermore, most participants who responded to the post-survey from S University are teaching courses in the field of management and business (97%).

Participants were provided with instructions to create an “Anonymous Participant Code” to protect their privacy. Nevertheless, the researcher noticed that participants employed different codes for the pre- and post-surveys. Consequently, the researcher decided to compare the demographic data to determine if the samples were similar. Further examination revealed that the two participant groups from both universities shared similar and common factors. For example, when analysing the frequency of teaching methods at T University, minor disparities were evident before and after the intervention. The majority indicated face-to-face teaching both before and after. Similarly, at S University, the

primary response was mixed teaching methods both before and after. Additionally, there was a continuity in the demographic profiles of the pre- and post-participant groups at both universities. For instance, participants from University T predominantly possessed 6-10 years of teaching experience, a trend that persisted after the intervention. Similarly, participants from University S predominantly reported 0-5 years of teaching experience both before and after.

Furthermore, there was homogeneity in the courses taught by participants. For example, most participants from T University taught general courses both before and after, while those from S University primarily taught management and business courses. This implies that the participant groups from both universities either comprised the same individuals or shared analogous demographic characteristics in terms of teaching methods, years of experience, and course subjects. Considering the similarities observed between the two groups before and after the intervention, the analysis of paired question comparisons was deemed appropriate.

4.2.4.2 Paired Question Comparison

The comparison of the two participant groups, one from each university, was carried out with the aim of understanding the impact of accessibility training on their respective teaching practices and experiences. The initial observation indicated that participants had used different codes for the pre- and post-surveys. However, upon closer examination, it became evident that these two groups were essentially drawn from the same population.

To assess the impact of the intervention, paired sample t-tests were employed. The utilisation of paired sample t-tests, also known as repeated measures t-tests, is essential when examining changes in scores among participants who underwent both pre- and post-intervention surveys. This statistical approach enables the examination of paired observations within the same group, allowing for the identification of significant differences between the two time points.

To select the appropriate statistical analyses, the decision-making process proposed by Pallant and Julie (2010) was employed, which consisted of the following steps: identification of the pertinent research questions requiring investigation; selection of the appropriate questionnaires, items, and scales to effectively addressing these research questions; determination of the inherent nature of each variable under examination; and construction of a diagram for each research question, aiding visualisation and comprehension. Subsequently, three distinct types of statistical tests were chosen, as outlined as follows:

1. Mann Whitney U test: This test was employed to assess the equality of scales in the question pair.

2. Wilcoxon Signed-Rank test: This test was employed because there were unequal scales in the question pair.

3. Cochran's Q test: This test was employed to analyse multiple responses in the question pair.

A detailed analysis of each survey question before the comparison is outlined in Appendix Six. As mentioned previously, the data analysis for the paired questions was conducted separately for each university, as follows.

T university

Table 4.3 shows results of the Mann Whitney U statistical test, the median and mean results for each paired scaled item on both surveys, and their significance values ($p<0.05$). Each question in the paired comparison was assigned a letter identifier. The item question identifiers are provided in detail in Appendix Seven.

Table 4-3: Results of Mann-Whitney U Statistical Test for T University.

Item		N	Mann-Whitney U Score	Standardized Test Statistic	Significance (p <0.05)	Reporting the output
QH	QF	56	412.500	0.411	0.681	A Mann-Whitney U test was performed to ascertain potential differences in attendance at the accessibility workshop between the pre- and post-surveys. The workshop attendance median scores for the pre- (Mdn=1.0) and post-surveys (Mdn=1.0) did not show statistically significant differences (U=412.5, z=.411, p=.681). The score distributions for this question in both the pre- and post-survey differed upon visual inspection. The post-survey group attended more sessions (Mean rank=29.25) than the pre-group (Mean rank=27.63).
QI	QG	56	491.500	1.716	.086	A Mann-Whitney U test was used to determine if there were differences in the opinion of the workshop's helpfulness between the pre- and post-workshop survey. Distributions of the scores for this

Item		N	Mann-Whitney U Score	Standardized Test Statistic	Significance (p <0.05)	Reporting the output
						question for pre- and post-groups were similar, as assessed by visual inspection. Median helpfulness scores for pre- (Mdn=3.0) and post-survey (Mdn=4.0) did not show statistically significant differences (U=211.5, z=.095, p=.924).
QJ	QU	56	345.000	-.798	.425	A Mann-Whitney U test was utilised to examine potential differences in opinions concerning the importance of accessible digital content between the pre- and post-surveys. Distributions of the scores for this question for pre- and post-groups were similar, as assessed by visual inspection. The median importance scores for pre- (Mdn=4.0) and post-surveys (Mdn=4.0) did not show statistically significant differences (U=345.0, z=-.798, p=.425).
QK	QV	56	354.500	-.647	0.518	A Mann-Whitney U test was conducted to examine whether there were different opinions regarding the importance of providing various approaches

Item		N	Mann-Whitney U Score	Standardized Test Statistic	Significance (p <0.05)	Reporting the output
						between the pre- and post-survey. Distributions of the scores for this question for both groups were similar, as assessed by visual inspection. Median importance scores for pre- (Mdn=5.0) and post-surveys (Mdn=4.5) did not show statistically significant differences (U=354.0, z=-.647, p=.518).

The Wilcoxon Signed-Rank test was conducted to analyse the differences between responses from the two faculty groups, considering the unequal scales of measurement. The Wilcoxon Signed-Rank test was applied to analyse the differences between the responses for seven paired questions as follows:

1. The Wilcoxon signed-rank test showed that attending accessibility training workshops and activating Ally did not elicit a statistically significant change in how faculty members approached accessibility for their content ($Z = -1.935$, $p = 0.053$). The median score rating was 3.50 for the pre- and 3.00 for the post-survey.
2. The Wilcoxon signed-rank test showed that awareness and knowledge of adding alternative text for images did not elicit a statistically significant change in how faculty members used alternative text in their course content ($Z = -.444$, $p = 0.657$). The median score rating for the pre-survey was 2.00, whereas it increased to 3.00 in the post-survey. This improvement indicated a positive (but not statistically different) change in the participants' abilities to add alternative text to images.
3. The Wilcoxon signed-rank test showed that awareness and knowledge of using headings when authoring documents did not elicit a statistically significant change in how faculty members used headings ($Z = -.706$, $p = 0.480$). The median score rating for the pre-survey was 2.00, whereas it increased to 3.00 in the post-survey. This improvement indicated a positive (but not statistically different) change in the participants' abilities to using headings.
4. The Wilcoxon signed-rank test showed a statistically significant change in PDF accessibility through post-training tagging ($Z = -2.436$, $p = 0.0154$). The median score rating for the pre-survey was 2.00, whereas it increased to 3.00 in the post-survey. This improvement indicated a positive statistically significant change in the participants' abilities to ensuring PDFs were accessible.
5. The Wilcoxon signed-rank test showed that fixing accessibility issues led to statistically significant changes in how accessibility issues could be fixed ($Z = -3.509$, $p = 0.01$). The median score rating for the pre-survey was 2.00, whereas it increased to 3.00 in the post-survey. This improvement indicated a positive statistically significant change in the participants' fixing of accessibility issues.

6. The Wilcoxon signed-rank test showed that the opinion of faculty members in the difficulty of creating accessible content did not elicit a statistically significant difference (Z = -1.066, p = 0.287). The median score rating for the pre-survey was 3.00, whereas it increased to 3.50 in the post-survey. This improvement indicated a positive (but not statistically different) change in how faculty perceived the difficulty of creating accessible content after using Ally.
7. The Wilcoxon signed-rank test showed that faculty awareness about the accessibility of their content led to a statistically significant change (Z = -3.623, p = 0.001). The median score rating for the pre-survey was 0.00, whereas it increased to 4.00 in the post-survey. This improvement indicated a positive statistically different change in the participants' awareness about their course's digital accessibility.

Cochran's Q test was used to analyse the paired questions with multiple response options. Table 4.4 shows the test statistics.

Table 4-4: Cochran's Q Test Analysed Paired Questions with Multiple Response Options at T University.

Test Statistics	
N	26
Cochran's Q	44.878a
df	9
Asymp. Sig.	<.001

The results of Cochran's Q test highlighted that there was a statistically significant difference in how faculty learned to use Ally before and after the intervention ($\chi 2$ (2) = 44.878, p < .001).

S University

Table 4.5 shows the Mann Whitney U statistical test, the median and mean results for each paired scaled item on both surveys, and their significance values ($p<0.05$). The item questions identifier is detailed in Appendix Seven.

Table 4-5: Results of Mann-Whitney U Statistical Test at S University.

Item		N	Mann-Whitney U Score	Standardized Test Statistic	Significance (p <0.05)	Reporting the output
Pre	Post					
QH	QF	56	127.00	1.607	.108	A Mann-Whitney U test was conducted to assess whether there were differences in attendance accessibility between the pre- and post-surveys. The median of attending workshop scores for pre- (Mdn=0.00) and post-surveys (Mdn=1.0) did not show statistically significant differences (U=127.00, z=1.60, p=.108). The score distributions for this question in both the pre- and post-survey differed upon visual inspection. The post-group attended more sessions (Mean rank= 29.25) than the pre-group (Mean rank= 27.63).
QI	QG	56	141.50	2.210	.027	A Mann-Whitney U test was run to determine if there were differences in the perception of the workshop's helpfulness between the pre- and

Item		N	Mann-Whitney U Score	Standardized Test Statistic	Significance (p <0.05)	Reporting the output
						post-surveys. Upon visual inspection, it was observed that the distributions of scores for this question in the pre- and post-groups were not identical. Median helpfulness scores for pre- (Mdn=3.0) and post-surveys (Mdn=5.0) showed statistically significant differences (U=141.50, z=2.2, p=.027).
QJ	QU	56	118.50	1.206	.228	A Mann-Whitney U test was conducted to examine whether there were any significant differences in the opinions regarding the importance of accessible digital content between the pre- and post-survey. Distributions of the scores for this question for pre- and post-survey were similar, as assessed by visual inspection. Median importance scores for pre- (Mdn=4.0) and post-surveys (Mdn=5.0) did not show statistically

Item		N	Mann-Whitney U Score	Standardized Test Statistic	Significance (p <0.05)	Reporting the output
						significant differences (U=118.50, z=1.206, p=.228).
QK	QV	56	107.00	.704	0.481	A Mann-Whitney U test was conducted to investigate whether there were any differences in the opinions regarding the importance of providing various approaches or methods between the pre- and post-survey. Distributions of the scores for this question for pre- and post-surveys were similar, as assessed by visual inspection. Median importance scores for pre- (Mdn=5.0) and post-surveys (Mdn=5.0) did not show statistically significant differences (U=107.0, z=0.704, p=0.481).

The Wilcoxon Signed-Rank test was conducted to analyse the differences between responses from the two faculty groups, considering the unequal scales of measurement. The Wilcoxon Signed-Rank test was conducted to analyse the differences between the responses for seven paired questions as follow:

1. The Wilcoxon signed-rank test showed that attending accessibility training workshops and activating Ally resulted in statistically significant changes in how faculty members approached accessibility for their content after the training ($Z = -2.165$, $p = 0.030$). The median score rating was 2 for the pre- and 3.00 for the post-survey. This improvement indicated a positive change in how faculty approached accessibility for their courses.
2. The Wilcoxon signed-rank test showed that awareness and knowledge of adding alternative text for images did not elicit a statistically significant change in how the faculty members used alternative text in their course content ($Z = -.639$, $p = 0.523$). The median score rating for the pre-survey was 2.00, whereas it increased to 3.00 in the post-survey. This improvement indicated a positive (but non-statistically significant) change in the participants' abilities to add alternative text for images.
3. The Wilcoxon signed-rank test showed that awareness and knowledge of using headings when authoring documents did not elicit a statistically significant change in how faculty members used headings ($Z = -1.129$, $p = 0.259$). The median score rating for the pre-survey was 3.00, whereas it increased to 5.00 in the post-survey. This improvement indicated a positive (but non-statistically significant) change in the participants' abilities to use headings.
4. The Wilcoxon signed-rank test showed that ensuring PDFs are tagged led to a statistically significant change in how faculty members were ensuring PDFs were accessible ($Z = -2.266$, $p = 0.023$). The median score rating for the pre-survey was 1.00, whereas it increased to 4.00 in the post-survey. This improvement indicated a positive (statistically significant) change in the participants' abilities to ensure that PDF files were accessible.

5. The Wilcoxon signed-rank test showed that fixing accessibility issues after the training did not elicit a statistically significant change in how faculty members were fixing accessibility (Z = -1.44, p = 0.15). The median score rating for the pre-survey was 2.00, and 0.00 in the post-survey. It is important to note that in this university, the course coordinator held the authority to make modifications to the content, rather than the faculty members.
6. The Wilcoxon signed-rank test showed that the opinion of faculty members about the difficulty of creating accessible content did not elicit a statistically significant change (Z = -.954, p = 0.340). The median score rating for the pre-survey was 3.00, whereas it increased to 4.00 in the post-survey. This improvement indicated a positive (but non-statistically significant) change in how faculty perceived the difficulty of creating accessible content after using Ally.
7. The Wilcoxon signed-rank test showed that faculty awareness about the accessibility of their content resulted in a statistically significant change (Z = -2.572, p = 0.010). The median score rating for the pre-survey was 1.00, whereas it increased to 4.00 in the post-survey. This improvement indicated a positive (statistically significant) change in the participants' awareness about their course's digital accessibility.

Cochran's Q test was utilised to analyse the paired questions that involved multiple response options, specifically focusing on how participants learned to use Ally. Table 4.6 displays the test statistics.

Table 4-6: Cochran's Q Test analysed Paired Questions with Multiple Response Options at S University.

Test Statistics	
N	9
Cochran's Q	59.377a
df	9
Asymp. Sig.	<.001

The results of Cochran's Q test showed that there was a statistically significant difference in how faculty members used Ally pre- and post-survey ($\chi 2(2) = 59.37$, $p < .001$).

4.3 Student Survey

4.3.1 Introduction

The pre-survey administered to students consisted of four sections encompassing a total of 28 questions. The first section focused on gathering general information about the students, such as their degree programme, academic status, and whether they had any disabilities or specific learning needs. The second section delved into the students' preferred devices, whereas the third and fourth sections centred around the primary accessibility challenges encountered by students when accessing digital course content, as well as their awareness of alternative formats available at the university. It is important to note that the second and fourth sections were adapted from the survey instrument developed by Ally Research SIG (Ally Anthology, 2018).

Subsequently, the post-survey was conducted to assess students' feedback following the training and the impact of having immediate access to alternative formats. Participants were asked to respond to 24 questions in this survey. The training sessions were offered in two different formats: 1) campus announcements, which attracted only a few students; and 2) emails sent to all students, which also garnered limited participation. However, class visits proved to be the most successful method in terms of student engagement compared to the previous two approaches.

Students were given the option to voluntarily participate in the study. Despite faculty encouragement and sharing of the post-survey link with the students, a significantly lower response rate was observed compared to the pre-survey. Despite these challenges, the collected data from the participants who did respond still provides valuable insights and contributes to the overall findings of the study. Table 4.7presents the total number of participants who responded to the survey question for both the pre-survey and post-survey.

Table 4-7: Total number of Participants who Responded to the Survey Question for both the Pre-Survey and Post-Survey.

University	Pre-Survey Responses	Post-Survey Responses
T	25	15
S	54	7
Total	79	22

4.3.2 Student Survey Reliability

The internal reliability consistency of the questionnaire was assessed by calculating Cronbach's Alpha coefficient using the responses to all questions in the questionnaire, except for the multiple-choice questions in the pre- and post-surveys. The Cronbach's Alpha values for all surveys indicated a high level of internal consistency (Bland & Altman, 1997; Pallant & Julie, 2010) as shown in Table 4.8.

The item total statistics suggest that none of the questions had an excessive impact on the internal reliability consistency of the questionnaire.

Table 4-8: Questionnaire Internal Reliability and Consistency in Student Survey.

Student	T University	S University
Pre-survey	0.912	0.783
Post-survey	0.719	0.912

4.3.3 Results

4.3.3.1 Demographic Results

Most participants for the pre-survey from T University were in their 2nd and 4th academic years, each accounting for 28% of the respondents, while students in their 1st, 3rd, and graduate academic years had frequencies of 12%, 20% and 12% respectively. Among the participants, 68% were pursuing a bachelor's degree, 16% were enrolled in a master's programme, and 8% were pursuing a doctoral degree. Most participants (64%) were full-time undergraduates, while a smaller proportion (8%) were full-time graduate students. Additionally, 28% of the respondents were part-time undergraduate students.

Out of the respondents, 28% were employed, while the majority (72%) were not currently employed. The distribution of participants across different schools at T University varied. The highest representation was from the IT and management and business schools, each accounting for 28% of the respondents. Other schools, such as engineering, public health, College of Technological Innovation (CTI), psychology, and multimedia design, had smaller frequencies ranging from 4% to 12%. Most participants (92%) reported not having children, while 8% of participants indicated that they were parents.

When it came to learning methods, 52% of the respondents attended mixed classes, followed by 36% attending face-to-face classes and 12% opted for online classes. Table 4.9 shows the breakdown of the participants' demographics.

Table 4-9: The Breakdown of the Participants' Demographics Pre-Survey - T university.

Student Pre-Survey - T University			
Variable	Level	Frequency	Percentage
Academic year			
	1st	3	12%
	2nd	7	28%
	3rd	5	20%
	4th	7	28%
	Graduate	3	12%
Degree			
	Bachelor's	17	68%
	Maser	4	16%
	Doctoral	2	8%
	Other	2	8%
Enrolment Status			

	Full- time undergraduate	16	64%
	Full- time graduate	2	8%
	Part- time undergraduate	7	28%
Employment Status			
	Employed	7	28%
	Not employment	18	72%
College			
	General	1	4%
	IT	7	28%
	Engineer	2	8%
	Management & Business	7	28%
	Public Health	3	12%
	CTI	3	12%

	Psychology	1	4%
	Multimedia design	1	4%
Parental Status			
	Yes	2	8%
	No	23	92%
Learning Methods			
	Online	3	12%
	Face to Face	9	36%
	Mixed	13	52%

The analysis of the demographic variables from the student post-survey at T University shows that 20% of participants were in their 2nd year, 40% were in their 3rd year, 33.3% were in their 4th year, and 6.7% were graduate students. In terms of degree, 80% were pursuing a bachelor's degree, 6.7% were enrolled in a master's programme, and 13.3% fell under the "other" category which corresponds to other degree levels like diplomas. Most participants (66.7%) were full-time undergraduate students, 6.7% were full-time graduate students, and 26.7% were part-time undergraduate students. Employment-wise, 33.3% of respondents were employed, while 66.7% were not currently employed. Looking at the school distribution, 13.3% were in the general school, 26.7% in the IT school, 13.3% in the engineering school, 13.3% in the management and business school, 6.7% in the public health school, and 13.3% in the CTI school. Additionally, 6.7% of participants attended both the psychology and multimedia design schools. A small

proportion (6.7%) of participants were parents, while the majority (93.3%) did not have children. As for learning methods, 6.7% attended online classes, 53.3% face-to-face, and 40% mixed methods. Detailed information can be found in Table 4.10.

Table 4-10: The Breakdown of the Participants' Demographics Post- Survey - T University.

Student Post -Survey - T University			
Variable	Level	Frequency	Percentage
Academic year			
	2nd	3	20%
	3rd	6	40%
	4th	5	33.3%
	Graduate	1	6.7%
Degree			
	Bachelor's degree	12	80%
	Maser	1	6.7%
	Other	2	13.3%
Enrolment Status			
	Full- time undergraduate	10	66.7%
	Full- time graduate	1	6.7%

	Part- time undergraduate	4	26.7%
Employment Status			
	Employed	5	33.3%
	Not employed	10	66.7%
College			
	General	2	13.3%
	IT	4	26.7%
	Engineer	2	13.3%
	Management &Business	2	13.3%
	Public Health	1	6.7%
	CTI	2	13.3%
	Psychology	1	6.7%
	Multimedia design	1	6.7%
Parental Status			

	Yes	1	6.7%
	No	14	93.3%
Learning Methods			
	Online	1	6.7%
	Face to Face	8	53.3%
	Mixed	6	40%

Participants were guided to create an “Anonymous Participant Code” to ensure their privacy. Upon comparing the responses before and after, the following observation was noted:

1. Academic Year:
   - The percentages for the 2nd and 4th years are quite close between the two datasets, showing a consistency in representation.
   - In the post-survey, the 3rd year has a higher percentage (40%) compared to the 3rd year in the pre-survey (20%).

2. Degree:
   - Both datasets exhibit a higher percentage of bachelor’s degree students.
   - There is a slight shift in the percentages for master’s degree and “Other” categories between the datasets.

3. Enrolment Status:

- There is a noticeable similarity in the percentages for full-time undergraduate students.
- The part-time undergraduate percentage is slightly higher in the post-survey compared to the previous one.

4. Employment Status:

- The “Employed” and “Not employed” percentages show some variation between the two datasets.

5. College:

- Although the distribution among colleges varies, the general pattern indicates a mix of students from diverse college backgrounds in both datasets.

6. Parental Status:

- The percentages for “Yes” and “No” in parental status display a similar trend in both datasets.

7. Learning Methods:

- The proportion of students using “Face-to-Face” and “Mixed” learning methods is relatively consistent across both datasets.
- However, there is a shift in the percentage of students learning “Online” between the two datasets.

These comparisons reveal both similarities and variations in student demographics between the two sets of data, indicating certain consistencies and changes in specific categories. Consequently, for the students' data, paired questions were conducted, relying on Ally reports, specifically, the alternative format usage report. These results were then compared with the statistical results from the paired questions to ensure reliability of the analysis.

The highest number of student responses for the pre-survey was recorded at S University. When it came to academic years, 64.8% of participants were in their 2nd year, followed by 22% in the 4th year, 11% in the 3rd year, and only 1.9% in the 1st year. In terms of degree, 74% of participants were pursuing a bachelor's degree, 14.8% were enrolled in a master's programme, and 11% were doctoral students. As for the academic status, 79.6% were full-time undergraduate students, 18.5% were full-time graduate students, and a small proportion (1.9%) were part-time undergraduate students. In terms of employment status, 46.3% of participants were employed, while 53.7% were not currently employed. Looking at the distribution across schools, 79.6% of participants were in the public health school, 16.7% were in the management and business school, and 3.7% were in the IT school. Parental status indicated that 44.4% of participants were parents, while the majority (55.6%) were not. In terms of learning methods, the majority (98.1%) were attending mixed learning classes, with only 1.9% opting for online classes. Table 4.11 shows the demographic characteristics of participants at S university for the pre-survey, highlighting the distribution across academic years, degrees, enrolment status, employment status, colleges, parental status, and preferred learning methods.

Table 4-11: The Breakdown of the Participants' Demographics Pre-Survey - S university.

Student Pre-Survey - S university			
Variable	Level	Frequency	Percentage
Academic year			
	1st	1	1.9%
	2nd	35	64.8%
	3rd	6	11%
	4th	12	22%
Degree			
	Bachelor's degree	40	74%
	Maser	8	14.8%
	Doctoral	6	11%
Enrolment Status			
	Full- time undergraduate	43	79.6%
	Full- time graduate	10	18.5%
	Part- time undergraduate	1	1.9 %
Employment Status			
	Employed	25	46.3%
	Not employment	29	53.7%
College			

	IT	2	3.7 %
	Management &Business	9	16.7%
	Public Health	43	79.6%
Parental Status			
	Yes	24	44.4%
	No	30	55.6%
Learning Methods			
	Online	1	1.9%
	Mixed	53	98.1%

By contrast, for the post-survey, 57.1% of participants were in their 4th year, 28.6% were in their 2nd year, and 14.3% were in their first year. In terms of degree level, 57% were completing their bachelor's degree, 28.6% were pursuing their master's, and the remaining 14.3% were pursuing their doctoral studies. Most participants were full-time undergraduate students (71%) and employed (57.1%). The distribution across colleges showed a higher representation from the public health school (57.1%) compared to the management and business school (42.9%). Additionally, 42.9% of participants reported being parents. The preferred learning method was mixed (57.1%). However, it is important to note that the response rate for the post-training survey was relatively low, potentially due to the timing of the survey coinciding with the end of the academic year and the examination period. Table 4.12 shows the demographic details.

Table 4-12: The Breakdown of the Participants' Demographics Post-Survey - S University.

Student Post-Survey - S University			
Variable	Level	Frequency	Percentage
Academic year			
	1st	1	14.3%
	2nd	2	28.6%
	4th	4	57.1%
Degree			
	Bachelor's degree	4	57%
	Master's degree	2	28.6%
	Doctoral	1	14.3%
Enrolment Status			
	Full-time undergraduate	5	71%
	Part-time undergraduate	1	14.3 %
	Part-time graduate	1	14.3 %

Employment Status			
	Employed	4	57.1%
	Not employment	3	42.9%
College			
	Management & Business	3	42.9%
	Public Health	4	57.1%
Parental Status			
	Yes	3	42.9%
	No	4	57.1%
Learning Methods			
	Online	1	14.3%
	Face-to-face	2	28.6%
	Mixed	4	57.1%

When comparing the pre- and post-surveys at S University, it was not feasible to observe substantial differences due to the response differences between the two survey instances.

4.3.3.2 Paired Questions Comparison and Descriptive Analysis

To evaluate the effectiveness of the intervention, paired sample t-tests and descriptive analysis were utilised. The statistical methodology employed for the faculty survey was also applied to analyse the students' survey data.

Two distinct types of statistical tests were selected for the analysis, as outlined as follows:

- Mann-Whitney U test: This test was used to compare responses with equal scales in the question pair.
- Cochran's Q test: This test was chosen for analysing multiple responses within the question pair.

As mentioned previously, the data analysis for the paired questions was conducted separately for each university, following the same steps (see Section 4.2.4.2, Paired Questions Comparison).

T University

The students were presented with a series of questions, including one multiple-response item, to gauge their behaviour while accessing the course content and to identify the main challenges they encountered. Table 4.13 displays the descriptive statistics for the scaled responses. Refer to Appendix Eight for item-wise descriptive analysis.

Table 4-13. Descriptive Statistics for Scaled Response Data - T University.

Item	N	Mean	Std. Deviation	Median
QK	25	4.52	1.229	5.00
QL	25	3.16	1.724	3.00
QM	25	3.28	1.339	3.00
QN	25	4.04	1.274	5.00
QO	25	3.80	1.443	4.00
QP	25	4.36	.952	5.00

A large majority of students (84%) indicated that they consistently used their computers to access the course content, making it the most frequently chosen option. Additionally, a significant proportion reported that the course content worked well with their preferred device, with 55% stating it worked very well and 20% stating it worked well. In addition, 48% preferred easy annotation/highlighting of digital content for learning and 56% desired both reading and listening options for improved learning.

Students reported the following main barriers to accessing course materials: 26% cited other issues, 14% mentioned small text size, 12% expressed concerns about the poor quality of scanned documents, and an additional 12% identified the lack of captioning in videos.

Tables 4.14 shows the Mann Whitney U statistical test, the median and mean results for each paired scaled item on both surveys, and their significance values (p. <0.05). Refer to Appendix Eight for item-wise descriptive analysis.

Table 4-14: Mann-Whitney U Statistical Test Results, Median, and Mean Values for Paired Scaled Items on Both Surveys - T University.

Item		Item	N	Mann- Whitney U Score	Standardized Test Statistic	Significance ($p < 0.05$)	Median
Pre	Post						
QX	QN	Frequency of downloading alternative formats of course files	36	216.500	2.918	0.04	Pre-survey: 1:00 Post-survey: 4:00
QW	QM	How did you learn about the alternative formats	36	249.500	3.936	.001	Pre-survey: 2:00 Post-survey: 6.00
QU	QW	Frequency of requests for course materials accommodation	36	89.500	-1.728	.084	Pre-survey: 2:00 Post-survey: 1.00
QV	QX	Which alternative formats do you request despite	36	67.000	-2.524	.012	Pre-survey: 3:00 Post-survey: 0.00

Item		Item	N	Mann- Whitney U Score	Standardized Test Statistic	Significance (p <0.05)	Median
Pre	Post						
		Ally's availability?					
QAA	QV	Whether the instructor encouraged the use of alternative formats	36	252.500	4.122	.001	Pre-survey: 1:00 Post-survey: 4:00

Before the training sessions, alternative formatting was made available to all students and yet only 40% of students downloaded the alternative format. However, after the training, this usage increased significantly to 72%. Additionally, 45% of students afterwards downloaded the alternative formats very often, which emphasises the positive impact of the training on their awareness.

To assess the differences in downloading the alternative format before and after the training, the researcher used a Mann-Whitney U test. After the test was done, visual inspection of the score distributions indicated a shift towards the pre-survey. The median scores for the pre-survey (Mdn=1.0) and post-survey (Mdn=4.0) showed statistically significant differences, with a U value of 216.5, a z-score of 2.91, and a p-value of 0.004. In addition, the Mann-Whitney U test was used to investigate potential differences in how students learned about alternative formats before and after the intervention. Visual inspection of the score distributions revealed that they were not symmetrical. The median score for how students learned about Ally in the pre-survey group was 2.0, while in the post-survey group it was 6.0. These medians showed a statistically significant difference, with a U value of 249.5, a z-score of 3.93, and a p-value of 0.001. Additionally, the impact of the training sessions was evident. Prior to the intervention, only 4% of students attended and learned about alternative formats. In contrast, 66% of students reported learning about alternative formats after attending the training sessions.

Moreover, among the 40% of students who had previously attempted to access alternative formats, their downloads were exclusively limited to tagged PDFs since they were unaware of the benefits offered by other formats. However, after the training sessions, there was a notable shift in their behaviour. Out of this group, 37% continued to download tagged PDFs, while a marked change occurred as 25% of them started utilising HTML, and another 25% began using ePUB formats. The training proved to be a catalyst in broadening their awareness and usage of diverse alternative formats.

Additionally, a Mann-Whitney U test was used to determine whether there were any differences in alternative format requests before and after utilising Ally from the disability centre. In fact, student requests for an alternative format from the disability centre were

reduced to 36.4% (from 72%) after using Ally. Visual inspection also revealed that the score distributions for this question were shifted towards the pre-survey. The median for downloading alternative formats was found to be significantly different between the pre-survey group (Mdn=3.0) and the post-survey group (Mdn=0.0), with a U value of 67.00, a z-score of -2.524, and a p-value of .015. Furthermore, specific formats such as accessible MS Word documents saw a significant decline, from 11% before using Ally to just 3% after training. Similarly, the need for enlarged documents and audio requests diminished as Ally automatically provided these formats, eliminating the necessity for students to make such requests. For instance, 33% of students rated the quality of the alternative format as high, while another 33% rated it as very high.

A Mann-Whitney U test was also used to determine if there were differences in whether the instructor encouraged the use of alternative formats before and after the intervention. Distributions of the scores for this question for pre- and post-groups were not similar, as assessed by visual inspection. Median helpfulness scores for the pre- (Mdn=1.0) and post-survey (Mdn=4.0) showed statistically significant differences with U=252.5, z=4.122, p=.001.

Cochran's Q test analysed paired questions on course accessibility before and after using Ally, including the impact of accessing inaccessible/accessible content. Table 4.15 displays the frequencies and test statistics obtained from this analysis. It is worth mentioning that the findings of Cochran's Q test were statistically significant for the impact of receiving accessible/inaccessible course materials directly, courses for which students found their materials not accessible, despite Ally being available and courses in which students reported improved material accessibility after using Ally. Figure 4.11 shows the student reports on inaccessible materials.

Table 4-15: Cochran's Q test for Paired Multiple Choice Items on Both Surveys - T University.

Item	Description	N	Asymp. Sig.
Q.TT	The impact of receiving accessible/inaccessible course materials directly	15	.001
Q. SS	Courses for which students found their materials not accessible, despite Ally being available	15	.001
Q.SR	Courses in which students reported improved material accessibility after using Ally	15	0.001

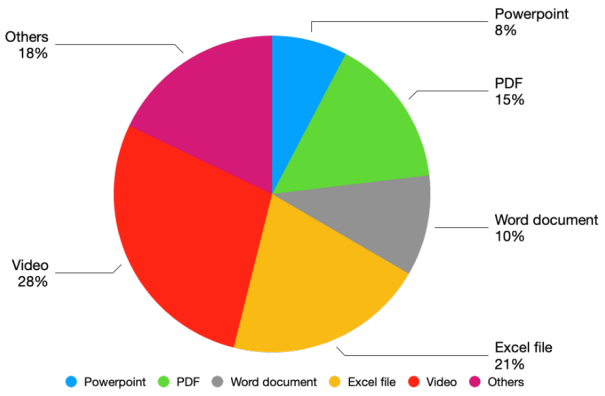


Figure 4-11. The Student Reports on Inaccessible Material - T University.

Before implementing Ally, students reported that mathematics was the most inaccessible course (32%), followed by Arabic (24%), laboratory (19%), English (13%), and science (10%). After implementing Ally, the Arabic course remained the most inaccessible (53%), followed by mathematics (20%). However, the English course inaccessibility decreased to 8%. Furthermore, after using alternative formats, the English course accessibility improved significantly by 66%, while mathematics and laboratory courses saw a slight increase of 7% each.

Cochran's Q test determined that there was a statistically significant difference in file and course accessibility before and after the intervention as shown in Table 4.15.

S University

The responses gathered from S University varied for the pre- and post-survey. The responses for the pre-survey reached 54, whereas post-survey had only 7 responses. These differences were considered during data analysis.

It is important to mention that the same questions were asked of students at T University, and the paired question data analysis was identical. The first set of questions assessed their behaviour when accessing course content and identifying main challenges. Table 4.16 shows the descriptive statistics for the scaled responses.

Table 4-16: Descriptive Statistics for Scaled Response Data - S University.

Item	N	Mean	Std. Deviation	Median
QK	54	4.19	1.275	5.00
QL	54	2.63	1.752	2.00
QM	54	3.72	1.366	4.00
QN	54	4.13	.891	4.00
QO	54	3.98	1.189	4.50
QP	54	4.13	1.100	5.00

After analysing the data, it was deduced that 65% of students were consistently using computers to access course content. Furthermore, 50% of students stated that the course content worked very well on their preferred devices. However, 25% were uncertain about its compatibility. Additionally, 45% of students expressed a preference for easy annotation to enhance their learning. Similarly, 50% desired both reading and listening options to improve their learning experience. The main barriers reported by students included difficult font style (27%), inaccessible images (15%), small text size (15%), and poor quality of scanned documents (14%).

Table 4.17 shows for the Mann Whitney U statistical test, the median and mean results for each paired scaled item for both surveys, and their significance values (p. <0.05). (Refer to Appendix Nine for item-wise descriptive analysis)

Table 4-17: Mann-Whitney U Statistical Test Results, Median, and Mean Values for Paired Scaled Items on Both Surveys - S university.

Item		Item	N	Mann- Whitney U Score	Standardized Test Statistic	Significance (p <0.05)	Median
Pre	Post						
QX	QN	Frequency of downloading alternative formats of course files	61	296.00	2.568	0.010	Pre-survey: 2.45 Post-survey: 0.43
QW	QM	How did you learn about the alternative formats	61	345.000	3.625	.01	Pre-survey: 2.93 Post-survey: 5.71
QU	QW	Frequency of requests for course materials accommodation	61	217.000	1.080	.280	Pre-survey: 1.24 Post-survey: 1.29
QV	QX	Which alternative formats do you request despite	61	92.500	-2.289	.022	Pre-survey: 2.13 Post-survey: 3.71

Item		Item	N	Mann- Whitney U Score	Standardized Test Statistic	Significance (p <0.05)	Median
Pre	Post						
		Ally's availability?					
QAA	QV	Whether the instructor encouraged the use of alternative formats	61	289.500	2.394	.017	Pre-survey: 1.67 Post-survey: 3.34

Even though alternative formats were available at S University for one year before the training, 46% of students were unaware of them. However, the training helped create a significant increase in the usage of alternative formats. In fact, 60% began using them more frequently.

Regarding the training impact, 86% of participants acquired knowledge about Ally through the training sessions, whereas 26% had previously utilised other methods, which could be due to their curiosity about the new LMS symbol mentioned in the focus group, which will be further discussed in the upcoming section. A Mann-Whitney U test was conducted to assess the differences in downloading the alternative format before and after the training. The median scores for the pre-survey (Mdn=2.98) and post-survey (Mdn=5.71) showed statistically significant differences, with a U value of 345, a z-score of 3.625, and a p-value of 0.001. Among 46% who previously accessed alternative formats, most downloaded tagged PDFs, unaware of other benefits, and 50% explored the new icon only. Post-training, a notable shift occurred: 29% still downloaded tagged PDFs, while 71% started using HTML. The results show that the training broadened awareness and usage of diverse formats.

A Mann-Whitney U test revealed no significant difference in alternative format requests before and after utilising Ally from the disability centre, as shown in Table 4.17.

When comparing the use of alternative formats before and after the introduction of Ally, it is important to mention that the most requested alternative format was an enlarged document (36%), which decreased to zero after Ally was introduced. Nonetheless, despite Ally's presence, the most requested format was Accessible Arabic PDF. The result of a Mann-Whitney U test showed a significant difference before and after the intervention, with a U value of 92.500, a z-score of -2.289, and a p-value of .022. The results also showed that 57% of students reported that the alternative formats had high quality, 29% said they very high quality, and 14% stated they had average quality.

In addition, a Mann-Whitney U test was run to determine if there were differences in whether the instructor encouraged the use of alternative formats before and after the

intervention. Median helpfulness scores for pre- (Mdn=1.67) and post-survey (Mdn=3.43) showed a statistically significant difference, with values U=289.500, z=2.394, and p=.017.

Cochran's Q test analysed paired questions on course accessibility before and after training on Ally, including the impact of accessing inaccessible/accessible content. Table 4.18 presents the frequencies and test statistics obtained from this analysis. It is worth mentioning that the Cochran's Q test findings were statistically significant for three items.

Table 4-18: Cochran's Q test r Paired Multiple Choice Items on Both Surveys - S University.

Item	Description	N	Asymp. Sig.
Q.TT	The impact of receiving accessible/inaccessible course materials directly	7	.199
Q. SS	Courses for which the students found their materials not accessible, despite Ally being available	7	.437
Q.SR	Courses for which the students found their materials accessible after using Ally	7	.437

Figure 4.12 shows students' reports on inaccessible materials.

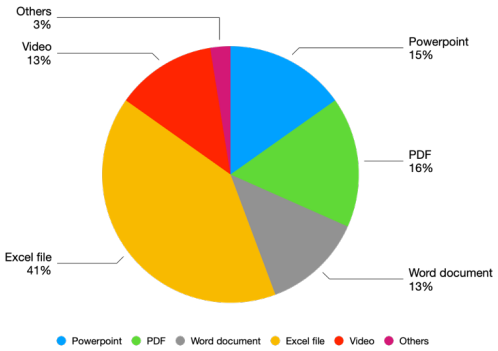


Figure 4-12. The Student Reports on Inaccessible Material - S University.

Before implementing Ally, students reported that mathematics was the most inaccessible course (32%), followed by English (26%), and laboratory (26%). After implementing Ally, the English course remained the most inaccessible (60%). However, alternative formats helped improve the accessibly of the mathematics course by 60% (see Appendix Eight).

4.4 Ally Institution Report

The second set of quantitative data comes from the Ally institution report, providing an insight into the institution's course content accessibility. It offers insights into monthly, term-based, and academic year accessibility scores. Additionally, the report displays details on student and instructor usage of Ally, such as alternative format downloads and fixes for accessibility issues. This report complements the summary, which showcases the institution's digital course content performance. It presents a comprehensive accessibility score and detects accessibility issues by month, term, or academic year. Users can access more detailed information by exporting the report, noting that deleted courses are visible only in the monthly and academic reports but excluded from the term report.

4.4.1 Institution Report Overview - Accessibility Score

The research was conducted over a period of 3 to 4 months at each university. It is also important to mention that the accessibility score analysis was performed monthly rather than on a term-based academic year. A sample report is shown in Appendix Ten.

T University

Ally was activated in September 2021, with an overall accessibility score of 35%. However, the focus of this study, which is the uploaded file accessibility, had a score of 28%, whereas the 'what you see is what you get' (WYSIWYG) score for the faculty-created content on the LMS was 97%. The first accessibility session took place in December 2022, with five sessions delivered to the institution. By the end of the training in March 2023, the overall accessibility scores slightly improved to 40%, while course accessibility reached 32% and the WYSIWYG score remained high at 98% (see Figure 4.13).

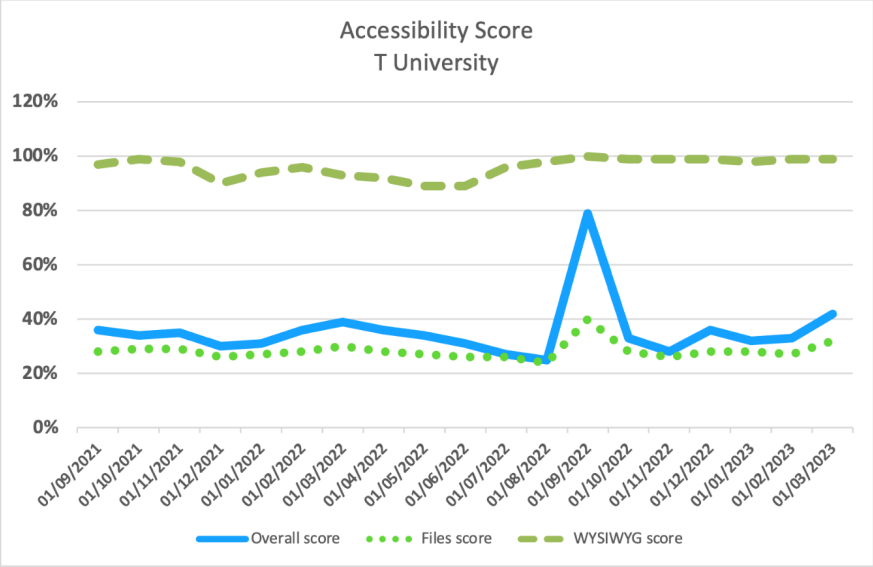


Figure 4-13. Accessibility Scores during a Specific Period that includes Pre- and Post- training.

To provide a comprehensive overview of the primary accessibility issues pertaining to file-type uploads before and after the training, a comparative analysis was conducted using the data recorded in the reports dated 1/04/2022 and 1/03/2023. These specific time periods were selected due to their similarity in the number of files uploaded compared to the period when Ally was first activated on 1/09/2021. By adopting this approach, the aim was to gain authentic insights into the enduring accessibility challenges associated with file uploads.

All the data analysis and comparisons focused on these specific periods. Figure 4.14 illustrates that images were the most frequently uploaded files during both periods, accounting for 83% in period 1 and 84% in period 2 of the uploads, respectively. PDFs followed with 8% and 10% of the uploads for the corresponding periods, respectively.

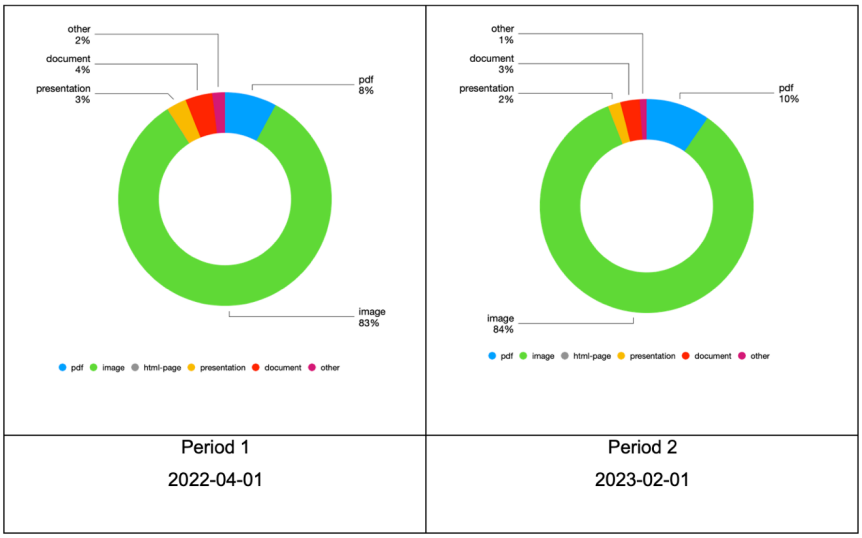


Figure 4-14. Percentage of File Type Uploaded to Blackboard between Two Periods.

The comparison of the most prevalent accessibility issues between the two periods revealed that the primary concern was the lack of image descriptions. Additionally, other accessibility challenges were evenly distributed between contrast sensitivity issues and inaccessible PDFs as shown in Figure 4.15.

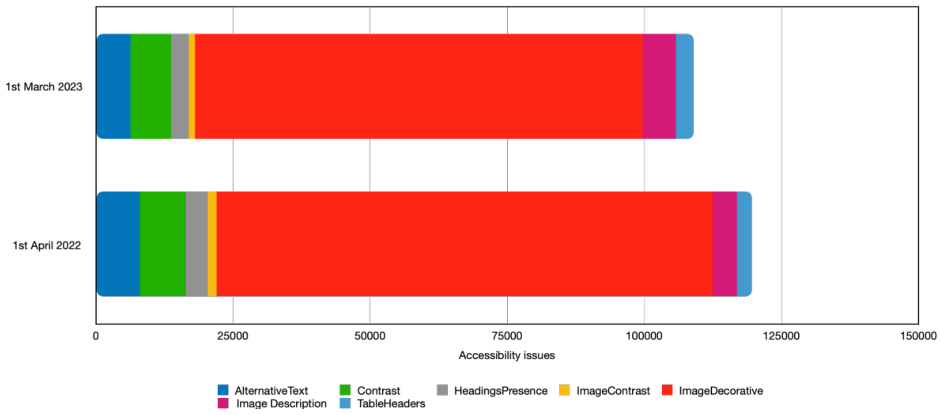


Figure 4-15. Comparisons of Course File Accessibility during Specific Periods - T University.

In general, it is evident that the accessibility issues decreased over time. In fact, after the training, notable improvements were observed in the accessibility of various elements. Image descriptions showed a 25% enhancement, contrast accessibility improved by 12%, image contrast by 24%, and document headings by 20%. However, it is worth mentioning that the accessibility of tables and PDFs decreased by 25% and 17% respectively, indicating a decline in their accessibility during the assessment period.

S University

Ally was activated in August 2021 at University S, achieving an overall accessibility score of 34%. The score of the uploaded file accessibility was 17%, while the WYSIWYG score for faculty-created content on the LMS was 75%. The first accessibility session occurred in December 2022, with seven sessions delivered to the institution. By the end of the training in March 2023, there was a significant improvement in the overall accessibility score, reaching 90%, with course accessibility at 60% and the WYSIWYG score at 100%. Refer to Figure 4.16 for a visual representation of the overall accessibility scores during the research period.

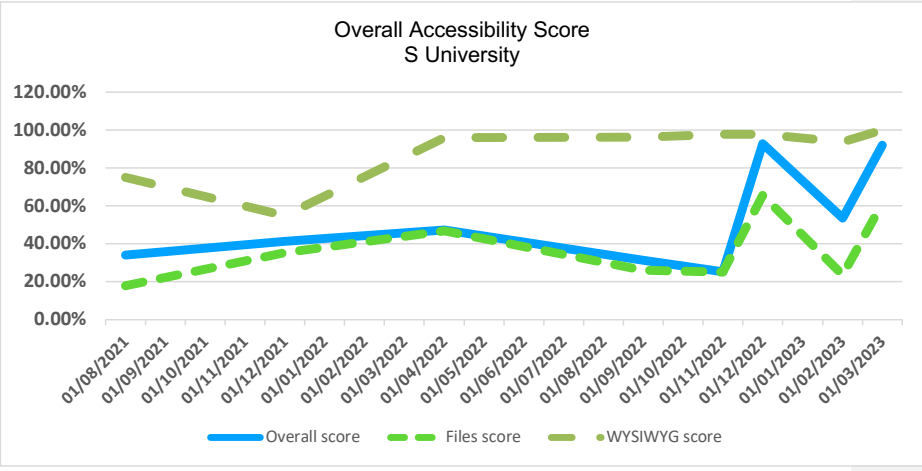


Figure 4-16. File Accessibility Scores during a Specific Period that Includes Pre- and Post-Training.

Between the period of 1/08/2021 to 1/03/2023, the most frequently uploaded file type was “other”, accounting for 56% of the uploads, followed by images at 30%, and PDFs at 12%. Throughout the study, it was deduced that file uploads were managed by a coordinator at University S, leading to a bulk of content uploaded at the start of each academic year and throughout. Capturing accessibility improvement before and after changes was difficult due to this pattern. Hence, the decision was made to analyse accessibility issues collectively from 1/08/2021 to 1/03/2023, which allows for the consideration of the start of each semester and thus enables a comprehensive assessment.

Figure 4.17 shows that the primary accessibility issue was related to image description, accounting for 49%, followed by image text at 15%. This indicates instances where PDF documents or presentations contained at least one image without alternative text.

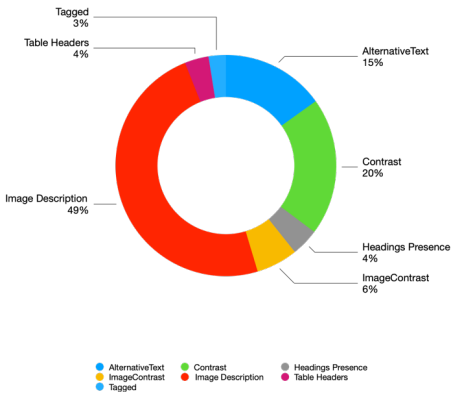


Figure 4-17. Primary Accessibility Issue When Uploading Course Content.

When comparing the most common accessibility issues between the two periods, it became evident that the primary concern was related to contrast sensitivity and table headers. It was observed that, overall, the percentage of accessibility issues decreased after the training. It is worth noting that this comparison specifically focused on the period before and after the training, and the number of uploaded files facilitated an accurate assessment, as illustrated in Figure 4.18.

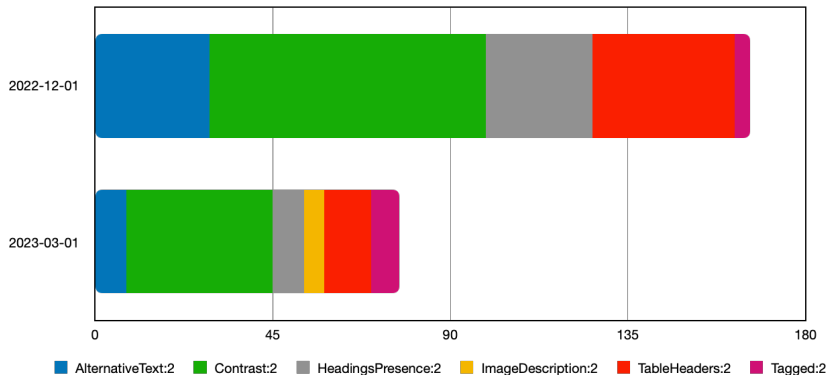


Figure 4-18. Comparisons of Course File Accessibility during Specific Periods - S University.

Overall, accessibility issues decreased over time, with significant improvements observed post-training: image descriptions improved by 72%, contrast accessibility by 47%, and document headings by 70% as shown in Figure 4.18.

4.4.2 Ally Usage Report

The Ally usage report plays a key role in providing insights into the utilisation of Ally by students and faculty members. In addition, it also shows how frequently alternative formats are downloaded by students and how often faculty members address accessibility issues. The report is presented in a spreadsheet format, organised into five separate worksheets:

1. Alternative Formats (alternative formats) Launches
2. Alternative Format Weekly
3. Instructor Feedback Launches
4. Instructor Feedback Weekly
5. Data

T University

According to the "Engagement with Alternative Formats" data, after the training, there were 60,156 instances where the alternative format icon was accessed, resulting in 31,492 alternative formats being downloaded. This is a significant increase compared to the period before the training when there were only 4,800. These findings are visually represented in Figures 4.19 and 4.20.

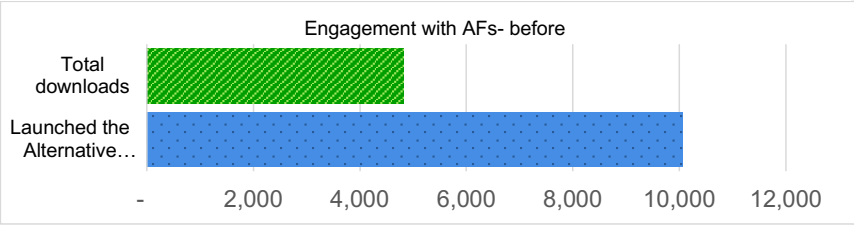


Figure 4-19. Engagement with Alternative Formats Data before Training - T University.

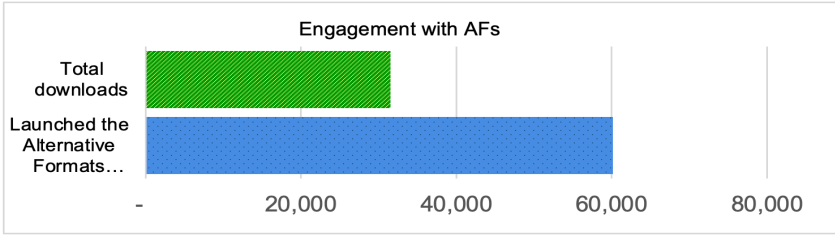


Figure 4.20. Engagement with Alternative Formats Data after Training.

The conversion rate, representing the proportion of downloads relative to the total number of times the panel was opened, reached 52%. Moreover, there were 9,955 unique user downloads. Among the downloaded formats, tagged PDFs was the most frequently chosen at 54%, followed by HTML at 22% and ePub at 15% (see Figure 4.21).

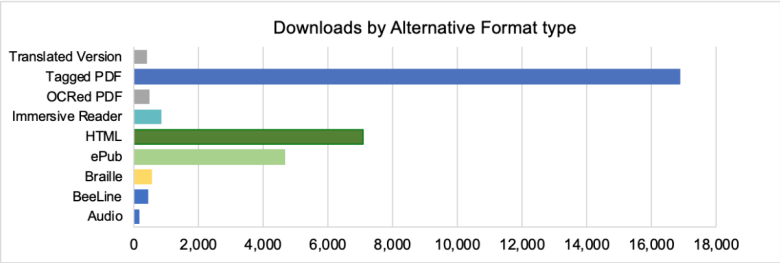


Figure 4-21. Downloads by Alternative Format Type - T University.

The student training began in early 2023. During the research period, there was a notable increase in both alternative format downloads and clicks, reflecting a growing trend of students using the alternative format window. Figure 4.22 illustrates these findings.

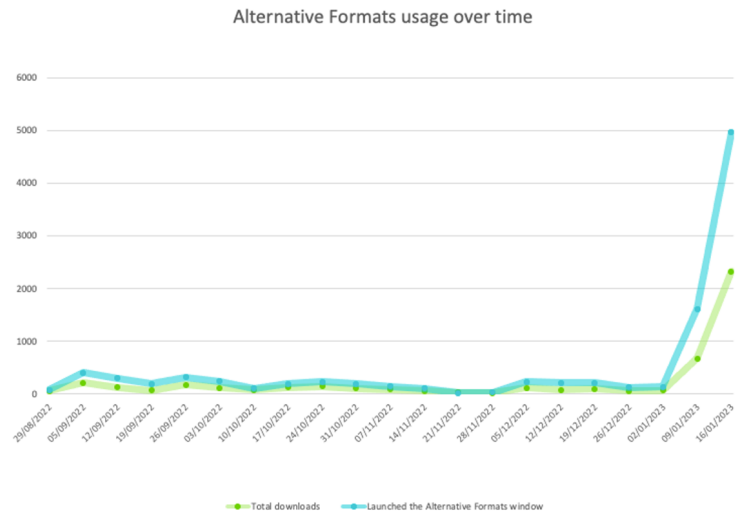


Figure 4-20. Alternative Format Usage over a Period of Intervention - T University.

As shown in Figure 4.23, the analysis of engagement with instructor feedback data revealed that faculty members launched the instructor feedback files more than 1,200 times. Additionally, they checked the accessibility report for the course in general 338 times, with a total of 95 fixes implemented. The data further indicates that 21 courses had accessibility fixes. The conversion rate was found to be 8%.

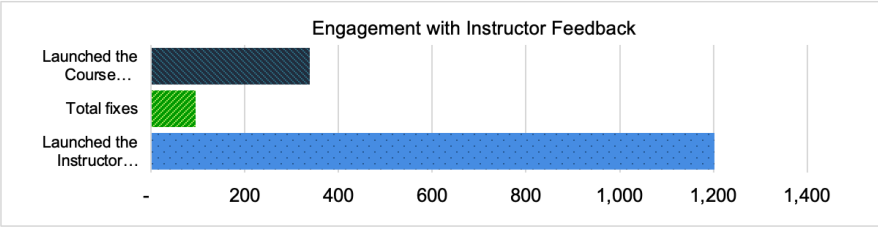


Figure 4-23. Engagement with Instructor Feedback.

The increase in launching the instructor feedback was associated with the training period, indicating that faculty members were more likely to utilise the feedback feature during that time. On the other hand, the peak of fixing accessibility issues was linked to specific training sessions, driven by attendees' requests for addressing the identified accessibility issues (see Figure 4.24).

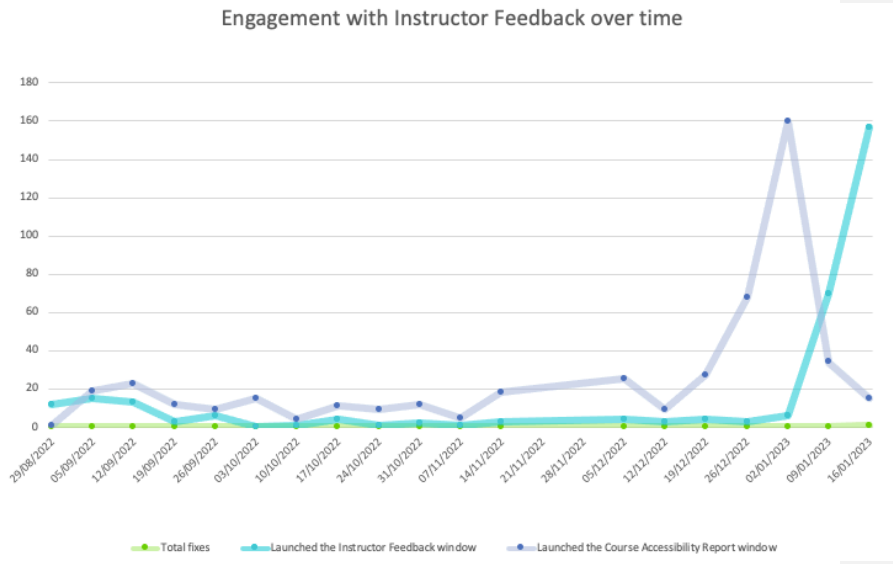


Figure 4-24. Engagement with Initiator Feedback over Time - T University.

S University

As per the "Engagement with Afs" data, after the training, there were 123,214 instances where the alternative format icon was accessed, leading to 77,000 alternative formats being downloaded. This marked a significant increase compared to the period before the training when there were only 5,000 downloads. Figures 4.25 and 4.26 visually represent these findings.

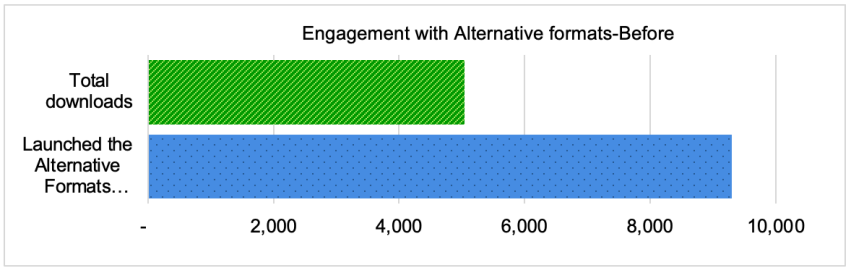


Figure 4.4-21. Engagement with Alternative Formats Data before Training - S University.

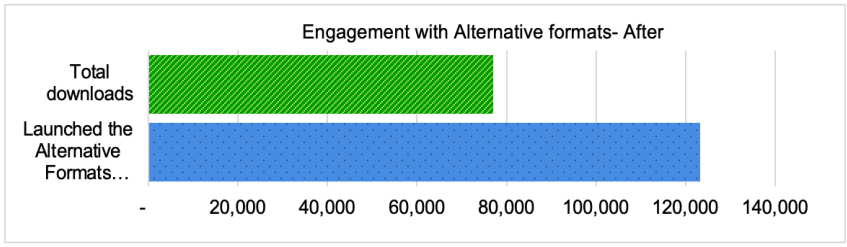


Figure 4-26. Engagement with Alternative Formats Data after Training - S University.

After the training, the conversion rate improved to 63% from 54%. The total number of unique user downloads was 11,824 and the most frequently downloaded format was tagged PDFs, accounting for 46% of downloads, followed by ePub formats at 30%, and HTML at 13%, as shown in Figure 4.27.

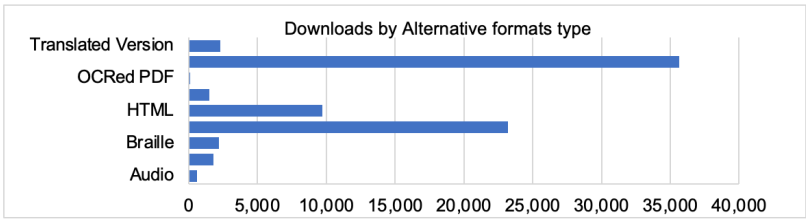


Figure 4-27. Alternative Format Downloads by Type.

The analysis of engagement with instructor feedback data revealed that faculty members launched the instructor feedback for files 282 times. Additionally, they checked the accessibility report for the course in general 130 times, with 8 fixes implemented. It is worth noting that the number of fixes was limited as the university's process assigned coordinators to upload materials at the beginning of each academic year, and instructors did not have access to fix accessibility issues (see Figure 4.28 for a visual representation).

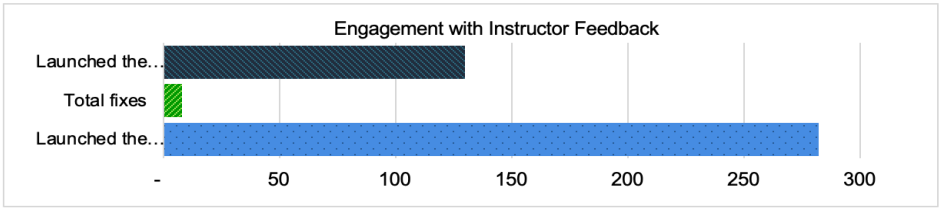


Figure 4-22. Engagement with Instructor Feedback - S University.

The data on alternative format usage for student and faculty in the period of the research showed fluctuations without any noticeable impact from the training.

4.5 Qualitative Data

To gain insights into the individual perspectives of participants, contextual factors, and comprehension of each link in the chain, as well as to understand the intervention's impact, two sets of qualitative data were collected and analysed. The first data set consisted of interviews conducted with faculty members who participated in the training and completed both the pre- and post-surveys. A total of 12 interviews were conducted from both universities. The second set of qualitative data involved student focus groups, with three focus groups conducted at both universities for students who completed both the pre- and post-surveys.

4.5.1 Faculty Interviews

4.5.1.1 Demographic data

At the end of both the pre- and post-surveys, a question asked volunteers to provide their contact information to participate in an online interview. Thirteen participants provided their contact information to participate in the interviews. However, one faculty member had personal commitments and subsequently withdrew from the interview. Table 4.19 lists each interview participant by their assigned pseudonym.

Table 4-19: The Distribution of Faculty Participants in Interviews.

Pseudonym	College	Code	Learning methods	Teaching experience
Faculty Participants from T University				
P1	General	P1TU	Mixed learning	10-15 years
P2	General	P2TU	Mixed learning	5-10 years
P3	Mathematics	P3TU	Online	5-10 years
P4	General	P4TU	Mixed learning	5-10 years
P5	General Provide support for the Disability Center at the University	P5TU	Face-to-Face	16-20 years

P6	Management and business	P6TU	Face-to-Face	10-15 years
Faculty Participants from S University				
P7	Management and business	P7SU	Mixed learning	10-15 years
P8	General	P8SU	Mixed learning	16-20 years
P9	Learning disability specialist at the accessibility center and adjunct faculty teaching general courses	P9SU	Mixed learning	5-10 years
P10	Public health	P10SU	Mixed learning	0-5 years
P11	General Provide accommodation for accessibility centre	P11SU	Mixed learning	0-5 years
P12	General	P12SU	Mixed learning	5-10 years

The demographic analysis of the interviewees provides a variety of experiences and roles across faculty members drawn from the two universities. For instance, P1TU and P2TU, with 10-15 years and 5-10 years of experience respectively, both teach using mixed learning methods. P5TU, with 16-20 years of experience and a role supporting the Disability Centre, teaches a general course and provides learning support twice a week for students with disabilities at the disability centre.

All participants from SU teach using mixed methods and are relatively new to teaching, with 5-10 years of experience. P9 is a Learning Disability Specialist at the Accessibility Centre, combining 5-10 years of teaching and supporting students with disabilities. P11 provides material accommodations for the accessibility centre part-time.

4.5.1.2 Findings

The six steps approach (Creswell & Guetterman, 2019) was used in analysing and interpreting both sets of qualitative data (faculty interviews and student focus groups) using the computer program NVivo and manual as follows:

1. Data preparation and organisation
2. Generating initial codes
3. Developing a general picture from the codes (Themes)
4. Reviewing themes and generating a thematic map of the analysis
5. Interpreting results and relating back to research questions
6. Validating and connecting findings with quantitative data (iterative process)

This method provided a deeper understanding of faculty opinions and in-depth experiences following the training. The analysis process consisted of two levels of depth. The researcher utilised both manual techniques with printed copies and computer-assisted software (NVIVO). The two iterations further detailed were:

- **The first iteration:** This iteration included 12 interviews. An inductive approach to qualitative data analysis was employed using Ally. The analysis generated 4 themes and 9 sub-themes.
- **The second iteration:** This iteration was of a deductive nature. Its objective was to answer the research questions proposed for this study, and any themes that did not contribute to this objective were removed.

The coding process resulted in thematic categories, which are covered as follows:

4.5.1.2.1 General Theme 1: Raising Awareness and Equipping Faculty

To measure the impact of accessibility training on digital accessibility of the course materials, the researcher collected comments that highlighted the effects of the training sessions. These comments were gathered from a specific question directly related to the training sessions and from discussions and responses to other related questions. Through the analysis, two sub-themes emerged from the data.

Sub-theme 1.1: Raising Awareness Around Accessibility

Based on the participants' responses, it was found that training sessions were vital for raising awareness among faculty about the importance of accessibility and the challenges students faced. For instance, P7SU noted:

"*Before attending the training session, I had very little knowledge about accessibility and its importance in education. During the training, I realised that students often struggled with the format of the materials, especially PDFs, which were difficult to annotate and interact with*."

This highlights a significant lack of awareness among faculty regarding accessibility before the training. Training sessions are crucial for bridging this

knowledge gap, which is a fundamental step towards improving accessibility in educational settings. P2TU echoed this sentiment:

"I *had the opportunity to attend two workshops with you, and I must say they were truly eye-opening experiences for me*."

Similarly, P8SU shared:

"*I've found that regular training sessions for teachers are incredibly effective. These should ideally be part of our professional development. By making accessibility a part of professional development, faculty can stay informed about best practices and emerging tools.*"

Faculties' statements indicate that the training has raised their awareness and reflects a commitment to prioritising accessibility within the educational framework. By suggesting that accessibility training be embedded into professional development, it becomes a sustained focus rather than a temporary initiative for this research.

P9SU specifically mentioned:

"*Even though the Ally tool was accessible to us, it had not been previously brought to our attention. However, following the training session, our awareness regarding the Ally tools significantly increased."*

This quote highlights the effectiveness of training sessions in increasing faculty awareness of available accessibility tools, underscoring the importance of structured training in ensuring that faculty are informed about and capable of using tools like Ally to enhance accessibility and the availability of these tools.

P3TU added to P9SU's comments related to the impact of the training on increasing faculty awareness of the availability of accessibility tools:

"*I believe that additional training and ongoing support would greatly benefit all participants. As a relatively new topic, it requires continued learning and guidance*

to ensure a comprehensive understanding and effective implementation of accessibility practices."

Many participants frequently highlighted the importance of providing practical training. P11SU stated:

"*I attend these workshops and find them fascinating. However, the practical application is often missing. We attend, but nothing gets done afterwards. If there were tasks and deadlines associated with these workshops, it might encourage more practical application and engagement from faculty members.*"

P4TU also emphasised the need for hands-on training:

"*I attended two sessions and found them very beneficial. However, we need more practical face-to-face training and time to practise. Ongoing training is essential to keep up with accessibility best practices*."

These responses indicate that while training sessions are essential for equipping faculty with the skills needed to create accessible content, there is a need for more hands-on, practical training and continuous learning opportunities to ensure faculty can apply these skills effectively.

Sub-theme 1.2: Equipping Faculty with Necessary Skills

The training sessions were instrumental in enhancing faculty competence in developing accessible content. During the interviews, participants initially addressed the challenges they encountered in creating accessible materials. Subsequently, they discussed the difficulties students experience in accessing course materials, based on their observations and experiences. These inquiries highlight areas where faculty may benefit from additional training or resources. Ultimately, questions were directed at evaluating the effectiveness of the training in helping them acquire the skills needed to address these challenges.

The analysis indicated that faculty members encountered significant challenges when trying to provide accessible course materials. For example, P8SU highlighted the challenge of selecting the most appropriate accessible format:

"*One of the biggest challenges I face is figuring out the best alternative formats to offer. It's not always clear which format will be most beneficial for students with different needs. Additionally, the process of making materials accessible can be quite time-consuming. Without specific knowledge or training, it can be daunting to ensure everything meets accessibility standards and sometimes I end up second-guessing if I'm doing it right."*

P6TU shared similar struggles, particularly with PDFs:

"*When dealing with PDF files, particularly those saved as images without OCR capabilities, the challenge arises in terms of effectively covering the content. This involves manually retyping the text, adding appropriate headings and formatting, and inserting alternative text for images. While this process may be time-consuming, it is a necessary step to ensure equal access and inclusivity for all users".* These challenges highlight the need for tailored training and resources to equip faculty with the skills required to create accessible content efficiently. The analysis showed that, although hands-on workshops and awareness sessions were limited due to the research timeframe, they had been particularly effective in promoting greater awareness and facilitating the creation of accessible materials. P6TU emphasised the importance of training:

"*Training should be a credit course for students, mandatory for all to be aware of the tools available. Once they pass this course, they can register for other courses. For faculty, passing an accessibility course during their probation period should be required to continue working at the university."*

P7SU highlighted the transformative impact of these sessions:

"*The training sessions substantially transformed my approach to creating accessible content. Before the training, I had never heard of Ally or other*

accessibility tools. The sessions significantly increased my awareness and understanding.".

These insights indicate that continuous professional development and training are crucial in equipping faculty with the necessary skills to ensure accessibility. Specifically, faculty gained skills related to alternative text, creating accessible PDFs, and using Ally tools, as indicated by the analysis. P9SU shared her experience in creating accessible PDFs after the training:

"*Initially, I was unaware of the specific needs and challenges related to providing accessible materials. The course book I use is in PDF format, and when I checked its accessibility score using Ally, it was a dismal 5%. This was a wake-up call for me. Despite my limited authority to change core materials, I took the initiative to make other documents more accessible by adding alternative text and using accessible formats."*

While P1TU learned skills to create and remediate accessibility issues for MS Word documents, she found it challenging to do the same for PDFs:

"*Converting ready materials, especially those in Arabic, was difficult because students need to easily select, copy, and translate content. However, links must be accessible and correctly labelled, regardless of file type."*

After the training, P1TU started considering the tips shared, such as adding heading levels and labelling links correctly.

"Fixing accessibility issues in Word documents was manageable, but PDFs posed a greater challenge."

The training focused on specific skills, starting with the Ally report identifying the most common accessibility issues for the university and considering skills that support 'quick wins'. The analysis indicated that, after the training, participants became aware of these issues and started utilising these skills as indicated previously. P4TU explained:

"*Links must be accessible and correctly labelled regardless of the file type. The training emphasized the importance of adding correct heading levels and other accessibility tips, which I've started to implement… I tried most of the tips from the training, and it was easy to fix Word documents. Adding labels to links, alternative text, and contrast were straightforward tasks. The accessibility checker was very useful.*"

Providing headings, labelling, and tagging in PDF files are essential accessibility skills that contribute to creating accessible formats. Faculty comments indicated that they were aware of these skills and understood the impact of their implementation.

4.5.1.2.2 General Theme 2: Impact of Ally software on the accessibility of digital course materials

Faculty experiences with specific tools like Ally and Microsoft accessibility features have been mixed but generally positive. The interviews revealed insights into the effectiveness of Ally in identifying accessibility issues, and the challenges and limitations encountered. The findings are organised into two sub-themes.

Sub-theme 2.1: Effectiveness of Ally Software in Identifying Accessibility Issues

The analysis indicates that Ally software is highly effective in identifying accessibility issues within course materials. Faculty members appreciated the clarity and visibility of Ally's indicators, which helped them understand and address accessibility problems more efficiently. P9SU and P4TU noted that Ally software easily identified each accessibility issue for each file and provided step-by-step guidance on how to remediate the accessibility issue. P9SU commented as follows:

"*Ally provides clear indicators that make it easy to see the accessibility issues within the file. The step-by-step instructions are particularly helpful, making the process of fixing accessibility issues straightforward and manageable."*

Ally effectively identifies accessibility issues, such as the need for alternative text for images, thus helping faculty enhance the accessibility of their materials. P1TU stated:

"*Before embedding Ally, images were not readable. After embedding Ally, meaningful descriptions can be added to images, making the content more accessible."*

However, the volume of issues identified by Ally can be overwhelming, particularly for faculty members who are new to accessibility practices. For example, P12SUL indicated:

"*Almost all the materials on Blackboard showed a 'red' rating for accessibility. Attempting to reformat everything was overwhelming and I struggled to manage this on top of my regular teaching duties."*

While Ally identifies accessibility issues effectively, the high number of issues indicates a need for extra support and time to address them. This large volume of accessibility issues is anticipated, given that accessibility was not previously considered. P4TU elaborated more on this issue, related to lack of accessibility policy:

"*However, we don't have a policy requiring us to ensure all indicators are green. Using an official template that is already accessible would make it easier for faculty to focus on content accessibility."*

Overall, the clarity provided by Ally's indicators aid faculty in addressing accessibility issues, thereby making the process of creating accessible materials more straightforward. P4TU highlighted that:

"*I tried using Ally on Blackboard directly. It was very easy to review my files and apply the necessary changes. The Ally indicator showed and highlighted all accessibility issues, which Simplify the procedure."*

The visibility and clarity of Ally's indicators help faculty understand where improvements are needed, leading to better engagement with accessibility tools.

Faculty engagement will be covered under General Theme 3 – Sub-theme 3.2: Engagement with Accessibility Tools.

Challenges and Limitations

The analysis revealed that faculty members faced challenges related to the training programme and the Ally software. These challenges were related to the programme's implementation and the software itself.

- Challenge in Training Programme Timing

The implementation of training programmes was part of this research study, occurring between the end of the first semester and the start of the second semester. This timing was not ideal for faculty. The majority advised that training should be included as part of professional development and continuous training and support. P12SU stated that:

"My experience with Ally was not very positive. It was introduced suddenly as a part of the research while I was teaching an intensive course with pre-written materials."

P8SU pointed out:

"*Emphasizes that the current intervention is insufficient moving forward after this research, highlighting the need for continuous training and support for faculty. This ongoing professional development is essential to ensure that educators can effectively enhance their skills and adopt best practices."*

- Challenge in Remediation

The analysis revealed that faculty members encountered challenges in their efforts to rectify or develop accessible content. P8SU commented:

"*I've only briefly used Ally, but I have some experience with Microsoft's accessibility tools. Honestly, it often takes much more time to prepare accessible materials, which can be discouraging. I found myself only doing it when a particular student required it, rather than making it a standard practice. This extra*

time and effort can be a significant barrier, especially when juggling multiple responsibilities."

Other faculty members were overwhelmed by the volume of file remediation. They found that remediating MS Word documents was much easier compared to MS PowerPoint and PDF files. P5TU shared that:

"*It takes a lot of time to make materials accessible. Only Word documents are generally fine and easy to manage. Other tools haven't been very helpful so far."*

Remediating a MS Word document is generally easier than remediating a PDF for several reasons. For example, MS Word documents are inherently editable, making changes to text, headings, lists, and other elements straightforward. In contrast, PDFs often require specialised software and can be more complicated to edit. P12SU echoed her experience, stating that:

"I was surprised when I used the Ally indicator and saw the course accessibility score with a significant amount of accessibility issues. This might be the result of not having a policy in place to mandate faculty to upload and create accessible files."

This situation may be attributed to insufficient faculty expertise regarding the creation of accessible materials, alongside the significant quantity of already-uploaded, inaccessible content. Furthermore, the problem is intensified by the lack of a comprehensive institutional policy addressing accessibility.

- Challenges and Limitations of Ally Software

Specific challenges, such as the lack of effective tools for converting certain types of documents, highlight the need for more specialised and efficient solutions within Ally to address diverse accessibility needs. P11SU's experience related to an Arabic file:

"*For Arabic documents, there is no easy application to convert PDFs to Word documents. It often requires typing everything from scratch which consumes a lot of time."*

P3TU had a similar experience related to the accessibility of Arabic files*:*

"The lack of software options to make Arabic files accessible poses a significant challenge. Currently, there is a need for effective tools that can ensure accessibility for Arabic content. The accessibility features and solutions available for other languages may not be as readily applicable or supported for Arabic files. This gap highlights the importance of further research and development in the field of Arabic accessibility."

It is evident that converting Arabic PDFs to Word documents is particularly challenging due to the lack of applications or software for this purpose. This often necessitates retyping the entire document from scratch, which is highly time-consuming. P3TU's experience corroborates this, indicating a broader issue with the accessibility of Arabic files mainly for untagged Arabic PDFs. Additionally, the lack of effective software tools specifically designed for Arabic text accessibility presents a significant challenge. While there are many accessibility features and solutions available for other languages, these are not as readily applicable or supported for Arabic documents. This disparity underscores a critical need for the development of specialised tools and solutions that can cater to the unique requirements of Arabic content.

P2TU reported another challenge related to the delay of software:

"However, it is important to address a notable issue I have encountered, mainly, the delay in receiving instructor feedback when uploading files. This delay has been noticeable and should be considered when evaluating the overall effectiveness and efficiency of the tools. Nonetheless, it is essential to recognize the positive impact and functionality these tools provide in promoting accessibility and inclusion."

A few faculty members reported the same issue with the Ally software, specifically the delay in receiving instructor feedback after uploading files. This delay affected the overall effectiveness and efficiency of the tool. The researcher received requests during office hours, primarily concerning this challenge. She

discovered that these issues often arise when uploading very large files or files containing numerous images. This exacerbates the difficulties in converting and making documents accessible, as the size and complexity of the files contribute to the inefficiency and delays experienced with current software tools.

Despite this, the faculty acknowledged the positive impact and functionality of Ally in promoting accessibility and inclusion. This feedback highlighted the need to address the feedback delay to improve the software's overall performance while recognising its beneficial role in enhancing educational accessibility.

Sub-theme. 2.3: Evaluation of accessibility tools

Faculty members were asked to rate Ally/accessibility tools as a solution to help ensure the accessibility of their course content. The results are summarised in Table 20.

Table 4-20. Faculty Ratings of Ally/Accessibility Tools for Ensuring Accessible Course Content.

Pseudonym/Code	Rating out of 5	Comments
P1TU	4	Very useful, especially for students with vision impairments
P2TU	4	I am optimistic that with more usage and familiarity, my rating might change to a 5
P3TU	NA	Needs more time to be able to rate
P4TU	4	They have great potential but require time and practice to fully utilize

P5TU	5	The tools have been incredibly useful in ensuring that course content is accessible and inclusive for all students
P6TU	4	There is room for improvement in terms of reducing delays
P7SU	4	
P8SU	She preferred not to mention a specific number	I think any program we use to help make course content more accessible is a win-win. If the alternative is no accessibility tools, then we lose, and so do the students who need them
P9SU	4	
P10SU	4	Needs more time to practice
P11SU	2	The quality and effectiveness of these tools need to be improved
P12SU	NA	It's difficult to provide a definitive rating due to my limited experience. However, I think the concept is excellent

The overall perception of Ally software among faculty members was positive, with most ratings around 4 out of 5, indicating general satisfaction. However, several faculty members suggested that with more usage, familiarity, and practice, their ratings could improve, highlighting the need for ongoing training and support. A recurring theme was the necessity of time to fully utilise the software's potential, emphasising the importance of sufficient practice. Despite the positive feedback, specific concerns were noted, such as delays in the software's functionality and the need for improvement in quality and effectiveness specifically for Arabic files. The diverse experiences among faculty members, with some finding the tools

extremely beneficial and others requiring more improvement and support; for example, P11SU provided support for the disability centre in remediating inaccessible files. One of her challenges was dealing with inaccessible Arabic and mathematical formats:

“The challenge of inaccessible PDFs and accessing math courses, particularly when it comes to reading graphs and using tools like Nemeth code for blind students, highlights the need for improved accessibility measures. Additionally, the lack of software options to make Arabic files accessible poses a significant challenge. Effective tools are needed to ensure accessibility for Arabic content.”

This indicates the need for continuous enhancements and tailored training programmes to maximise the software’s effectiveness.

4.5.1.2.3 General Theme 3: Faculty Engagement with Accessibility Indicators and Tools

Sub-theme 3.1: Understanding Accessibility Indicators

The analysis indicated that faculty engagement with accessibility tools had enhanced their understanding of accessibility indicators and how to fix the accessibility issues. P4TU mentioned:

“*Using Ally, I learned to assess and improve the accessibility of my course materials… The visual indicators provided by Ally help faculty identify specific areas needing improvement, fostering a more inclusive educational environment.”*

A few faculty members found the initial scores on tools like Ally discouraging but recognised their importance, especially considering the challenges related to remediation mentioned earlier. Training sessions improved faculty awareness and ability to assess and enhance the accessibility of their materials. P9SU noted:

"*The course book I use is in PDF format and when I checked its accessibility score using Ally it was a dismal 5%, which prompted proactive steps to improve document accessibility by adding alternative text and using accessible formats."*

P1TU highlighted:

"*Before using Ally, creating content that was accessible on different devices used to be a challenging task. However, after implementing Ally, we have noticed a significant difference. It is no longer difficult to ensure accessibility, and the process has become much smoother… I agree. Teaching staff would be able to recognize the difference between accessible and non-accessible materials and improve their documents accordingly."*

This demonstrates that faculty members have developed a clearer understanding of accessibility indicators provided by the Ally tool and are utilising this understanding to improve their course materials. For example, P9SU's statement showed that she can interpret the scores from Ally and take informed actions to enhance document accessibility.

Sub-theme 3.2: Engagement with Accessibility Tools

The analysis indicates that faculty members were not only understanding the tools and indicators provided by Ally but were also actively engaging with these tools to achieve higher accessibility scores. P4TU reported:

"*I was happy to reach 100% accessibility for one of the files. Uploading direct content to Blackboard and using the accessibility checker embedded in Blackboard made the process easier. For this semester, we are uploading all content as links directly to Blackboard. I checked old files and found varying levels of accessibility. Using Ally made it clear which files needed work, like those with many images that lacked alternative text."*

This proactive use of accessibility tools demonstrated a keen engagement with the indicators provided by Ally to audit and enhance existing course materials effectively. P9SU mentioned:

"*The accessibility indicator is a powerful tool. We actively engage in discussions within our department, seeking ways to improve the indicator scores and enhance the accessibility of our materials."*

This statement demonstrates that faculty are not just passively using the tools but are actively monitoring and interpreting the indicators to gauge the accessibility of their materials. They are actively engaging in departmental discussions aimed at improving accessibility scores. P2TU also shared an initiative with another colleague:

"*I am collaborating with a colleague to create a course for the next semester. Our plan is to ensure all course materials are easily accessible and meet the recommendations of the Ally indicator. We are both committed to making the course inclusive."*

This initiative illustrates a high level of engagement with accessibility tools and a strong collaborative effort to enhance inclusivity in education. The faculty members' proactive planning, use of Ally indicators, and shared commitment to accessibility demonstrated a robust approach to creating user-friendly and inclusive course materials. This engagement not only improved accessibility but also fostered a culture of collaboration and continuous improvement, benefiting students, demonstrating significant engagement and collaborative effort towards enhancing accessibility in education.

4.5.1.2.4 General Theme 4: Implementation and Impact of Inclusive Practices

Sub-theme 4.1: Implementing Inclusive Practices

The analysis indicated that the faculty members were recognising the necessity of implementing inclusive practices in their teaching methods and course materials. The challenges they faced often related to the initial lack of awareness and the complexity of creating accessible materials. The training and tools had led faculty to implement inclusive practices from the outset of content creation.

P5TU, P2TU, P9SU, and P12SU shared that they had started to consider the accessibility of course materials during the design and creation process, rather than afterwards. P5TU stated:

"*I began to think about accessibility from the start of the content creation process."*

P12SU added:

"*The trainer's demonstrations of what it's like for a student to use inaccessible materials really resonated with me. It made me think deeply about the barriers these students face. Attending these sessions was crucial in shifting my perspective and helping me understand the importance of accessibility from the outset."*

P1TU discussed how the use of accessibility tools expanded their understanding of students' varying learning approaches and needs, prompting a more inclusive approach to teaching:

"The utilization of these tools has greatly assisted me as a faculty member in broadening my perspective on students' diverse studying styles and needs. It has prompted me to consider and accommodate different learning preferences, ensuring a more inclusive and effective teaching approach."

The proactive integration of accessibility considerations during content creation, the impact of targeted training sessions, and the utilisation of accessibility tools all contributed to a more inclusive and effective learning environment. Faculty members were recognising the importance of understanding and accommodating the diverse needs of their students, ensuring that all students had equal opportunities to succeed.

Sub-theme 4.2: Impact on Student Engagement and Learning

The implementation of accessible materials positively impacted student engagement and learning. This sub-theme is supported by multiple faculty observations and experiences. Both P1TU, P9SU and P5TU provided valuable insights into the impact of accessible course materials on student engagement and learning. Their observations highlighted the importance of accessibility in education and the benefits it brought to students. P1TU noted:

"I've noticed increased engagement and understanding among my students.""

P1TU also added:

"*It was noticed that students became less stressed and were willing to finish their tasks independently by using accessible course materials provided by Blackboard Ally. It is less time-consuming for them."*

These observations highlight that accessible materials not only enhance students' engagement with the content but also potentially reduce their stress levels, thereby enabling them to complete tasks independently. P5TU added:

"*In my experience, students do tend to perform better when accessible courses are provided through Blackboard Ally feedback. The availability of alternative formats and accessibility features has allowed students with diverse learning needs to engage with the course content more effectively. Providing alternative formats allows students to engage with the content in a way that enhances their understanding and learning experience. This flexibility can lead to improved grades and foster equitable access."*

Given P5TU's role in supporting the Disability Centre, he had a unique perspective on the practicalities of accessibility in education. This involvement likely provided him with direct feedback from students and a deeper understanding of the specific needs and preferences of students with disabilities. His insights were thus informed by both personal experience and his professional role, making his observations particularly valuable.

The observations from both P6TU and P11SU emphasised the critical need for high-quality, accessible educational materials. They also identified the specific formats that were most effective and beneficial for students. P11SU observed:

"*Yes, having multiple options is beneficial. However, the quality of these files is often not good. Students are happy to see options, but they end up using PDFs because other formats have too many errors and technical issues."*

P11SU points out a critical aspect of accessibility—while providing multiple formats is advantageous, the quality and usability of these formats are important. Students tend to rely on PDFs due to the technical issues and errors present in other formats. This indicates that merely offering various formats is not enough; the formats must be of high quality to be truly effective and useful for students. P6TU added to this point:

"*Based on my observation and feedback from students, the alternative format that is downloaded the most is the accessible PDF format. This format allows students to access the course materials in a visually consistent and structured manner. The accessible PDFs often include features such as text-to-speech functionality, allowing students to have the content read aloud to them. This feature is particularly beneficial for students with visual impairments or those who prefer auditory learning."*

P6TU's observation aligns with P11SU's emphasis on the preference for PDF alternative formats. The consistent and structured nature of accessible PDFs, combined with features like text-to-speech functionality, makes them highly beneficial for students, particularly those with visual impairments or those who prefer auditory learning.

4.5.2 Student focus groups

5.5.2.1. Demographic data

The second set of data involved student focus groups. At the end of both the pre- and post-surveys, a question asked volunteers to provide their contact

information to participate in focus groups. Initially, the researcher aimed to have four focus groups, each consisting of 4-5 students, at each university. However, due to a low response rate from students, only three focus groups were conducted. Table 4.20 displays the distribution and background details of participants in the sample.

Table 4-21: The Distribution of Student Participants in Focus Groups

Student Focus Group					
University	Number Of the Focus Group	Number Of Participants	Pseudonym Code	Disability	Academic year
T University	1	3	TUS1	NA	Not Available
			TUS2	NA	Not Available
			TUS3	NA	Not Available
S University	2	First session: 2 participants with vision impairment Second session: 5 participants, 2 participants with	SUS4	Blind	3rd
			SUS5	Blind	3rd
			SUS6	NA	Not Available

		learning difficulties	SUS7	Learning disability	4th
			SUS8	NA	Not Available
			SUS9	NA	Not Available
			SUS10	Learning disability	2nd

The demographic details of the student focus groups revealed a diverse representation in terms of disability and academic years across two universities. A single focus group was carried out at T University with three participants, none of whom had their specific disabilities or academic years documented. In contrast, two focus groups were conducted at S University, comprising a total of seven participants. The first session included two participants with vision impairments, both in their third academic year, while the second session featured five participants, among whom two had learning difficulties, in their second and fourth academic years. However, the disabilities and academic years for the remaining participants were not available. Findings

The six-step approach (Creswell & Guetterman, 2019) was used to analyse and interpret the qualitative data from the student focus groups, as explained in the previous section (4.5.1).

The analysis of the student focus group data revealed key themes and sub-themes regarding the extent to which the use of alternative formats enhanced students' access to digital course content.

4.5.2.1.1 Theme 1: Challenges with Standard Formats

Sub-theme 1.1**:** PDFs' Lack of Accessibility

The analysis of the focus group discussions with students revealed a challenge in accessing standard format files, particularly PDFs that are saved as images. Most students reported struggling with these image-based documents, as they posed substantial barriers by preventing the use of essential assistive technologies such as text-to-speech software and automated translation tools. Consequently, students who depended on these tools for their studies found it difficult to engage with the content, leading to accessibility issues that hindered their overall learning experience. As SUS7 with learning difficulties shared:

"*PDFs saved as images pose a considerable obstacle as they lack the necessary textual data that can be extracted and processed by assistive technologies such as text-to-speech software*."

SUS4, a student who is blind, reported difficulties in accessing PDF files with her Braille device and VoiceOver:

"PDFs saved as images pose a considerable obstacle as they lack the necessary textual data that can be extracted and processed by assistive technologies that I use such as Braille note touch or screen reader."

This statement highlights a critical issue in digital accessibility, where the choice of file format—specifically, image-based PDFs—excludes students who rely on assistive technologies. This specific challenge reflects a larger issue within digital accessibility: content creators, particularly faculty, may not fully understand or consider the needs of users who rely on assistive technology. As a result, students who depend on accessible formats often face delays in accessing content, as they require additional time to convert materials into accessible formats. This delay can prevent them from engaging with the content at the same time as their peers, further exacerbating the barriers to equitable learning opportunities.

While SUS4 struggled with accessing inaccessible PDFs using her assistive technology devices, TUS1 experienced similar challenges with the inability to translate text inside these PDFs:

"*Similarly, being unable to translate PDFs saved as images compounds the difficulty of accessing vital information. Translating documents is especially crucial when dealing with content in unfamiliar languages or when English is not the primary language. Translating allows me to bridge language barriers and grasp the content more effectively. However, since the text in image-based PDFs cannot be directly selected or copied, it becomes nearly impossible to use automated translation tools."*

TUS2 added to this discussion, highlighting yet another aspect of the accessibility challenges faced by students:

"I always find it necessary to print out the course materials to make them more accessible for highlighting and taking notes. With a physical copy, I can easily add highlights and make annotations directly on the document, which enhances my learning process. However, I do acknowledge the challenges that come with relying on printed materials, such as the cost and inconvenience of printing."

Inaccessible PDFs do not only affect students with vision impairments but also students with learning disabilities. Students with learning disabilities often rely on software such as text-to-speech to access and comprehend text effectively. Additionally, other students without disabilities also benefit from accessible files, as they enable features like text translation and annotation, which can aid in understanding and engagement with the material. This demonstrates that creating accessible documents is not just about accommodating students with disabilities; it is about enhancing the learning experience for all students.

Sub-theme 1.2: MS PowerPoint Presentations and Screenshots

Students reported difficulties with MS PowerPoint presentations and screenshots inside the MS PowerPoints, which often required manual conversion to accessible formats mainly for students with disability. One of these difficulties, as reported by SUS10, is accessing MS PowerPoint presentations from their telephone or tablet, where the layout often gets 'messed up':

"Sometimes, I have extra hours between classes or while I'm heading home, and I want to utilize that time productively by reviewing my PowerPoint presentations on my phone. However, when I try to open them, the formatting often gets messed up, making it difficult to study effectively."

This issue makes it challenging for students to review or study the material effectively on mobile devices, limiting their access to specific devices and environments.

While a few students reported other issues with the accessibility of MS PowerPoint presentations, SUS6 had a specific experience related to a public health course. SUS6 observed that the MS PowerPoint slides for this course contained numerous screenshots of important text and information, which posed additional challenges. SUS6 noted:

"One of the most important subjects in my major is core courses such as anatomy and physiology. Unfortunately, all the content is presented as screenshots from textbooks, which makes accessing these screenshots challenging. Converting PowerPoint presentations into a more accessible document format would greatly enhance my ability to access the course content and facilitate a more comprehensive understanding of the material. Having the presentation in a document format would allow me to navigate through the text more efficiently and extract key points."

Screenshots pose significant obstacles to effectively engaging with the material and can impede comprehension and productivity. However, the analysis does not indicate that the accessibility issues with MS PowerPoint presentations pose

the same challenges as those associated with PDFs. This is because most of the files are uploaded in PDF format, which presents a different set of accessibility obstacles.

Sub-theme 1.3: Arabic File Accessibility

Arabic courses presented significant challenges in terms of accessibility, making them particularly difficult for students to engage with effectively. One of the primary issues SUS10 highlighted was the inability of OCR (Optical Character Recognition) software to accurately convert Arabic text:

"I believe Arabic courses presented the most challenges in terms of accessibility. The main issue is that there is no software that can effectively convert Arabic text as efficiently as it does for English text. As a result, I must request an accessible format from the accessibility centre, where the accommodation officer manually retypes the content. Additionally, the fonts used in Arabic materials are often outdated, and the text size is too small, making it difficult to read. Another limitation is that we cannot write our notes directly on Arabic PDF files, which further hampers our ability to engage with the material effectively."

The challenges highlighted in this context reveal significant barriers to accessing Arabic course materials effectively. The primary issue is the lack of Optical Character Recognition software that can convert Arabic text as efficiently as it does for English text. This limitation means that students must rely on the accessibility centre to provide an accessible format, which involves the accommodation officer manually retyping the content. This process is not only time-consuming but also prone to errors, leading to delays in accessing the necessary materials. Additionally, the outdated fonts and small text sizes commonly used in Arabic materials further complicate readability, making it difficult for students to engage with the content. Another critical challenge is the inability to annotate directly on Arabic PDF files, which restricts students' abilities to take notes and interact with the material in a meaningful way. SUS9 added a comment in the chat, noting that:

"*Also, the Arabic PDFs are always scanned in very bad quality*."

This additional observation highlights another layer of the challenges faced by students accessing Arabic course materials. Poorly scanned PDFs further degrade the usability of the content, making it even harder to read and interact with. The low-quality scans likely exacerbate the existing difficulties with outdated fonts, small text sizes, and the inability to convert or annotate the text, ultimately compounding the barriers to effective learning and engagement with the material. Both SUS6 and TUS2 also agreed with their colleague that Arabic files pose significant challenges. They echoed the concerns about the poor quality of scanned Arabic PDFs, outdated fonts, small text sizes, and the general difficulty in converting and annotating these documents.

4.5.2.1.2 Theme 2: Benefits of Alternative Formats

Sub-theme 2.1: Accessible PDFs and E-books

Accessible PDFs and ePub formats were highly favoured by most of the students. For example, students SUS5, SUS7, SUS8, SUS9, and TUT3 highly favoured accessible PDFs and ePub formats because of their ability to integrate text-to-speech and annotation features. TUS2 stated:

"*As a student, my go-to alternative format is the accessible PDF. It has proven to be the most helpful in accessing content that is initially in an inaccessible format. The accessible PDF allows me to overcome barriers such as scanned documents by annotaing and add notes while I'm studying*."

SUS 9 added:

"*I find accessible PDFs and e-books to be convenient, as they allow me to access the text digitally and use features like text-to-speech and highlighting. Interactive online modules have been particularly helpful for subjects that require visual demonstrations or interactive exercises."*

This indicates that accessible formats are crucial in supporting diverse learning needs, enabling students to overcome accessibility barriers and engage more effectively with their educational content. This understanding underscores the importance of making accessible and interactive formats a standard practice in educational environments.

Sub-theme 2.2: Other Accessible Formats

The analysis also reveals that students value a range of accessible formats to accommodate their diverse learning needs and contexts. While accessible PDFs and e-books are favoured for their interactive features like text-to-speech and annotation, SUS6 added to the conversation by highlighting the usefulness of audio formats. SUS6 noted that:

"*Audio format is also a good accessible format I tried when I was driving long distances or when I wanted to do a quick revision.*"

This underscores the flexibility of audio formats as a valuable complement to other accessible formats, offering students the ability to engage with their course material even in situations where traditional methods are impractical.

Additionally, tools like the Immersive Reader, which includes features such as a picture dictionary, were particularly beneficial. SUS10 explained:

"*The picture dictionary feature allows me to click on any word within the text and view an image representation of that word's meaning, enhancing my understanding*."

This feature adds another layer of accessibility by supporting visual learning and helping students better grasp complex concepts. The Picture Dictionary enhances reading and comprehension by utilising multi-sensory processing, allowing students to see a picture and hear a word simultaneously. This multi-sensory approach provides a deeper, more interactive learning experience, particularly for visual learning.

Together, these insights emphasise the importance of providing educational resources in multiple accessible formats, including audio, accessible PDFs, e-books, and enhanced reading tools like Immersive Reader. By offering a variety of options, educational institutions can ensure that all students, regardless of their specific learning preferences or needs, can effectively interact with and benefit from their learning materials.

4.5.2.1.3 Theme 3: Awareness and Training

Sub-theme 3.1: Initial Lack of Awareness

The analysis of student feedback reveals a gap in awareness regarding the availability of alternative formats prior to training sessions. Many students were unaware of the tools and resources available to them, which limited their ability to fully engage with course materials. For example, SUS2 stated:

"*I did not use the alternative formats available through Ally Software before the training session because I simply wasn't aware that such tools existed.*"

This quote highlights the lack of communication or promotion about these accessible options, which left students at a disadvantage.

SUS4 further emphasised this point, expressing frustration that:

"It's unfortunate that we were not made aware of the availability of these tools, especially since they have been available in Blackboard for around two years now."

This statement underscores the missed opportunities for students to enhance their learning experience due to the lack of information about accessible resources that had been available for an extended period.

TUS3 added:

"Without proper knowledge and training on the alternative format that is available on Ally Software, it is understandable that many students, including myself, were

unaware of its existence and the benefits it could offer. It's disappointing that such valuable resources were not introduced to us earlier, as they could have greatly enhanced our accessibility and learning experience throughout our academic journey."

This quote reinforces the notion that the absence of appropriate training and awareness significantly hindered students' abilities to utilise these tools to their full potential.

Collectively, these reflections indicate that the initial lack of awareness about available accessibility tools like Ally Software deprived students of opportunities to improve their academic experiences.

Sub-theme 3.2: Increased Awareness and Utilisation post-intervention

The analysis reveals that the post-intervention period marked an increase in both awareness and utilisation of alternative formats among students, leading to a more effective and inclusive learning experience. This shift is particularly evident when examining the impact of training sessions, which played a crucial role in bridging the knowledge gap regarding available accessible formats.

Before the intervention, many students were unaware of the tools and resources that could enhance their learning. However, following the training, students like TUS2 and SUS5 reported a newfound confidence in selecting and utilising the alternative formats that best suited their needs. TUS2 highlighted the broader impact of this increased awareness, stating:

"*Promoting awareness and encouraging the adoption of tools that truly benefit students will not only empower individuals but also foster a more inclusive and supportive educational environment*."

This quote demonstrates the importance of not just introducing tools but actively promoting their use to create a more equitable learning environment. SUS5 echoed this response by sharing a personal example:

"*After the training sessions, I feel more confident in choosing the alternative format that best suits my needs. For example, I can access accessible PDFs on my phone using VoiceOver, while I prefer to use Word documents on my BrailleNote Touch*."

This demonstrates how the training empowered students to make informed choices about which formats would be most beneficial for their specific learning contexts, thereby enhancing their overall academic experience.

This increased awareness and utilisation directly connected with the earlier discussed benefits of alternative formats, as highlighted in Sub-themes 2.1 and 2.2. For instance, students SUS5, SUS7, SUS8, SUS9, and TUT3 had already expressed a strong preference for accessible PDFs and ePub formats due to their ability to integrate text-to-speech and annotation features. TUS2 previously noted:

"*As a student, my go-to alternative format is the accessible PDF. It has proven to be the most helpful in accessing content that is initially in an inaccessible format*."

This earlier recognition of the value of accessible formats is further supported by SUS9, who added:

"I find accessible PDFs and e-books to be convenient, as they allow me to access the text digitally and use features like text-to-speech and highlighting."

Moreover, the flexibility of audio formats and the multi-sensory features of tools like Immersive Reader, as discussed in Sub-theme 2.2, align with the post-intervention reports of increased confidence and usage. SUS6 had mentioned the practicality of audio formats for on-the-go learning, while SUS10 emphasised the benefits of the Picture Dictionary feature in Immersive Reader, which enhanced comprehension through visual and auditory reinforcement.

The post-intervention increases in awareness and utilisation of alternative formats reflects the effectiveness of targeted training in empowering students to take full advantage of available resources.

4.5.2.1.4 Theme 4: Impact on Academic Performance

Based on the analysis of the focus group question, “Did you perform better when accessible courses were provided in alternative formats?” and discussion, two sub-themes emerged.

Sub-theme 4.1: Improved Academic Success

The analysis revealed that many students reported a noticeable improvement in their academic performance when courses were provided in alternative, accessible formats. Students who had previously struggled with traditional formats found that accessible PDFs, e-books, and other alternative formats allowed them to engage more effectively with the course material. For example, SUS5 mentioned:

“*I found that I could focus better and retain more information when I used accessible PDFs with text-to-speech features, which definitely helped improve my grades.*”

Access to alternative formats was reported to positively impact academic performance. SUS7 noted:

“*My GPA is higher when accessible courses are provided by alternative formats. The ability to quickly grasp and comprehend course content through accessible documents saved time and effort*.”

This statement highlights a direct relationship between accessible course materials and academic success. The student’s abilities to quickly grasp and comprehend course content through accessible documents directly contributes to saving time and effort, which in turn can positively impact their GPA. This quote clearly illustrates how accessible formats can lead to improved academic performance by making the learning process more efficient and less burdensome for students. However, further observation is required as only one student reported an impact on her GPA.

Sub-theme 4.2: Enhanced Learning Experience

Overall, students rated their experience with alternative formats highly. The convenience and accessibility of these formats improved their understanding and retention of course content, contributing to a more organised and effective study routine. TUS2 shared:

"*Accessible courses in alternative formats have undoubtedly improved my academic performance, allowing me to access content more efficiently and focus on understanding and applying my knowledge."*

Students with disabilities emphasised that immediate access to alternative formats, without the typical five-day waiting period for accommodations, significantly enhanced their learning experience. SUS5 shared:

"I also feel that my colleagues have the privilege of accessing course materials immediately, giving them the chance to review the content right away. Meanwhile, I must request accessible formats from the accessibility centre, which can sometimes take up to five working days, especially for Arabic content. But now, with alternative formats, I can get access to a few courses immediately, and the number of requests I need to make to the accessibility centre has decreased."

SUS4 added:

"I used to request extensions for deadlines because I had to wait for the accessible format, but this changed after the introduction of alternative formats, especially for English courses."

These insights underline the importance of timely access to accessible materials, as delays can hinder the ability of students with disabilities to keep up with their coursework, impacting their overall learning experience. The availability of alternative formats not only reduces the dependency on accessibility services but also promotes equity in accessing course content.

4.6 Data Triangulation: Combining Quantitative and Qualitative Data

Quantitative data, including survey results and Ally reports, along with qualitative data from faculty interviews and focus groups, have been used for triangulation through cross-verification (Oates et al., 2022). The primary data source is the survey, while interviews and focus groups (secondary data) provide in-depth insights into participants' experiences, which are compared with survey findings in this section. Recognising the limitations of representation from both sources, as outlined in Section 3.4, this triangulation aims to align the research findings and explore the similarities and differences to address the research questions. Table 22 demonstrates how the various themes and sub-themes from the interviews and focused groups aligned with survey topics. Sub-themes have been associated with the research questions. Due to the richness of the data across the study, the examples provided as follows are representative of the entire data set.

Table 4-22. Alignment of Interview and Focus Group Themes with Survey and Research Questions.

Research questions	**General theme**	**Survey**		**Ally report**		**Faculty interview**	**Focus Group**
		Student Survey	**Faculty Survey**	**Accessibility Scores**	**Ally usage report**		
To what extent will the professional development delivered to the target faculty	Awareness and Skill Development	Indirect Relationship: Student feedback on accessibility improvements indirectly reflects	Direct Relationship: Paired analysis showed increased awareness and skills post-	Indirect Relationship: Changes in accessibility scores post-training suggest content	NA	Direct Relationship: Theme 1: Raising Awareness	Indirect Relationship: Theme 1: Challenges with Standard Formats

Research questions	General theme	Survey		Ally report		Faculty interview	Focus Group
		Student Survey	Faculty Survey	Accessibility Scores	Ally usage report		
members raise awareness about accessibility issues and equip them with the skills to increase		enhanced faculty skills post-training	intervention; t-tests indicated improvement in understanding and application of accessibility tools	accessibility improvements		and Equipping Faculty Sub-theme 3.1: Understanding Accessibility Indicators	<u>Theme 3:</u> Awareness and Training

Research questions	General theme	Survey		Ally report		Faculty interview	Focus Group
		Student Survey	Faculty Survey	Accessibility Scores	Ally usage report		
the accessibility of their digital course content?			Faculty survey indicates increased perceptions of training effectiveness			Indirect Relationship: Subtheme 4.1: Implementing Inclusive Practices	

Research questions	General theme	Survey		Ally report		Faculty interview	Focus Group
		Student Survey	Faculty Survey	Accessibility Scores	Ally usage report		
To what extent will using the Ally software increase the accessibility of digital course materials?	Digital Accessibility Improvement	Direct Relationship: Student paired analysis shows enhanced format usage and reduced barriers post-intervention,	Direct Relationship: Faculty survey data confirms use of Ally in positive impact on material accessibility, teaching	Direct Relationship: Accessibility scores before and after Ally implementation show marked improvements in overall, file,	Indirect Relationship: Usage reports track detailed engagement, feedback incorporation, and format	Direct Relationship: Theme 2: Impact of Ally software on the accessibility of	Indirect Relationship: Theme 2: Benefits of Alternative Formats

Research questions	General theme	Survey		Ally report		Faculty interview	Focus Group
		Student Survey	Faculty Survey	Accessibility Scores	Ally usage report		
		supporting increased accessibility Indirect Relationship: Paired analysis of student and faculty surveys shows increased	practices, and overall digital content improvement	and specific content areas	utilisation patterns	digital course materials	

Research questions	General theme	Survey		Ally report		Faculty interview	Focus Group
		Student Survey	Faculty Survey	Accessibility Scores	Ally usage report		
		use of alternative formats and decreased accessibility requests					
In what ways can faculty engagement	Faculty Engagement	Indirect relationship:	Direct Relationship: Paired t-tests	Direct Relationship:	Direct Relationship:	Direct Relationship:	Indirect Relationship:

Research questions	General theme	Survey		Ally report		Faculty interview	Focus Group
		Student Survey	Faculty Survey	Accessibility Scores	Ally usage report		
with the Ally accessibility indicators contribute to enhancing their teaching practice for inclusive education**?**	and Teaching Practices	Courses in which students reported improved material accessibility after using Ally	indicated a significant positive change in faculty engagement with accessibility indicators and their teaching	The increased usage of Ally tools has a direct correlation with improving accessibility scores	Reports show engagement with Ally indicators and with instructor feedback on corrections implemented	Theme 3: Faculty Engagement with Accessibility Indicators and Tools	Theme 3: Awareness and Training "Student feedback indicates improved learning

Research questions	General theme	Survey		Ally report		Faculty interview	Focus Group
		Student Survey	Faculty Survey	Accessibility Scores	Ally usage report		
			practices towards inclusive education post-intervention			Indirect Relationship: <u>Subtheme.</u> <u>2.3.</u> Evaluation of accessibility tools	experiences indirectly linked to faculty's engagement with accessibility tools"

Research questions	General theme	Survey		Ally report		Faculty interview	Focus Group
		Student Survey	Faculty Survey	Accessibility Scores	Ally usage report		
To what extent does the use of alternative formats by students enhance their access to	Student Access Enhancement	Direct Relationship: Paired analysis shows improvements in student access to content through	Indirect Relationship: Faculty perspectives support the importance of accessible content,	Indirect Relationship: Accessibility scores reflect alternative format usage	Direct Relationship: The increase in: Total downloads and launched	Indirect Relationship: Subtheme 4.2: Impact on Student Engagement and Learning	Direct Relationship: Theme1: Challenges with Standard Formats,

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Research questions	General theme	Survey		Ally report		Faculty interview	Focus Group
		Student Survey	Faculty Survey	Accessibility Scores	Ally usage report		
digital course content?		alternative formats, with reduced accommodation requests Paired student survey results	indirectly reinforcing student access	improvement post-training	the alternative formats Conversation rate Alternative format usage over a period of intervention	Theme1: Raising Awareness and Equipping Faculty	Benefits of Alternative Theme 2: Benefits of Alternative Formats

Research questions	General theme	Survey		Ally report		Faculty interview	Focus Group
		Student Survey	Faculty Survey	Accessibility Scores	Ally usage report		
		show increased usage of alternative formats, with marked improvements in content accessibility and engagement					Theme 4: Impact on Academic Performance

1. Awareness and Skill Development

Analysis of the faculty survey responses indicates that the training sessions increased faculty awareness of digital accessibility issues, such as fixing inaccessible PDFs and providing alternative text for images (see Section 4.2.4.2). This is further validated by the accessibility scores from the Ally reports, which show an improvement in accessibility scores for both universities and a reduction in the number of accessibility issues related to PDFs and alternative formats following the training (see Section 4.4.1). Additionally, the student survey results indicated that a PDF was the most accessible format, further supporting the findings (see Section 4.5.2 Subtheme 2.1).

2. Digital Accessibility Improvement

The primary data source for measuring the improvement in accessibility scores was the Ally report, which included both the overall accessibility score and the Ally usage report. According to the report, the overall accessibility score for both universities improved after the training sessions, as detailed in Section 4.4.1. The usage report further supported this, showing increased faculty engagement with feedback to remediate accessibility issues in their files, which directly impacted the overall accessibility score. This improvement was also reflected in students' access to alternative formats, as confirmed by feedback from student focus groups (see Section 4.4.2).

To effectively address accessibility issues and improve scores, faculty must be aware of Ally tools and possess the skills needed to remediate content, as discussed in previous sections. This demonstrates the interconnectedness and correlation between the data sources, showing how they overlap and support one another. Faculty survey data also confirms Ally's positive impact on material accessibility, teaching practices, and overall digital content improvement (see Section 4.2.4.2).

3. Faculty Engagement and Teaching Practices

According to the Ally report, there had been an increase in faculty accessing instructor feedback and actively addressing accessibility issues. This increased engagement is directly linked to the improvement in accessibility scores and the reduction of remaining accessibility issues. Ally's feedback feature highlights the specific accessibility problems within each file and provides guidance on how to fix them, enhancing faculty's ability to improve their content.

The data show that faculty members are not only understanding the tools and indicators provided by Ally but are also actively using these tools to achieve higher accessibility scores. This is further supported by student focus group interviews, which indicate that students have noticed improvements in accessing their course content and have been encouraged by faculty to utilise alternative formats.

4. Student Access Enhancement

Paired analysis indicated improvements in student access to content through alternative formats, with a noticeable reduction in accommodation requests. Paired student survey results showed increased usage of alternative formats, leading to marked improvements in content accessibility and student engagement. These data are further validated by the Ally usage report, which specifically highlighted the increase in downloads of alternative formats. Additionally, focus group discussions with students revealed their preferred types of alternative formats, aligning with the reported download data for these formats.

Chapter 5: Discussions and Conclusion

Efforts to ensure accessibility for all learners, particularly in the wake of the COVID-19 pandemic, extended to both K-12 schools (age 5-18-year-olds) and institutions of higher education. Nevertheless, designing online learning environments to ensure accessibility for all learners remains a prominent challenge for faculty members, content creators, instructional designers, and educational institutions (Bong & Chen, 2021; Walters, 2022). The challenges with ensuring accessibility to online learning environments extends beyond mere adherence to Web Accessibility and LMS standards. That is because the content uploaded must also be structured for accessibility. In fact, neglecting this aspect during the design phase places learners at the potential disadvantage of being unable to engage effectively with course materials (Bong & Chen, 2021). Therefore, it is crucial for educational institutions to nurture a culture that prioritises accessibility, and therefore fosters the integration of inclusive design principles. Not only that, but institutions should empower faculty members by providing opportunities for professional development that equip them with the essential skills to design accessible content. Institutions can also promote the use of accessibility tools like Ally anthology, which not only aids in producing accessible materials but also serves as a method to assess and improve the accessibility of course materials (Walters, 2022).

To determine the effectiveness of professional development and the utilisation of accessibility tools such as Ally in improving the digital accessibility to course content, this study explored the following research questions in the context of two universities in Saudi Arabia:

- To what extent will the professional development delivered to the target faculty members raise awareness around accessibility issues and equip them with the skills to increase the accessibility of their digital course content?
- To what extent will using the Ally software increase the accessibility of digital course materials?
- In what way can faculty engagement with the Ally accessibility indicators contribute to enhancing their teaching practice for inclusive education?

- To what extent does the use of alternative formats by students enhance their access to digital course content?

This study aimed to investigate the impact of integrating Ally software alongside targeted professional training on enhancing digital accessibility in higher education settings in Saudi Arabia. Through a combination of surveys, interviews, focus groups and institutional data reports, several key insights were obtained, reflecting both the effectiveness of these interventions and the challenges linked to their implementation.

This chapter presents the study's findings, connecting them to the research questions and theoretical frameworks of Universal Design for Learning (UDL) and the Web Content Accessibility Guidelines (WCAG). The discussion examines how the integration of Ally software, along with the training provided to faculty members, influenced digital accessibility in higher education. By organising the discussion around the main research questions, this chapter offers a theoretically grounded interpretation of the findings, highlighting the relationships between faculty engagement with accessibility tools, the impact on students' access to alternative formats, and the broader effects on inclusive teaching practices.

Furthermore, the chapter explores how different teaching modes—hybrid, online, and face-to-face—interact with digital accessibility, offering insights into how various student needs are influenced by specific impairments.

5.1 Discussion related to Research Questions

5.1.1. Responses to Research Question 1

RQ1: To what extent will the professional development delivered to the target faculty members raise awareness around accessibility issues and equip them with the skills to increase the accessibility of their digital course content?

One of the primaries aims of this study was to assess the extent to which professional training raised faculty members' awareness of accessibility issues and equipped them with the necessary skills to improve the accessibility of digital course content across the universities involved in the study.

Increased Awareness of Accessibility Issues

The professional development provided through this study effectively raised faculty members' awareness of accessibility challenges faced by students, particularly those with disabilities. Prior to the training, many faculty members demonstrated limited knowledge of accessibility requirements, as indicated by the pre-training survey results. This aligns with the findings of Walters (2022), who noted that faculty often lack awareness of digital accessibility issues, which in turn creates barriers to inclusive education.

However, post-training data showed a shift in faculty attitudes and understanding the critical role of accessibility in course design. The training centred on the principles of the Universal Design for Learning (UDL) framework, which promotes the development of learning environments that are both accessible and adaptable to meet the needs of diverse learners. This theoretical foundation was pivotal in enhancing faculty awareness, as it encouraged them to integrate accessibility into the fundamental structure of their courses, rather than treating it as an afterthought. Faculty members reported a more profound comprehension of how inaccessible digital materials—such as documents lacking alternative text or screenshots—can obstruct the learning experiences of students with various impairments.

Furthermore, this shift in perspectives extended beyond addressing the needs of students with disabilities. Through the framework of UDL, which advocates for flexible learning environments (CAST, 2018), faculty members recognised the importance of inclusive practices that benefit a wider range of learners, including English language learners and students in noisy environments. The adoption of UDL principles, facilitated by Ally, allowed faculty to engage in proactive accessibility design rather than retrofitting content. This change in practice highlights the effective application of UDL in higher education (Seale, 2020) and suggests that targeted training is essential for embedding accessibility into teaching practices (Walters, 2022).

Skill Development and Practical Application

In terms of skill acquisition, the training programme equipped faculty with both the technical knowledge and practical tools needed to enhance the accessibility of their course content. This was primarily achieved through hands-on sessions that familiarised faculty with Ally, a tool integrated within the Blackboard LMS. Ally's accessibility indicators and feedback mechanisms enabled faculty to identify and rectify accessibility issues in their course materials, following WCAG guidelines. The focus on perceivability, operability, and robustness from the WCAG 2.1 guidelines such as alternative text, heading and tagging PDF provided faculty with clear, actionable steps to improve content accessibility.

This was particularly evident at T University, which adopted a mixed-methods approach to teaching. Faculty members at T University noted that Ally's feedback, combined with their newly acquired skills from the training, enabled them to create accessible materials more effectively for both face-to-face and online teaching. This was in line with UDL principles, which emphasise providing learners with multiple means of accessing information (Ortiz, 2014).

At S University, where online teaching is the primary method, the impact of Ally and the associated training was even more pronounced. Faculty members, who primarily work with digital materials for both classes and uploaded content, found the software and training essential for ensuring that their course content adhered

to WCAG accessibility standards. With a focus on online content, faculty were able to apply the training lessons more consistently, illustrating how the teaching model can significantly influence the reliance on accessibility tools.

The effectiveness of this professional development in raising awareness and equipping faculty with practical skills resulted in a shift in how faculty members approached accessibility in course design. By incorporating UDL principles into the training, faculty were encouraged to consider the diverse needs of all students, not just those with disabilities, fostering a broader understanding of accessibility as a key pedagogical priority that benefits all learners. This shift underscores the importance of targeted training in helping faculty adapt their teaching materials to meet diverse needs, and demonstrates the critical role of institutional support in establishing a culture of accessibility within both hybrid and online teaching environments.

The study also highlights how training and tools like Ally can be used to put UDL principles into practice, enhancing the inclusivity of course materials across different teaching modalities. Moreover, the findings suggest a relationship between the professional development and improvements in accessibility. The training helped faculty overcome attitudinal barriers, as indicated in previous research (Hong, 2015), which often prevent educators from fully engaging with accessibility practices. By providing a strong theoretical foundation through UDL and practical tools like Ally and WCAG guidelines, the training resulted in changes in how faculty approached the design and delivery of their digital course content, improving accessibility for all students.

5.1.2. Responses to Research Question 2

RQ2: To what extent will using the Ally software increase the accessibility of digital course materials?

The second research question aimed to assess the effectiveness of Ally software in increasing the accessibility of digital course materials. The integration of Ally software provided insights into its practical utility for faculty and students alike.

Through both quantitative and qualitative data, the research examined the extent to which Ally improved the accessibility of course materials.

Improvements in Digital Accessibility through Ally

The results demonstrated an improvement in the accessibility of digital course materials following the implementation of Ally. Accessibility scores for course files increased, particularly in terms of adherence to WCAG 2.1 guidelines, which emphasise the need for digital content to be perceivable, operable, understandable, and robust. The Ally tool played a central role in addressing these criteria by automatically detecting accessibility issues in uploaded materials and providing real-time feedback to instructors on how to improve them (Ally Anthology, 2018).

For instance, the use of alternative text for images and closed captions for multimedia content increased, which aligns with the perceivability criterion of the WCAG framework (W3C, 2018). Similarly, Ally's feedback encouraged the use of screen-readable formats for documents, which enhanced the operability of content for students using assistive technologies like screen readers.

At S University, which has fully adopted online learning, the impact of the tool was even more pronounced. With the university's exclusive use of digital materials, Ally became essential in ensuring the accessibility of all student-facing content. The data indicate that faculty at S University extensively utilised Ally's alternative format features, especially for PDFs and other static documents that were previously challenging to make accessible. This highlights the tool's pivotal role in enhancing digital inclusivity, particularly in online-only environments where students depend heavily on accessible digital formats for their learning. At T University, where a mixed-methods approach is employed, the software proved particularly useful in ensuring that online materials uploaded before or after class were accessible. Faculty utilised the tool to make sure that all digital content met accessibility standards, enhancing the learning experience for all students, regardless of when or how they engaged with the course materials.

Faculty Engagement and the Role of Ally

While Ally's role in improving accessibility was heavily dependent on faculty engagement with the software, the training sessions had a direct influence on how frequently and effectively faculty utilised Ally's feedback to address accessibility issues. The extent of faculty engagement will be explored in detail in the discussion of the relevant research question.

The training sessions had a direct influence on how frequently and effectively faculty used Ally's feedback to rectify accessibility issues. Qualitative interviews revealed that faculty members who actively engaged with Ally reported an increased sense of accountability for the accessibility of their materials. This was in part due to the visibility of Ally's accessibility indicators, which provided continuous updates on the status of course materials. In this way, Ally functioned as both a monitoring and educational tool, aligning with the UDL framework's principle of creating inclusive learning environments from the outset rather than retrofitting solutions after problems arise.

However, the extent of improvement varied between faculty members and was influenced by the type of course materials used and the mode of teaching (hybrid, online, or face-to-face). Faculty who primarily taught online courses saw the improvements, as they relied heavily on digital materials. These instructors were more engaged with Ally's features and demonstrated a commitment to making continuous improvements to their materials.

Ally's feedback system, which is based on WCAG 2.1 standards, helped faculty understand and address specific accessibility barriers in their course content. By following WCAG guidelines, Ally ensured that course materials became more inclusive, not only adhering to legal accessibility standards, but also promoting social justice and equity in education, as discussed by Kezar and Posselt (2020).

Ally acts as an enabler for faculty to create content that is both technically accessible (per WCAG) and pedagogically inclusive (per UDL). By making accessibility a continuous and visible process through its feedback system, Ally

shifted accessibility from a technical requirement to a central pedagogical practice.

Responses to Research Question 3

RQ3: In what way can faculty engagement with the Ally accessibility indicators contribute to enhancing their teaching practice for inclusive education?

This question sought to assess how faculty members' interactions with the Ally accessibility indicators could contribute to the improvement of their teaching practices in the context of inclusive education. It aimed to understand how engaging with these indicators could influence and shape their instructional methods to better accommodate diverse learners and promote inclusivity.

Faculty Engagement with Ally's Accessibility Indicators

Faculty members' engagement with Ally's accessibility indicators had a positive effect on their approach to teaching. The indicators, which provide real-time feedback on the accessibility of uploaded course materials, allowed faculty to identify specific areas for improvement, such as ensuring that documents were screen-reader accessible or that multimedia content included alternative text.

At T University, where a mixed-methods approach is employed, faculty appreciated the immediate feedback provided by Ally, which allowed them to address accessibility issues across both in-person and online components of their courses. For instance, instructors reported using Ally's feedback to improve the readability of MS PowerPoint presentations used in face-to-face lectures, as well as ensuring that the online versions of these materials met accessibility standards.

This engagement with detailed feedback aligned well with the WCAG 2.1 guidelines, particularly in making content more perceivable, operable, and understandable for students with disabilities.

Many faculty members reported that the visibility of these accessibility scores made them more aware of accessibility as an ongoing concern, rather than a one-time consideration. As they received continuous updates on the accessibility status of their course materials, they began to see accessibility not just as a technical requirement but as a pedagogical enhancement that could benefit all students. This shift in mindset aligns with UDL's principle of providing multiple means of representation by ensuring that course content could be accessed in different ways, depending on students' needs and preferences (Meyer et al., 2014).

Teaching Practice Changes and Pedagogical Shifts

The data from the post-training surveys and interviews indicated that Ally's indicators encouraged faculty to adopt a more proactive approach to inclusive teaching. Rather than retrofitting accessibility accommodations after receiving specific requests from students with disabilities, faculty began incorporating accessibility considerations into their course design. Faculty members at S University reported that the software played a crucial role in ensuring that their courses met WCAG standards, particularly in relation to creating alternative formats for students with diverse needs. For example, the availability screen reader accessible content for visually impaired students or the ability to create audio format for students who preferred listening over reading. The fully online nature of S University's courses meant that faculty relied more heavily on Ally for all aspects of content delivery, further underscoring the software's utility in online learning environments.

The qualitative data further revealed that faculty members felt more empowered and confident in their ability to meet the diverse needs of their students. This confidence stemmed from their ability to actively track and improve the accessibility of their materials using Ally's clear, step-by-step feedback. This engagement with accessibility practices reflects Marquis et al.'s (2016) argument that faculty members who are more aware of accessibility issues are more likely to incorporate inclusive practices into their teaching.

5.1.3. Responses to Research Question 4

RQ4: To what extent does the use of alternative formats by students enhance their access to digital course content?

This research question focuses on the extent to which students' use of alternative formats—facilitated by Ally—improves their access to digital course content. The findings provide clear evidence that access to multiple content formats (e.g., audio, Braille, ePub) significantly enhanced students' ability to engage with their course materials.

Increased Access through Alternative Formats

One of the findings from the study was the increased use of alternative formats among students after the implementation of Ally. Both quantitative usage data and student feedback indicated that the ability to download materials immediately in different formats—such as audio, ePub, and Braille—had a positive impact on students' engagement with course content. This outcome directly aligns with the UDL principle of providing multiple means of representation, which encourages offering content in various formats to accommodate different learning approaches and needs (Meyer et al., 2014).

For students with visual impairments (SUS4 and SUS5), the availability of screen reader-friendly and Braille formats were essential for accessing reading materials, as traditional text formats often posed significant barriers. Similarly, students with learning disabilities (SUS7 and SUS10) benefited from tagged PDF files, which enabled them to activate text-to-speech functions and annotate the materials. This finding aligns with WCAG 2.1 guidelines, which emphasise the importance of making web content perceivable for all users, including those with disabilities.

Impact on the General Student Population

Interestingly, the use of alternative formats was not limited to students with disabilities. Many students without documented disabilities also reported using

alternative formats, particularly in contexts where they found the format more convenient or suited to their learning preferences. For example, students who commute or prefer to study in **audio format** found the ability to download course materials as audio files particularly beneficial. This supports the broader UDL concept that accessibility benefits all learners, not just those with disabilities. By offering multiple formats, Ally ensured that course materials were accessible to students in various contexts, thereby supporting **inclusive learning**.

The quantitative data revealed a steady increase in the download and use of alternative formats after the implementation of Ally, particularly in courses that were offered in hybrid or online formats. Students in fully online or hybrid courses were more likely to download alternative formats because digital content was central to their learning experience. This suggests a clear relationship between teaching modality and the effectiveness of alternative formats: the more students relied on digital materials, the more they used alternative formats to enhance their access.

By offering content in different formats, Ally empowered students to select the format that best aligned with their learning preferences, needs, and contexts. This directly supports UDL's emphasis on flexibility in content delivery, which advocates for providing options that cater to diverse learners. The increase in student engagement with course content demonstrates that making materials accessible in various formats can lead to improved academic outcomes.

Additionally, the use of alternative formats aligns with WCAG's operability principle, which requires that content be adaptable to various assistive technologies and user preferences. Ally's ability to provide these formats automatically made it easier for students to navigate content in ways that best suited their abilities and contexts, thereby reducing barriers to learning.

5.2 Conclusion

This research has made significant strides in understanding the impact of integrating Ally software and targeted professional development on digital accessibility in Saudi Arabian higher education. By examining both faculty and student experiences, the study revealed important insights into how accessibility tools and training can enhance inclusive education. The integration of Ally, alongside structured training, not only improved faculty awareness and skills but also enhanced the accessibility of digital course materials, benefiting a diverse range of learners.

At T University, where a mixed-methods approach is employed, faculty reported an improved ability to the digital content accessibility. The hybrid nature of their courses provided a unique opportunity to explore how Ally's feedback mechanisms could be applied to both face-to-face and online teaching. In contrast, at S University, which primarily offers online courses, the results were particularly significant. The institution's reliance on digital materials meant that Ally played an immediate and essential role in ensuring compliance with accessibility standards, directly impacting content used in online classrooms, activities, and materials being uploaded. These findings highlight the tool's flexibility across different teaching models and its potential scalability in diverse educational contexts.

A key contribution of this research is the application of Universal Design for Learning (UDL) and Web Content Accessibility Guidelines (WCAG) within the Saudi Arabian context. By operationalising these frameworks through Ally and targeted training, the study demonstrates the practical value of combining theoretical accessibility models with digital tools. The results indicate that embedding UDL principles into course design fosters a proactive approach to inclusivity, benefiting all learners, not just those with disabilities.

This research contributes both theoretically and practically to the understanding of digital accessibility in higher education. It extends the application of UDL and WCAG in the Saudi Arabian context, offering a clear example of how these

frameworks can be effectively implemented through technology like Ally. The study illustrates that accessibility is not a static goal but an evolving process, shaped by faculty engagement and the continuous improvement of course materials. By aligning theoretical principles with practical tools, the research bridges the gap between accessibility theory and its application in real-world educational settings.

Moreover, the study adds to the growing body of knowledge on the role of technology in supporting inclusive teaching practices. Ally's integration into learning management systems provided a concrete example of how digital tools can facilitate compliance with accessibility standards while also enhancing pedagogical practices. The tool's ability to provide real-time feedback and generate alternative formats for course materials significantly increased both faculty engagement and student access, demonstrating its potential to improve educational outcomes across various teaching models.

In conclusion, the study demonstrates that digital accessibility tools, when paired with structured professional development, can improve the inclusivity of higher education. The findings emphasise the importance of a comprehensive approach that combines technology, pedagogy, and institutional support to meet the diverse needs of all students. This research serves as a model for future studies and practices in digital accessibility, providing a roadmap for institutions aiming to create more inclusive learning environments.

5.3 Limitations and Future Research

5.3.1 Limitations

There are several noteworthy limitations in this research. One limitation pertains to self-selection bias, where participants had the choice to engage in both the quantitative survey (pre- and post-) and qualitative interviews. Participation was voluntary, potentially affecting the representation of the population and influencing the results. Another limitation involves the participant invitation being exclusively in Saudi Arabic, potentially limiting the generalisability of the data

obtained in this institution to other higher education institutions due to differences in inclusion and accessibility policies and standards. Additionally, gaps in individual participants' knowledge and interest in the research topic are considered limitations.

Furthermore, a notable limitation is the low number of student responses from both universities after the training. The pre-survey was collected before the student training session, followed by the post-survey sent by faculty a week later, resulting in very few responses. This impacted the comparison of the paired questions, primarily for students at S University before and after the training.

Moreover, Blackboard Ally continually evolves with regular feature additions. It is crucial to note that Ally may not calculate accessibility scores for all items, and it may not consistently identify all accessibility issues within content or documents. Limitations also exist in assessing specific file formats, like MS Excel, and certain native Apple apps such as Pages and Keynote. Consequently, ensuring complete accessibility in evaluating all course content may not be feasible.

This study solely focused on evaluating materials uploaded to Blackboard Learn by a sample of randomly selected faculty members. It did not aim to assess the accessibility of instructional materials hosted outside the Blackboard Learn (LMS) environment.

5.3.2 Future Research

This study lays the groundwork for future research to explore digital accessibility and universal design for learning in greater depth. It is important to note the following points about the research:

1. In general, the study faced challenges in terms of low participation rates, particularly among students, when compared to the substantial size of the university where the research was conducted. This could potentially restrict the extent to which the findings of the study can be applied to the broader study population. Therefore, future survey research in this domain should strive to

utilise larger sample sizes, aiming to offer a more comprehensive insight into faculty attitudes and technical capabilities in crafting accessible course content and students' experiences and feedback.

2. This study focused on the accessibility score of courses offered through the institutional LMS, concentrating on comprehensive accessibility scores and top-level reporting. A potential avenue for further investigation could involve conducting a case study analysis on specific courses' accessibility scores such as mathematics or English to assess their accessibility levels in greater detail. Such an approach would involve a more in-depth examination of individual courses' scores, enabling the identification of strengths and areas requiring enhancement.

3. This study was carried out during the interval between the conclusion of the autumn semester and the commencement of the spring semester, a period during which not all course content was uploaded. To gain a more comprehensive understanding and valuable insights, a cohort study spanning a complete academic year could offer a deeper understanding of the impact of training and accessibility tools.

References

Ableser, J., & Moore, C. (2018). *Universal Design for Learning and Digital Accessibility: Compatible Partners or a Conflicted Marriage?* https://er.educause.edu/articles/2018/9/universal-design-for-learning-and-digital-accessibility-compatible-partners-or-a-conflicted-marriage

Abu Abu Doush, I., Hammad, M., Alnabhan, M., Alsalem, G. M., Al-Alem, F. A., & Mouhammd Mahmoud, A.-a. (2020). Evaluating Usability and Content Accessibility for e-Learning Websites in the Middle East. *International journal of technology and human interaction*, *16*(1), 54-62. https://doi.org/10.4018/IJTHI.2020010104

Abu Doush, I., Sultan, K., Al-Betar, M. A., Almeraj, Z., Alyasseri, Z. A. A., & Awadallah, M. A. (2023). Web accessibility automatic evaluation tools: to what extent can they be automated? *CCF transactions on pervasive computing and interaction (Online)*, *5*(3), 288-320. https://doi.org/10.1007/s42486-023-00127-8

Adobe. (2023). *Create and verify PDF accessibility (Acrobat Pro)*. Retrieved 9 June from https://helpx.adobe.com/acrobat/using/create-verify-pdf-accessibility.html

Ainscow, M., Booth, T., & Dyson, A. (2006). Improving schools, developing inclusion? In (pp. 21-37). United Kingdom: Routledge. https://doi.org/10.4324/9780203967157-8

Akram, M., Ali, G. A., Sulaiman, A., & ul Hassan, M. (2023). Accessibility evaluation of Arabic University websites for compliance with success criteria of WCAG 1.0 and WCAG 2.0. *Universal Access in the Information Society*, *22*(4), 1199-1214. https://doi.org/10.1007/s10209-022-00921-8

Al-Khalifa, H. S., Baazeem, I., & Alamer, R. (2017). Revisiting the accessibility of Saudi Arabia government websites. *Universal Access in the Information Society*, *16*(4), 1027-1039. https://doi.org/10.1007/s10209-016-0495-7

Alghamdi, N. (2015). Higher education in Saudi Arabia: Achievements, challenges and opportunities. In (Vol. 69, pp. 1019-1021): Springer Science+Business Media B. V.

Allamki, Z. (2013). *The readiness of open access policy implementation : a case study within a Kuwaiti higher education institute* University of Salford].

Ally Anthology. (2018). Ally instructor and student surveys. https://usergroup.ally.ac/file/file/download?guid=8c52985b-edd2-4a52-895c-8cb2de8d8e4c&hash_sha1=bd6a7edd

Ally Anthology. (2023). *Empower learner choice. Build inclusive environments.* Retrieved 20 September from https://www.anthology.com/sites/default/files/2022-12/Anthology-Ally-for-LMS-Datasheet-V1-1222-EN-NA.pdf

Almutairi, N., & Alsuwayl, A. (2023). Assessing the knowledge of elementary school teachers on universal design for learning in Saudi Arabia. *Cogent education*, *10*(2). https://doi.org/10.1080/2331186X.2023.2270295

Alnahari, M., & Chakraborty, J. (2019). Preliminary Findings from a Study of an Arabic Accessibility Tool Checker. In M. Antona & C. Stephanidis, *Universal Access in Human-Computer Interaction. Theory, Methods and Tools* Cham.

Alsalem, G., & Doush, I. (2018). Access Education: What is Needed to Have Accessible Higher Education for Students with Disabilities in Jordan? *International journal of special education*, *33*, 541-561.

Alsalem, M. A. (2015). *Considering and supporting the implementation of universal design for learning among teachers of students who are deaf and hard of hearing in Saudi Arabia* (Publication Number 3713508) [Ph.D., University of Kansas]. ProQuest Dissertations & Theses Global. United States -- Kansas. https://www.proquest.com/dissertations-theses/considering-supporting-implementation-universal/docview/1708665311/se-2?accountid=11979

Alsalem, M. A. (2023). Towards New Disability Paradigms: Generating Equality in Saudi Arabian Policy in Light of the Convention on the Rights of Persons with Disabilities. *International journal of disability, development, and education*, *ahead-of-print*(ahead-of-print), 1-15. https://doi.org/10.1080/1034912X.2021.1980864

Amor, A. M., Hagiwara, M., Shogren, K. A., Thompson, J. R., Verdugo, M. Á., Burke, K. M., & Aguayo, V. (2018). International perspectives and trends in research on inclusive education: a systematic review. *International Journal of Inclusive Education*, *23*(12), 1277-1295. https://doi.org/10.1080/13603116.2018.1445304

Anthology. (n.d). *Anthology Trust Center- Accessibility*. https://www.anthology.com/trust-center/accessibility

Anthology Ally. (2023). @AnthologyInc. https://www.anthology.com/products/teaching-and-learning/learning-effectiveness/anthology-ally

Arkorful, V. E., Basiru, I., Anokye, R., Latif, A., Agyei, E. K., Hammond, A., Pokuaah, S., Arkorful, E. V., & Abdul-Rahaman, S. (2020). Equitable Access and Inclusiveness in Basic Education: Roadblocks to Sustainable Development Goals. *International journal of public administration*, *43*(3), 189-202. https://doi.org/10.1080/01900692.2019.1627554

Axelrod, J. (2018). Making materials accessible to students in higher education institutes: Institutional obligations, methods of compliance, and recommendations for future action [Article]. *Learned Publishing*, *31*(1), 39-44. https://doi.org/10.1002/leap.1148

Barnes, C., & Mercer, G. (2004). *Implementing the social model of disability : theory and research*. The Disability Press.

Basit, T. N., Tomlinson, S., & ProQuest. (2012). *Social inclusion and higher education*. Policy Press.

Bland, J. M., & Altman, D. G. (1997). Cronbach's alpha. *BMJ*, *314*(7080), 572-572. https://doi.org/10.1136/bmj.314.7080.572

Bond, M., Bedenlier, S., Marín, V. I., & Händel, M. (2021). Emergency remote teaching in higher education: mapping the first global online semester. *International Journal of Educational Technology in Higher Education*, *18*(1). https://doi.org/10.1186/s41239-021-00282-x

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*, *ahead-of-print*(ahead-of-print), 1-17. https://doi.org/10.1080/13603116.2021.1937344

Booth, T., & Ainscow, M. (2002). Index for Inclusion. Developing Learning and Participation in

Schools. *3rd ed.Bristol: CSIE.* https://www.eenet.org.uk/resources/docs/Index%20English.pdf

Brophy, P., & Craven, J. (2007). Web Accessibility. *Library Trends*, *55*(4), 950-972. https://doi.org/10.1353/lib.2007.0029

Bureau of Experts at the Council of Ministers. (2024a). *Basic regulations for persons with disabilities rehabilitation program.* Retrieved 21 May from https://laws.boe.gov.sa/BoeLaws/Laws/LawDetails/dcc76b09-2e3b-41cc-8b8f-a9a700f2bb5e/1

Bureau of Experts at the Council of Ministers. (2024b). *Basic law of governance in Saudi Arabia.* https://laws.boe.gov.sa/BoeLaws/Laws/LawDetails/16b97fcb-4833-4f66-8531-a9a700f161b6/1

Burgstahler, S. E. (2018). Inclusive Online Science Education: What Teachers Need to Know. In C. M. Wehlburg & S. Chadwick-Blossey (Eds.), *In Towards Inclusion of All Learners Through Science Teacher Education*. https://ebookcentral.proquest.com/lib/lancaster/detail.action?docID=5570460

Burrell-Ihlow, M. M. (2009). An investigation of teaching and learning: Using course management software in a typical face-to-face course. . *International Journal on E-Learning, 8(1):5–16.* .

Butterworth, B., Mareschal, D., & Tolmie, A. (2014). *Educational neuroscience*. Wiley.

Calvo, R., Iglesias, A., & Moreno, L. (2014). Accessibility barriers for users of screen readers in the Moodle learning content management system. *Universal Access in the Information Society*, *13*(3), 315-327. https://doi.org/10.1007/s10209-013-0314-3

Casey, C. (1999). Accessibility in the Virtual Library: Creating Equal Opportunity Web Sites. *Information technology and libraries*, *18*(1), 22-25.

CAST. (2018). Universal Design for Learning Guidelines version 2.2. In.

CAST (2018a). *Universal Design for Learning Guidelines version 2.2*. CAST. https://udlguidelines.cast.org/

CAST (2018b). *UDL and the learning brain*. Retrieved 8 June from http://www.cast.org/our-work/publications/2018/udl-learning-brain-neuroscience.html

Chataika, T., McKenzie, J. A., Swart, E., & Lyner-Cleophas, M. (2012). Access to education in Africa: responding to the United Nations Convention on the Rights of Persons with Disabilities. *Disability & society*, *27*(3), 385-398. https://doi.org/10.1080/09687599.2012.654989

Cherryholmes, C. H. (1992). Notes on Pragmatism and Scientific Realism. *Educational researcher*, *21*(6), 13-17. https://doi.org/10.2307/1176502

Cohen, E. G. (1994). *Designing group work: Strategies for the heterogeneous classroom* Teachers College Press. .

Coleman, M., & Berge, Z. (2018). A review of accessibility in online higher education. *ALISS Quarterly*, *13*(4), 22.

Communications Space & Technology Commission. (n.d). Digital Accessibility Breaking Down Barriers, Building Digital Inclusion. Retrieved 20 June 2024, from https://www.cst.gov.sa/en/researchs-studies/research-innovation/Documents/Digital-Accessibility.pdf

Consortium, I. G. L. (2004). *IMS access for all meta-data overview* http://www.imsglobal.org/accessibility/accmdv1p0/imsaccmd_oviewv1p0.html

Cooper, M. (1999). Evaluating Accessibility and Usability of Web Pages. In J. Vanderdonckt & A. Puerta (Eds.), *Computer-Aided Design of User Interfaces II: Proceedings of the Third International Conference on Computer-Aided Design of User Interfaces, 21–23 October, 1999, Louvain-la-Neuve, Belgium* (pp. 33-42). Springer Netherlands. https://doi.org/10.1007/978-94-011-4295-3_3

Cory, R. C. (2011). Disability services offices for students with disabilities: A campus resource. *New Directions for Higher Education*, *2011*(154), 27-36. https://doi.org/10.1002/he.431

Creswell, J. (2013). The Process of Conducting Research Using Quantitative and Qualitative Approaches. In. United Kingdom: Pearson Education UK.

Creswell, J. W. (2017a). *Designing and conducting mixed methods research* (3rd edition (international student edition). ed.).

Creswell, J. W. (2017b). *Research design : Qualitative, quantitative, and mixed methods approaches* (5th edition (international student edition). ed.). SAGE Publications.

Creswell, J. W., & Guetterman, T. C. (2019). *Educational research : planning, conducting, and evaluating quantitative and qualitative research* (Sixth edition. ed.).

Crow, K. L. (2008). The legal environment of accessible postsecondary online learning. *Quarterly review of distance education*, *9*(2), 169.

Das, M. (2022). *Designing for Accessible Collaborative Content Creation in Ability-Diverse Teams* (Publication Number 29390995) [Ph.D., Northwestern University]. ProQuest Dissertations & Theses Global. United States -- Illinois. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/designing-accessible-collaborative-content/docview/2754072538/se-2?accountid=11979

David, M., Parry, G., Bathmaker, A.-M., Crozier, G., Davis, P., Ertl, H., Fuller, A., Hayward, G., Heath, S., & Hockings, C. (2009). *Improving Learning by Widening Participation in Higher Education*. Taylor & Francis Group. http://ebookcentral.proquest.com/lib/lancaster/detail.action?docID=452088

De Wit, H. (2019). Evolving Concepts, Trends, and Challenges in the Internationalization of Higher Education in the World. *Вопросы образования*(2), 8-34. https://doi.org/10.17323/1814-9545-2019-2-8-34

Della Fina, V., Cera, R., & Palmisano, G. (2017). *The United Nations Convention on the Rights of Persons with Disabilities A Commentary* (1st 2017. ed.).

Denscombe, M. (2008). Communities of Practice: A Research Paradigm for the Mixed Methods Approach. *Journal of mixed methods research*, *2*(3), 270-283. https://doi.org/10.1177/1558689808316807

Dewey, J. (1958). *Experience and nature*. Dover Publications.

Dewey, J. (n.d.). *How We Think*. Project Gutenberg.

Doughty, H., & Allan, J. (2008). Social capital and the evaluation of inclusiveness in Scottish further education colleges. *Journal of further and higher education*, *32*(3), 275-284. https://doi.org/10.1080/03098770802220454

Dunham-Sootheran, K. M. (2014). *Digital Text: Exploring Stages Towards Universal Design for Learning* (Publication Number 3662072) [Ed.D., Harvard University]. ProQuest Dissertations & Theses Global. United States -- Massachusetts. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/i-digital-text-exploring-stages-towards-universal/docview/1644799925/se-2?accountid=11979

Duval, E., Sharples, M., & Sutherland, R. (2017). *Technology enhanced learning : research themes*.

Easterby-Smith, M., Thorpe, R., & Lowe, A. (1991). *Management research : an introduction*. Sage.

Economist Intelligence Unit. (2008). Saudi Arabia: Education. *ViewsWire*.

Edmonds, C. D. (2004). Providing Access to Students With Disabilities in Online Distance Education: Legal and Technical Concerns for Higher Education. *International journal of phytoremediation*, *18*(1), 51-62. https://doi.org/10.1207/s15389286ajde1801_5

Farrell, P. (2000). The impact of research on developments in inclusive education. *International Journal of Inclusive Education*, *4*(2), 153-162. https://doi.org/10.1080/136031100284867

Fenlon, K., Wood, L. C., Downie, J. S., Han, R., & Kinnaman, A. O. (2016). Toward accessible course content: Challenges and opportunities for libraries and information systems. *Proceedings of the ASIST Annual Meeting*, *53*(1), 1. https://doi.org/10.1002/pra2.2016.14505301027

Fetters, M. D., & Freshwater, D. (2015). Publishing a Methodological Mixed Methods Research Article. *Journal of mixed methods research*, *9*(3), 203-213. https://doi.org/10.1177/1558689815594687

Feyerabend, P. (1993). *Against method* (3rd ed.). Verso.

Flowers, C. P., Bray, M., & Algozzine, R. F. (1999). Accessibility of Special Education Program Home Pages. *Journal of special education technology*, *14*(2), 21-26. https://doi.org/10.1177/016264349901400202

Forlin, C. I., Chambers, D. J., Loreman, T., Deppler, J., & Sharma, U. (2013). Inclusive education for students with disability: A review of the best evidence in relation to theory and practice. *The Australian Research Alliance for Children and Youth (ARACY)*.

Francis, J., Adamson, S. R., Meiser, D., Boettcher, N., McLean, A., & Callahan, R. C. (2021). Developing New Online Course Accessibility Services for Faculty through Collaboration between Librarians and Campus Departments: A Case Study. *Medical reference services quarterly*, *40*(3), 261-273. https://doi.org/10.1080/02763869.2021.1945862

Gamage, K. A. A., Gamage, A., & Dehideniya, S. C. P. (2022). Online and Hybrid Teaching and Learning: Enhance Effective Student Engagement and Experience. *Education sciences*, *12*(10), 651. https://doi.org/10.3390/educsci12100651

Gatewood, J. A. (2020). *Full-Time Distance Education Faculty Perspectives on Web Accessibility in Online Instructional Content in a California Community College Context: An Evaluation Study* (Publication Number 28155544) [Ed.D., University of Southern California]. ProQuest Dissertations & Theses Global. United States -- California. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/full-time-distance-education-faculty-perspectives/docview/2476530107/se-2

Geith, C., & Vignare, K. (2008). Access to Education with Online Learning and Open Educational Resources: Can They Close the Gap? *Journal of Asynchronous*

Learning Networks, *12*(1), 105-126. https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ837472&site=ehost-live&authtype=ip,shib&user=s1523151

Gilligan, J. (2020). Competencies for Educators in Delivering Digital Accessibility in Higher Education. In (pp. 184-199). https://doi.org/10.1007/978-3-030-49108-6_14

Gordon, D. T., Gravel, J. W., & & Schifter, L. A., Eds. (2009). *A policy reader in Universal Design for Learning*. MA: Harvard Education Press.

GOV.SA. (2022). *Unified National Program, "Rights of People with Disabilities,"* Retrieved 9 June from https://www.my.gov.sa/wps/portal/snp/careaboutyou/RightsOfPeopleWithDisabilities.

GOV.SA. (2023). *Education and Training*. Unitfied National Platform- SA. Retrieved 19 from https://www.my.gov.sa/wps/portal/snp/aboutksa/EducationInKSA

GOV.UK. (2013, 2015). *Equality Act 2010: guidance*. Retrieved 13 March from https://www.gov.uk/guidance/equality-act-2010-guidance

Govender, D. W. (2010). Attitudes of students towards the use of a Learning Management System (LMS) in a face-to-face learning mode of instruction. *Africa education review*, *7*(2), 244-262. https://doi.org/10.1080/18146627.2010.515394

Grant, K., & Perez, L. (2018). *Dive into UDL : immersive practices to develop expert learners*.

Gronseth, S. (2018). Inclusive Design for Online and Blended Courses: Connecting Web Content Accessibility Guidelines and Universal Design for Learning. *Educational Renaissance*, *7. 14-22*.

Guilbaud, T. C. (2019). *Faculty Perception of Knowledge and Practice in Designing and Implementing Accessible Online Courses* (Publication Number 27547307) [D.Ed., The University of North Carolina at Charlotte]. ProQuest Dissertations & Theses Global. United States -- North Carolina. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/faculty-perception-knowledge-practice-designing/docview/2316056340/se-2?accountid=11979

Gunderson, J. L. (2015). *Exploring cognitively accessible academic lessons for students with intellectual disabilities using the iPad* (Publication Number 3715065) [Ph.D., University of Nevada, Las Vegas]. ProQuest Dissertations & Theses Global. United States -- Nevada. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/exploring-cognitively-accessible-academic-lessons/docview/1710455042/se-2?accountid=11979

Hall, P., & Imrie, R. (2001). *Inclusive design : designing and developing accessible environments*. Spon Press.

Hashey, A. I., & Stahl, S. (2014). Making Online Learning Accessible for Students With Disabilities. *Teaching exceptional children*, *46*(5), 70-78. https://doi.org/10.1177/0040059914528329

Hayhoe, S., Roger, K., Eldritch-Böersen, S., & Kelland, L. (2015). Developing Inclusive Technical Capital beyond the Disabled Students' Allowance in England. *Social inclusion*, *3*, 29. https://doi.org/10.17645/si.v3i6.410

Hodgson, D. C. (2012). The Role and Purposes of Public Schools and Religious Fundamentalism: An International Human Rights Law Perspective. *Forum on Public Policy Online*, *2012*(1). https://search.ebscohost.com/login.aspx?direct=true&db=eric&AN=EJ979441&site=ehost-live&authtype=ip,shib&user=s1523151

http://forumonpublicpolicy.com/vol2012.no1/archive/hodgson.pdf

Hoffman, J., Blessinger, P., & Makhanya, M. (2018). *Perspectives on Diverse Student Identities in Higher Education : International Perspectives on Equity and Inclusion*. Emerald Publishing Limited. http://ebookcentral.proquest.com/lib/lancaster/detail.action?docID=5609300

Hong, B. S. S. (2015). Qualitative Analysis of the Barriers College Students With Disabilities Experience in Higher Education. *Journal of college student development*, *56*(3), 209-226. https://doi.org/10.1353/csd.2015.0032

Hurst, H. A. (1990). *Access to higher education and people with disabilities : individual and institutional perspectives* University of Lancaster].

Iacovou, M. (2021). A contribution towards a possible re-invigoration of our understanding of the social model of disability's potential. *Disability & society*, *36*(7), 1169-1185. https://doi.org/10.1080/09687599.2020.1787816

IDEA. (2004). *Appendix F to Part 300—Index for IDEA—Part B Regulations (34 CFR Part 300) - Individuals with Disabilities Education Act*. https://sites.ed.gov/idea/regs/b/appendix-f/

Iglesias, A., Moreno, L., Martínez, P., & Calvo, R. (2014). Evaluating the accessibility of three open-source learning content management systems: A comparative study. *Computer applications in engineering education*, *22*(2), 320-328. https://doi.org/10.1002/cae.20557

Iniesto, F. (2020). *An Investigation into the Accessibility of Massive Open Online Courses (MOOCs)* (Publication Number 27981910) [Ph.D., Open University (United Kingdom)]. ProQuest Dissertations & Theses Global. England. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/investigation-into-accessibility-massive-open/docview/2402418929/se-2?accountid=11979

Jackson, A. K. (2023). *Closing the Digital Divide: Understanding Organizational Approaches to Digital Accessibility in Higher Education* (Publication Number 30485338) [Ed.D., University of South Dakota]. ProQuest Dissertations & Theses Global. United States -- South Dakota. https://www.proquest.com/dissertations-theses/closing-digital-divide-understanding/docview/2814304736/se-2?accountid=11979

Jick, T. D. (1979). Mixing Qualitative and Quantitative Methods: Triangulation in Action. *Administrative science quarterly*, *24*(4), 602-611. https://doi.org/10.2307/2392366

Johnson, R. B., Onwuegbuzie, A. J., & Turner, L. A. (2007). Toward a Definition of Mixed Methods Research. *Journal of mixed methods research*, *1*(2), 112-133. https://doi.org/10.1177/1558689806298224

Kaushik, V., & Walsh, C. A. (2019). Pragmatism as a research paradigm and its implications for Social Work research. *Social sciences (Basel)*, *8*(9), 255. https://doi.org/10.3390/socsci8090255

Kelsey Adkins, E. R. (2023). *Digital Accessibility in Colorado Higher Education Institutions* (Publication Number 30316475) [M.S., Colorado School of Mines]. ProQuest Dissertations & Theses Global. United States -- Colorado. https://www.proquest.com/dissertations-theses/digital-accessibility-colorado-higher-education/docview/2878678547/se-2?accountid=11979

Kezar, A., & Posselt, J. (2020). *Higher education administration for social justice and equity:*

Critical perspectives for leadership. Routledge. https://www.taylorfrancis.com/books/edit/10.4324/9780429435140/higher-education-administration-social-justice-equity-adrianna-kezar-julie-posselt

King Salman Center for Disability Research. (2024). *Disabilities code.* Retrieved 22 May from https://kscdr.org.sa/en/disability-code

Kumar, K. L., & Owston, R. (2016). Evaluating e-learning accessibility by automated and student-centered methods [Article]. *Educational Technology Research and Development*, *64*, 263+. http://dx.doi.org/10.1007/s11423-015-9413-6

Kurt, S. (2019). Moving toward a universally accessible web: Web accessibility and education. *Assist Technol*, *31*(4), 199-208. https://doi.org/10.1080/10400435.2017.1414086

Lambert, S. R. (2020). Do MOOCs contribute to student equity and social inclusion? A systematic review 2014–18. *Computers and education*, *145*, 103693. https://doi.org/10.1016/j.compedu.2019.103693

Levesque, A., & Malhotra, R. (2019). The dawning of the social model? Applying a disability lensto recentdevelopmentsin the law of negligence. *McGill journal of law and health*, *13*(1), 1-26.

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*, *30*(1), 21-34. https://doi.org/10.1080/02680513.2015.1007859

Maarouf, H. (2019). Pragmatism as a Supportive Paradigm for the Mixed Research Approach: Conceptualizing the Ontological, Epistemological, and Axiological Stances of Pragmatism. *International business research (Toronto)*, *12*(9), 1. https://doi.org/10.5539/ibr.v12n9p1

Mancilla, R., & Frey, B. (2021). Course design for digital accessibility: Best practices and tools. *Quality Matters*. https://www.qualitymatters.org/sites/default/files/research-docs-pdfs/QM-Digital- Accessibility-Best-Practices-Tools-WP.pdf

Marquis, E., Jung, B., Fudge Schormans, A., Lukmanji, S., Wilton, R., & Baptiste, S. (2016). Developing inclusive educators: enhancing the accessibility of teaching and learning in higher education. *The international journal for academic development*, *21*(4), 337-349. https://doi.org/10.1080/1360144X.2016.1181071

Massengale, L. R., & Vasquez, E. (2016). Assessing Accessibility: Are Online Courses Better Than Face-to-Face Instruction At Providing Access to Course Content for Students with Disabilities? *The journal of scholarship of teaching and learning*, *16*(1), 69-79. https://doi.org/10.14434/josotl.v16i1.19101

May, D. H., & Bridger, K. (2010). Developing and embedding inclusive policy and practice in higher education. *York: Higher Education Academy.*

McGinty, J. M. (2016). *Accessibility and inclusion in higher education: An inquiry of faculty perceptions and experiences* Colorado State University].

Meyer, A., Rose, D. H., & Gordon, D. (2014). *Universal design for learning: Theory and Practice*. MA: CAST Professional Publishing.

Microsoft. (2023). *Improve accessibility with the Accessibility Checker - Microsoft Support*. https://support.microsoft.com/en-us/office/improve-accessibility-with-the-accessibility-checker-a16f6de0-2f39-4a2b-8bd8-5ad801426c7f

Mitchell, A. (2018). A Review of Mixed Methods, Pragmatism and Abduction Techniques. *Electronic journal of business research methods*, *16*(3), 103-116.

MOE. (2022). *University Education*. Retrieved 5 August from https://moe.gov.sa/en/education/highereducation/Pages/UniversitiesList.aspx

Morgan, D. L. (2007). Paradigms Lost and Pragmatism Regained: Methodological Implications of Combining Qualitative and Quantitative Methods. *Journal of mixed methods research*, *1*(1), 48-76. https://doi.org/10.1177/2345678906292462

Morgan, D. L. (2014). Pragmatism as a Paradigm for Social Research. *Qualitative inquiry*, *20*(8), 1045-1053. https://doi.org/10.1177/1077800413513733

Moriña, A. (2017). Inclusive education in higher education: challenges and opportunities. *European journal of special needs education*, *32*(1), 3-17. https://doi.org/10.1080/08856257.2016.1254964

Mubarak S. Aldosari. (2024). Assessment of Universal Design Principles for the Enhancement of Special Education in the Kingdom of Saudi Arabia (KSA). https://www.researchgate.net/publication/381057503_Assessment_of_Universal_Design_Principles_for_the_Enhancement_of_Special_Education_in_the_Kingdom_of_Saudi_Arabia_KSA

Naylor, R., & James, R. (2016). Systemic Equity Challenges: An Overview of the Role of Australian Universities in Student Equity and Social Inclusion. In (pp. 1-13). https://doi.org/10.1016/B978-0-08-100213-1.00001-9

NCLB. (2001). No Child Left Behind Act of 2001. https://www2.ed.gov/nclb/landing.jhtml

Newby, P. (2010). *Research methods for education*. Longman.

Ngwenya, C. A. N. (2019). *Inclusive Teaching Practices in Adult Education and Training Institutions in Gauteng East District* (Publication Number 28279576) [D.Ed., University of Johannesburg (South Africa)]. ProQuest Dissertations & Theses Global. South Africa. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/inclusive-teaching-practices-adult-education/docview/2519864081/se-2?accountid=11979

Nilholm, C. (2021). Research about inclusive education in 2020 - How can we improve our theories in order to change practice? *European journal of special needs education*, *36*(3), 358-370. https://doi.org/10.1080/08856257.2020.1754547

Njoku, C. P. U. (2015). Information and communication technologies to raise quality of teaching and learning in higher education institutions. *International journal of education and development using information and communication technology*, *11*(1), 122.

Nolin, K. P. (2019). *An Instrumental Case Study in Instructional Design: Integrating Digital Media Objects in Alignment with Curriculum Content in the Online Higher Education Course* (Publication Number 22623227) [Ed.D., Northeastern University]. ProQuest Dissertations & Theses Global. United States -- Massachusetts. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/instrumental-case-study-instructional-design/docview/2296357859/se-2?accountid=11979

Oates, B. J., Griffiths, M., & McLean, R. (2022). *Researching information systems and computing* (2nd edition. ed.). SAGE Publications Ltd.

Obeid, M. (2018). *Toward Accessible Course Content: Challenges and Opportunities for Students of Determination in higher education*.

OECD. (2022). *Education at a Glance 2022: OECD Indicators*

Opertti, R., Walker, Z., & Zhang, Y. (2014). *Inclusive education: From targeting groups and schools to achieving quality education as the core of EFA.* (Vol. 1). SAGE.

Ormerod, R. (2006). The history and ideas of pragmatism. *The Journal of the Operational Research Society*, *57*(8), 892-909. https://doi.org/10.1057/palgrave.jors.2602065

Ortiz, T. R. (2014). *Accessibility in distance education: Implements of universal design for learning* (Publication Number 3582941) [Ph.D., University of Hawai'i at Manoa]. ProQuest Dissertations & Theses Global. United States -- Hawaii. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/accessibility-distance-education-implements/docview/1611919767/se-2?accountid=11979

PACER Center. (2011). Accessible Instructional Materials (AIM). https://www.pacer.org/stc/pubs/stc-22.pdf

Pallant, & Julie. (2010). Checking the reliability of a scale. In *SPSS Survival Manual a Step by Step Guide to Data Analysis Using SPSS.* Maidenhead: McGraw-Hill.

Poore-Pariseau, C. L. (2011). *Principles of universal design for learning: What is the value of UDL training on accessible pedagogy?* (Publication Number 3473537) [Ph.D., Capella University]. ProQuest Dissertations & Theses Global. United States -- Minnesota. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/principles-universal-design-learning-what-is/docview/896069453/se-2?accountid=11979

Reinle, M. N. (2020). *Faculty-Designers' Experiences with Universal Design for Learning Principles in Canvas* (Publication Number 28090324) [D.Ed., Capella University]. ProQuest Dissertations & Theses Global. United States -- Minnesota. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/faculty-designers-experiences-with-universal/docview/2446992759/se-2?accountid=11979

Robertson, Z. S., & Jaswal, V. K. (2024). Barriers to inclusion: Incorporating the social model in the study of children's understanding of disability. *Cognitive development*, *70*. https://doi.org/10.1016/j.cogdev.2024.101435

Rogers-Shaw, C., Carr-Chellman, D. J., & Choi, J. (2018). Universal Design for Learning: Guidelines for Accessible Online Instruction. *Adult learning (Washington, D.C.)*, *29*(1), 20-31. https://doi.org/10.1177/1045159517735530

Roh, S.-Z. (2004). *Designing accessible Web-based instruction for all learners: Perspectives of students with disabilities and Web-based instructional personnel in higher education* (Publication Number 3152829) [Ph.D., Indiana University]. ProQuest Dissertations & Theses Global. United States -- Indiana. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissert

ations-theses/designing-accessible-web-based-instruction-all/docview/305203989/se-2?accountid=11979

Ryan, R. M. (2023). *The Oxford Handbook of Self-Determination Theory* (1st ed.). Oxford University Press, Incorporated.

Ryan, R. M., & Deci, E. L. (2000). Self-Determination Theory and the Facilitation of Intrinsic Motivation, Social Development, and Well-Being. *The American psychologist*, *55*(1), 68-78. https://doi.org/10.1037/0003-066X.55.1.68

Sanderson, N. C., Kessel, S., & Chen, W. Q. (2022). What do faculty members know about universal design and digital accessibility? A qualitative study in computer science and engineering disciplines [Article]. *Universal Access in the Information Society*, *21*(2), 351-365. https://doi.org/10.1007/s10209-022-00875-x

Sanger, C. S., Sanger, C. S., & Gleason, N. W. (2020). *Diversity and Inclusion in Global Higher Education Lessons from Across Asia* (1st 2020. ed.). Springer Nature.

Saudi Vision 2030. (n.d). *Strategic objectives.* *https://vision2030.gov.sa/en/vision/roadmap*. Retrieved 23 May from https://www.vision2030.gov.sa/en/vision-2030/overview/

Saunders, M. N. K., Lewis, P., & Thornhill, A. (2012). *Research Methods for Business Students* (6th ed.). Pearson Education UK.

Scoles, J., Huxham, M., & McArthur, J. (2014). *Mixed-Methods Research in Education: Exploring Students' Response to a Focused Feedback Initiative* https://doi.org/10.4135/9781446273050135146 90

Scott, J. (2018). *Ally Research SIG*

Scott, S., & Aquino, K. (2020). Covid-19 transitions: Higher education professionals' perspectives on access barriers, services, and solutions for students with disabilities. *Association on Higher Education and Disability (AHEAD)*. https://higherlogicdownload.s3.amazonaws.com/AHEAD/38b602f4-ec53-451c-9be0-5c0bf5d27c0a/UploadedImages/COVID-19_/AHEAD_COVID_Survey_Report_Barriers_and_Resource_Needs__2_.docx

Seale, J. (2020). *Improving Accessible Digital Practices in Higher Education : Challenges and New Practices for Inclusion*. Springer International Publishing AG. http://ebookcentral.proquest.com/lib/lancaster/detail.action?docID=6017655

Seale, J., Garcia-Carrisoza, H., Rix, J., Sheehy, K., & Hayhoe, S. (2018). A proposal for a unified framework for the design of technologies for people with learning difficulties. *Technology and Disability*, *30*, 25-40. https://doi.org/10.3233/TAD-180193

Shah, M., Bennett, A., & Southgate, E. (2015). *Widening Higher Education Participation : A Global Perspective*. Elsevier Science & Technology. http://ebookcentral.proquest.com/lib/lancaster/detail.action?docID=4042671

Shahriar, A., & Syed, G. K. (2017). *Student culture and identity in higher education*. PA: IGI Global Publishing.

Shogren, K. A., Wehmeyer, M. L., Palmer, S. B., Forber-Pratt, A. J., Little, T. J., & Lopez, S. (2015). Causal Agency Theory: Reconceptualizing a Functional Model of Self-Determination. *Education and training in autism and developmental disabilities*, *50*(3), 251-263.

Shyman, E. (2015). Toward a Globally Sensitive Definition of Inclusive Education Based in Social Justice. *International journal of disability, development, and education*, *62*(4), 351-362. https://doi.org/10.1080/1034912X.2015.1025715

Singleton, K. J. (2017). *Integrating UDL Principles and Practices into the Online Course Development Process: A Delphi Study* (Publication Number 10256923) [Ph.D., George Mason University]. ProQuest Dissertations & Theses Global. United States -- Virginia. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/integrating-udl-principles-practices-into-online/docview/1934350597/se-2?accountid=11979

Sintema, E. J. (2020). e-learning-and-smart-revision-portal-for-zambian-primary-and-secondary-school-learners-a-digitalized-virtual-classroom-in-the-covid-19-era-and-beyond. *Aquademia*, *4*, ep20017. https://doi.org/10.29333/aquademia/8253

Stanley, D. (2013). *Like a palm tree in a hurricane: A dual case study of digital text in the inclusive classroom* (Publication Number 3606915) [Ed.D., Texas A&M University - Corpus Christi]. ProQuest Dissertations & Theses Global. United States -- Texas. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/like-palm-tree-hurricane-dual-case-study-digital/docview/1492361897/se-2?accountid=11979

Steinfeld, E., & Maisel, J. L. (2012). *Universal design creating inclusive environments*. John Wiley & Sons.

Stentiford, L., & Koutsouris, G. (2022). Critically considering the 'inclusive curriculum' in higher education. *British journal of sociology of education*, *43*(8), 1250-1272. https://doi.org/10.1080/01425692.2022.2122937

Taket, A. R. (2014). *Practising social inclusion*.

Tashakkori, A., & Creswell, J. W. (2007). Editorial: The New Era of Mixed Methods. *Journal of mixed methods research*, *1*(1), 3-7. https://doi.org/10.1177/2345678906293042

Tavakol, M., & Dennick, R. (2011). Making sense of Cronbach's alpha. *Int J Med Educ*, *2*, 53-55. https://doi.org/10.5116/ijme.4dfb.8dfd

Thompson, T., Burgstahler, S., & Moore, E. J. (2010). Web accessibility: A longitudinal study of college and university home pages in the northwestern United States.

Disabil Rehabil Assist Technol, *5*(2), 108-114. https://doi.org/10.3109/17483100903387424

Tomaševski, K. (2001). Human Rights Obligations: Making Education Available, Accessible, Acceptable and Adaptable. https://www.right-to-education.org/sites/right-to-education.org/files/resource-attachments/Tomasevski_Primer%203.pdf

Trotman, C. (2005). From the margins to the mainstream: Embedding widening participation in higher education. (London: Universities UK)

UDL ON CAMPUS. (2023). *About UDL*. UDL ON CAMPUS. Universal Design for Learning in Higher Education. http://udloncampus.cast.org/page/udl_about

UN. (2020). *Education – United Nations Sustainable Development.* Retrieved 20 August from https://www.un.org/sustainabledevelopment/education/

UN. (2016). General comment No. 4 on Article 24 - the right to inclusive education. https://www.ohchr.org/en/documents/general-comments-and-recommendations/general-comment-no-4-article-24-right-inclusive

UN. (n.d.a). *Convention On The Rights Of Persons With Disabilities (CRPD)*. United Nations.

UN. (n.d.b). *Convention on the Rights of the Child*. Retrieved 9 September from https://www.ohchr.org/en/instruments-mechanisms/instruments/convention-rights-child

UN. (n.d.c). Universal Declaration of Human Rights https://www.un.org/en/about-us/universal-declaration-of-human-rights#:~:text=Article%2026,on%20the%20basis%20of%20merit.

International Covenant on Economic, Social and Cultural Rights, (2016). https://www.right-to-education.org/sites/right-to-education.org/files/resource-attachments/ICESCR_1966_en.pdf

UNESCO. (2008). *INCLUSIVE EDUCATION: THE WAY OF THE FUTURE* INTERNATIONAL CONFERENCE ON EDUCATION, Geneva. https://www.ibe.unesco.org/fileadmin/user_upload/Policy_Dialogue/48th_ICE/CONFINTED_48-3_English.pdf

UNESCO. (2019). Right to education handbook. https://www.right-to-education.org/sites/right-to-education.org/files/resource-attachments/RTE-UNESCO_Right%20to%20education%20handbook_2019_En.pdf

UNESCO. (2021). *Saudi Arabia INCLUSION*. Retrieved 27 August from https://education-profiles.org/northern-africa-and-western-asia/saudi-arabia/~inclusion

UNICEF. (n.d). *Inclusive education*. Retrieved 23 August from https://www.unicef.org/education/inclusive-education#:~:text=Inclusive%20education%20means%20all%20children,speakers%20of%20minority%20languages%20too.

United Nations. (2006). The United Nations convention on the rights of persons with disabilities. https://treaties.un.org/doc/Publication/MTDSG/Volume%20I/Chapter%20IV/IV-15.en.pdf

United Nations. (n.d.d). *Sustainable Development Goals*. https://sdgs.un.org/goals

United Nations Saudi Arabia. (2024). *Our Work on the Sustainable Development Goals in Saudi Arabia*. Retrieved 23 May from https://saudiarabia.un.org/en/sdgs

ViŞAn, E. R. (2019). The rights to education, a strategic priority of the 70th anniversary of the Universal Declaration of Human Rights. *Law review (Romania)*, *X*(2).

Vollenwyder, B., Iten, G. H., Brühlmann, F., Opwis, K., & Mekler, E. D. (2019). Salient beliefs influencing the intention to consider Web Accessibility. *Computers in human behavior*, *92*, 352-360. https://doi.org/10.1016/j.chb.2018.11.016

W3C (n.d). *Web accessibility evaluation tools list.* . https://www.w3.org/WAI/ER/tools/

W3C, W. W. W. C. (2018). Web content accessibility guidelines (WCAG) 2.1. https://www.w3.org/TR/WCAG21/

W3C, W. W. W. C. (2019). *Web Accessibility Initiative. Web content accessibility guidelines (WCAG) overview*. https://www.w3.org/WAI/standards-guidelines/wcag/

Walker, S., Read, S., & Priest, H. (2013). Use of reflexivity in a mixed-methods study. *Nurse Res*, *20*(3), 38-43. https://doi.org/10.7748/nr2013.01.20.3.38.c9496

Walters, A. P. (2022). *Evaluating the Effectiveness of Online Faculty Development in Creating Accessible Content* (Publication Number 29403121) [Ph.D., The University of Toledo]. ProQuest Dissertations & Theses Global. United States -- Ohio. http://proquest.umi.com/login/athens?url=https://www.proquest.com/dissertations-theses/evaluating-effectiveness-online-faculty/docview/2697183039/se-2?accountid=11979

White, J. (2019). WCAG 2.1 Meets STEM: Application, Interpretation, and Opportunities for Further Standard Development. *Journal of science education for students with disabilities*, *22*(1), 1-7. https://doi.org/10.14448/jsesd.11.0008

Wilkens, L., & Buhler, C. (2022, Jun 26-Jul 01). Accessible Videos in Higher Education - Lost in Translation?!*Lecture Notes in Computer Science* [Universal access in human-computer interaction: User and context diversity, uahci 2022, pt ii]. 16th International Conference on UniversalAccess inHuman-Computer Interaction (UAHCI) Held as Part of the 24th International Conference on Human-Computer Interaction (HCII), Electr Network.

Wilkens, L., Bühler, C., & Bosse, I. (2020). Accessible Learning Management Systems in Higher Education. In M. Antona & C. Stephanidis, *Universal Access in Human-Computer Interaction. Applications and Practice* Cham.

Wilkens, L., Haage, A., Lüttmann, F., & Bühler, C. R. (2021). Digital Teaching, Inclusion and Students' Needs: Student Perspectives on Participation and Access in Higher Education. *Social inclusion*, *9*(3), 117-129. https://doi.org/10.17645/si.v9i3.4125

Woodfine, B. P., Nunes, M. B., & Wright, D. J. (2008). Text-based synchronous e-learning and dyslexia: Not necessarily the perfect match. *Computers and education*, *50*(3), 703-717. https://doi.org/10.1016/j.compedu.2006.08.010

World Bank Group. (2020). *Learning for All*. https://pubdocs.worldbank.org/en/418511491235420712/Education-Strategy-4-12-2011.pdf

World Health Organization. (2001). *International classification of functioning, disability and health (ICF)*. Retrieved 22 May from https://www.who.int/classifications/icf/en/

Zhang, L. (2020). *Design, Implementation, and Measurement of Personalized Learning Through the Lens of Universal Design for Learning* (Publication Number 28029717) [Ph.D., University of Kansas]. ProQuest Dissertations & Theses Global. United States -- Kansas. https://www.proquest.com/dissertations-theses/design-implementation-measurement-personalized/docview/2446640463/se-2?accountid=11979

Appendix One

Instructor Feedback Panel

Source:

https://help.blackboard.com/Ally/Ally_for_LMS/Administrator/Improve_Accessibility/Instructor_Feedback_Panel

Open the feedback panel.

Ally provides you detailed feedback and support to help you become an accessibility pro. Learn about accessibility issues, why they matter, and how to fix them. Green is the goal! After you upload files in your course, Ally produces an accessibility score for each file. In lessons with multiple files, the accessibility score is shown for each file. In areas where you access files, the accessibility icon is located to the right or left of the file.

Select the Accessibility score to open the feedback panel.

Figure 11.1. Accessibility score feedback panel.

Ally's feedback panel shows you a preview of the document's content as well as detailed feedback and support to help you fix your accessibility issues.

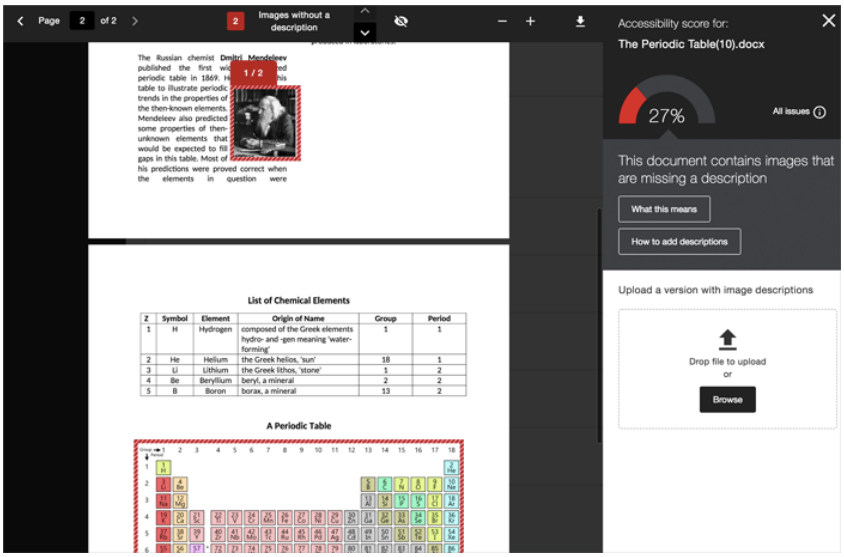


Figure 11.2. Feedback panel.

Not sure where to find your accessibility scores? Jump to View File Accessibility.

Preview the document:

The instructor feedback, in-browser, preview shows the content for PDFs, Word documents and PowerPoint documents.

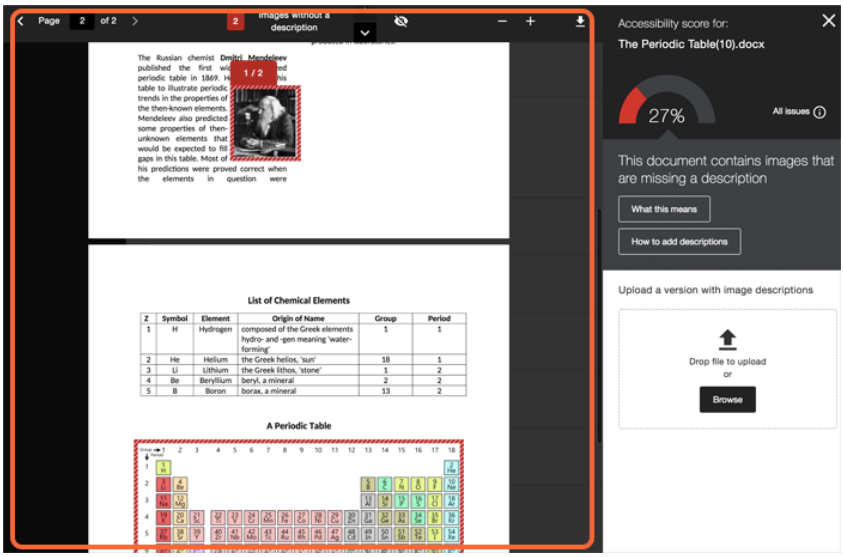


Figure 11.3. Preview Highlights.

Highlights

The preview highlights where specific accessibility issues can be found in the document. Highlights show every occurrence of one issue type at a time. For example, if your images are missing alternative descriptions, the highlights show you every place this specific issue occurs. If your document also has poor text contrast, select that issue in the feedback panel to see the occurrences of that issue highlighted.

Highlights are provided for these issues:

- Images without an appropriate alternative description
- Text fragments with insufficient contrast
- Tables without table headers

All other accessibility issues are not highlighted in the preview.

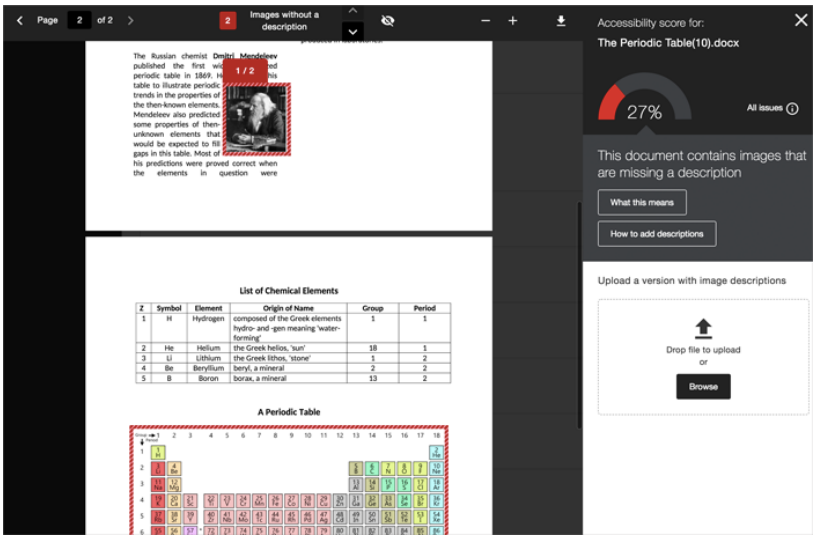


Figure 11.4: Missing text description

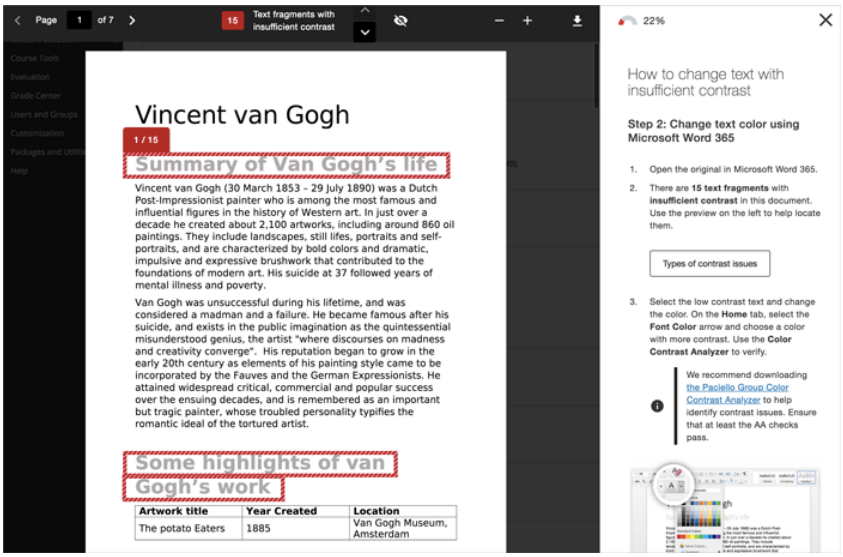


Figure 11.5: Text contrast

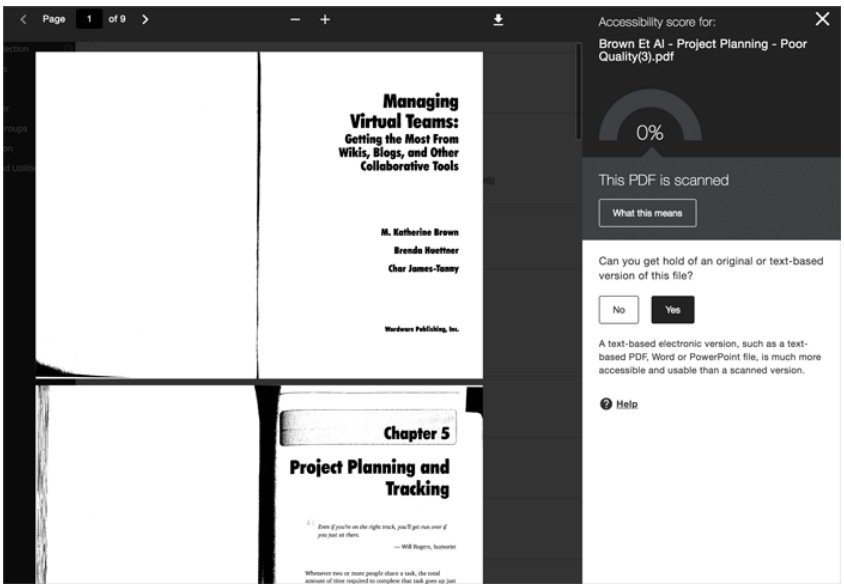


Figure 11.6: Scanned PDF.

Preview tools

Figure 11.7: Preview tools.

Use the tools above the preview to explore the issues in your document.

- Move through the document preview page by page.
- See how many times a specific issue appears in the document.
- Jump between the issue highlights.
- Hide or show the highlights.
- Zoom the preview content in or out.
- Download the original file.

Step-by-step guidance

For accessible files, Ally tells you what you did correctly. For files with Low to Highscores, Ally shows you the issues and gives a step-by-step guide on how to fix them.

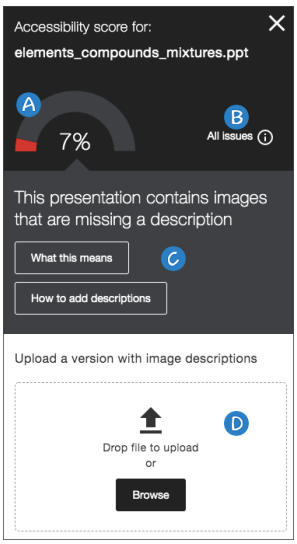


Figure 11.8: Accessibility Score.

A. Accessibility score: See the overall score for the entire file.
B. All issues: Select All issues to see every issue in the file. This view shows you by how much the score can improve by fixing each issue. Find the issue you want to start fixing and select Fix.

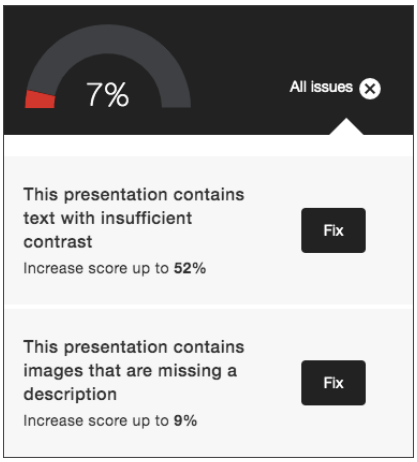


Figure 11.9: Accessibility issues.

C. Description of issue and step-by-step help: See the description for an issue with the file. Ally organizes this feedback in a decision tree, so all you need to do is read the directions and respond to the prompts. Learn what the issue is, why it matters, and how to correct it appropriately.
D. Select What this means to learn more about the issue.
E. Select How to and follow the steps to improve the file's accessibility.
F. These instructions change depending on the file and the accessibility issues found. For example, with a PDF you may see instructions on how to make the PDF tagged. Select How to Make a PDF Tagged.
G. Upload: Upload updated files to replace the existing one.

Appendix Two

Accessibility Awareness Faculty Survey

Pre-Survey

Cover Page:

My name is Maisa Sami, and I am a PhD student studying at the Department of Educational Research at Lancaster University. I would like to invite you to take part in a research project: Institutional change for improving Digital access: Accessibility tools alongside training.
Before you decide if you wish to contribute, you should be aware of the reason this research is being conducted and the extent of your involvement. Please take time to read the following information carefully.

What is the study about?

The main purpose of this study is to measure the impact of embedding accessibility tools, such as Ally, and associated training on how to use it, to courses on a digital LMS such as Blackboard. The measures of impact will focus on the accessibility of the course content from the perspective of the faculty and students. This study will adopt an experimental study approach to understand the impact of embedding an accessibility tool to the LMS alongside a focused training for the faculty and students. A survey will be used before and after the training to determine the effect of training on improving accessibility of courses. Interviews with participants will be used to investigate in depth participant's experiences and opinions after the intervention. Moreover, Ally generated reports will be analysed before and after the training as well to measure the impact of Ally and training on improving the accessibility of the courses.

About the Survey

This survey should take 15- 20 minutes and includes 22- 28 questions (based on your responses).

Anonymous Participants Code

The main aim of the participant ID Code is to maintain confidentiality and link surveys from pre- to post is to anonymously.

Please fill in the space:

- First letter of own first name (A–Z)
- First letter of father's first name (A–Z)
- Birth month – "01–12"
- Birth year – "yyyy"

We will be conducting interview after the training workshops. If you are interested, please share your:

Name: **Email:**

*Researcher will contact you

Consent to participate:

I have read and understood the description provided above; I have been provided with an opportunity to ask questions. By completing this questionnaire, you are agreeing to participate.

Participants are welcome to withdraw from the study at any time before or during the survey and up to 2 weeks following survey completion. However, participants need to share "Anonymous Participant Code" with researcher in order to remove their response.

Pre-survey questions Start here:

A. General

Language:

- Arabic
- English

1. College (Might change based on the university):
   - College of Arts and Creative Enterprises:
   - College of Business
   - College of Communication and Media Sciences
   - College of Education
   - College of Humanities and Social Sciences
   - College of Natural and Health Sciences
   - College of Technological Innovation

2. Learning Delivery methods
   - Online
   - Face to Face
   - Mixed

3. How many years have you been teaching in higher education?
   - 0 – 5
   - 5 – 10
   - 10 – 15
   - 15 – 20
   - 20 – 25
   - 25 – 30
   - 30 – < 35

4. What courses are you currently teaching? (drop menus for all courses)
5. How do you approach the accessibility of your digital course materials?
   - I don't think much about or prioritize the accessibility of my course materials.
   - I only think about accessibility when I'm made aware of a student with

disabilities in my course. (if a faculty responds to this option, then they will answer question 2)

- Contact the disability support when I'm made aware of a student with disabilities in my course.
- I consider potential accessibility issues, but don't know where to start.
- I sometimes take steps to make sure my digital materials are more accessible.
- I review my course content often for accessibility issues.

6. How difficult would it be to create accessible course content for students with disabilities? (When the faculty choose the second option in the previous question)

- Extremely difficult.
- Moderately difficult
- Neutral
- Moderately Simple
- Simple

7. How accessible would you consider your digital course materials to be? *
- 1 (Not accessible at all).
- 2
- 3
- 4
- 5 (very accessible)
- I don't know.

8. Have you ever modified or changed your course materials to make them more accessible?

- No, this isn't part of my job.
- No, I don't know how to make materials more accessible.
- Yes, for a student with disability who requested support.
- Yes, to improve the access for all students.

9. Have you ever attended an accessibility workshop or received accessibility training at your institution?
- Never
- Once
- More than once
- I'm not sure.

10. How helpful was the workshop or training? (leave blank if never attended)

- 1 (Not helpful at all)
- 2
- 3
- 4
- 5 (Very helpful)

11. How important do you think accessible digital content is to the learning experiences of all your students?

- 1 (Not important at all).
- 2
- 3
- 4
- 5 (very important)

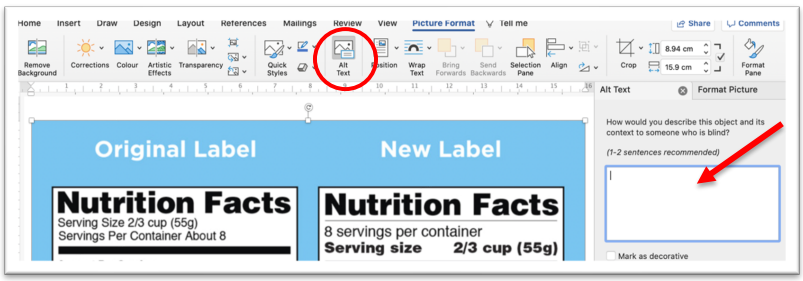
12. Do you feel providing students with different ways of consuming content (like listening to a text or accessing a mobile-friendly version) is important for their learning?

- 1 (Not important at all).
- 2
- 3
- 4
- 5 (very important)

13. How did you learn how to use Ally? (check all that apply)

- I still don't know how to use Ally.
- Playing with it in my course
- Through online help materials
- Through a workshop or training
- Student accessibility Services Department.
- Other

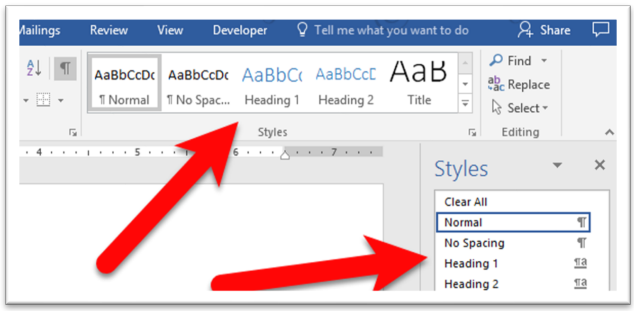
14. Alternative descriptions (alt-text) describe the content of a digital image, which can be read by screen readers. How do you use alt-text in your course?



- I don't know what Alternative description is.

- I don't add alt-text to my images because I don't have any blind students.
- I don't add them to my images because I don't know how.
- I only sometimes add them to my images because it's too much work.
- I always add alt-text to my images.
- I don't use images.

15. Styles and headings are tools to help you organize text in documents. How do you use headings in your documents (PowerPoint, Word Document)?



- I wasn't aware that using headings will improve accessibility.
- I know what headings are, but don't think they are useful.
- I know what headings are, but don't know how to use them.
- I know what headings are and use them in my documents.
- I don't create documents.

16. Tagging PDFs (Accessible PDFs) provide documents structure. How do you use PDFs in your course?

- I haven't heard of tagging a PDF.
- I've heard of tags, but don't know how they work.
- I know what tagging a PDF means, but don't think it's necessary.
- I know what tagging a PDF means, and ensure my PDFs are tagged.
- I don't use PDFs.

We will be conducting interview after the training workshop. If you are interested, please share:

Name **Email:**

*Researcher will contact you

Ally feedback survey for faculty

Post-Survey

A. General

Language:

- Arabic
- English

1. College: (Might change based on the university):
    - College of Arts and Creative Enterprises:
    - College of Business
    - College of Communication and Media Sciences
    - College of Education
    - College of Humanities and Social Sciences
    - College of Natural and Health Sciences
    - College of Technological Innovation

2. Learning Delivery methods
    - Online
    - Face to Face
    - Mixed

3. How many years have you been teaching in higher education?
    - 0 – 5
    - 5 – 10
    - 10 – 15
    - 15 – 20
    - 20 – 25
    - 25 – 30
    - 30 – <35

4. What courses are you currently teaching? (drop menus for all courses)

B. Ally feedback

17. How did you learn how to use Ally? (check all that apply)

- I still don't know how to use Ally.
- Playing with it in my course
- Through online help materials
- Through a workshop or training
- Student accessibility Services Department.
- Other

18. Did Ally change how you approach the accessibility of your digital course materials?
    - yes
    - maybe
    - no
    - no change from previous

19. Have you attended an accessibility workshop or received accessibility training on Ally?
    - Never.
    - Once.
    - More than once.
    - I'm not sure.

20. How helpful was the workshop or training? (leave blank if never attended)
    - 1 (Not helpful at all).
    - 2
    - 3
    - 4
    - 5 (very helpful)

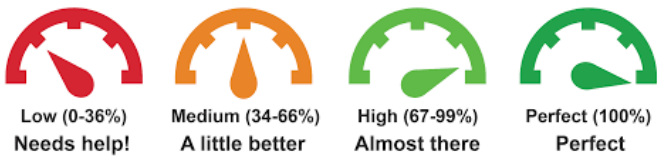
21. How confident do you feel using Ally in your courses?

    - 1 (Not Confident at all).
    - 2
    - 3
    - 4
    - 5 (very Confident)

22. Since implementing Ally, how often do you contact the Disability support Services to request materials for accommodation?

    - Never
    - Sometimes
    - Often
    - Always

23. Have you clicked on a Blackboard Ally "dial" indicator to access more information and to receive guidance in fixing an accessibility concern?



- Yes
- No

24. How frequently did you use the Ally indicators to improve your course material?

- 0 times per week
- 1-2 times per week
- 3-5 times perweek
- 5-7 times per week
- 7+ times per week

25. How did you first respond to seeing the Ally indicators in your course?

- Mostly ignored them.
- Contacted help or support.
- Clicked on the indicator to learn more.
- Clicked on the indicator and started fixing files.
- Other.

26. How many files did you fix for instructors during the Fall 2021 term? (Fix refers to improving the file to a green Ally indicator or near 100% accessibility score)

- 75 or more
- 50 – 75
- 25 – 50
- 5 – 25

- 1 – 5
- 0
- Unsure

27. If you can't figure out how to solve an accessibility issue with the Instructor Feedback, what would you do next?

    - Ignore the issue.
    - Look online for accessibility tutorials.
    - Replace the file with a new one.
    - Contact the Department of Student Accessibility Services for support.
    - I'm always able to fix the issue.

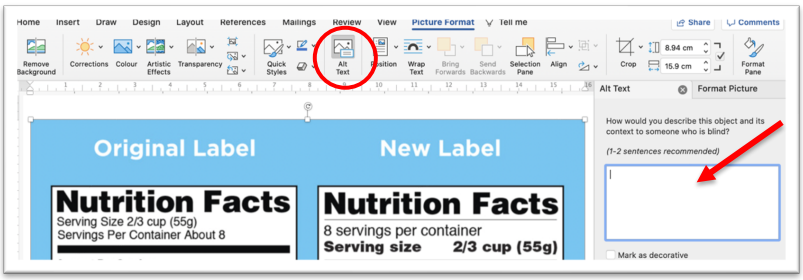
28. How would you rate the Instructor Feedback for fixing accessibility issues?

    - 1 (Not helpful at all)
    - 2
    - 3
    - 4
    - 5 (very helpful)

Accessibility Issues

The 5 items below cover specific accessibility issues. How confident do you feel using Ally to fix these issues? If you've never encountered an issue, leave the survey item blank.

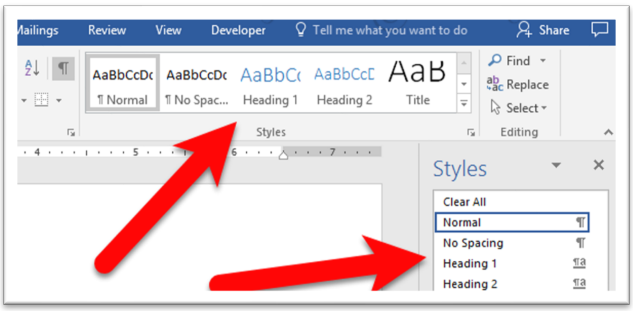
29. Adding descriptions (alt text) to your images:



- Not confident at all

- Very confident

30. Using headings and styles when authoring documents:



- Not confident at all
- Very confident

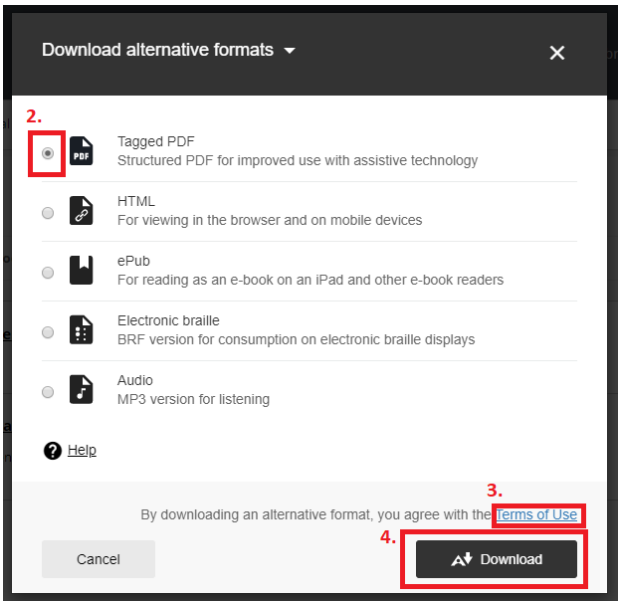
31. Using accessible PowerPoint templates:

- 1 (Not helpful at all).
- 2
- 3
- 4
- 5 (very helpful)

32. Ensure that PDFs are accessibility.

- Not confident at all
- Very confident

33. How useful are Ally's "Alternative Formats" to your students' learning?



- 1 (Not useful at all).
- 2
- 3
- 4
- 5 (very useful)

34. How important do you think accessible digital content is to the learning experiences of all your students?

- 1 (Not important at all).
- 2
- 3
- 4
- 5 (very important)

35. Do you feel providing students with different ways of consuming content (like listening to a text or accessing a mobile-friendly version) is important for their learning?

- 1 (Not important at all).
- 2

- 3
- 4
- 5 (very important)

36. Overall, how would you rate Ally as a solution to help you ensure the accessibility of your course content? (If you have recommendations for improvement of Ally, please include them on the last question of this survey.)

- 1 (poor).
- 2
- 3
- 4
- 5 (excellent)

37. Have you informed your students about how to access Ally's alternative formats such as: ePub, audio only, tagged PDF, electronic braille, and HTML?

- Yes
- No
- I was not aware of this capability.

We will be conducting interview after the training workshops. If you are interested, please share your:

Name: **Email:**

*Researcher will contact you

Students Pre-survey

Pre-survey

Cover Page:

My name is Maisa Sami, and I am a PhD student studying at the Department of Educational Research at Lancaster University. I would like to invite you to take part in a research project: Institutional change for improving Digital access: Accessibility tools alongside training.

Before you decide if you wish to contribute, you should be aware of the reason this research is being conducted and the extent of your involvement. Please take time to read the following information carefully.

What is the study about?

The main purpose of this study is to measure the impact of embedding accessibility tools, such as Ally, and associated training on how to use it, to courses on a digital LMS such as Blackboard. The measures of impact will focus on the accessibility of the course content from the perspective of the faculty and students. This study will adopt an experimental study approach to understand the impact of embedding an accessibility tool to the LMS alongside a focused training for the faculty and students. A survey will be used before and after the training to determine the effect of training on improving accessibility of courses. Interviews with participants will be used to investigate in depth participant's experiences and opinions after the intervention. Moreover, Ally generated reports will be analysed before and after the training as well to measure the impact of Ally and training on improving the accessibility of the courses.

About the Survey

This survey should take 10-15 minutes and includes 22- 28 questions (based on your responses).

Anonymous Participants Code

The main aim of the participant ID Code is to maintain confidentiality and link surveys from pre- to post is to anonymously.

Please fill in the space:

- First letter of own first name (A–Z)
- First letter of father’s first name (A–Z)
- Birth month – “01–12”
- Birth year – “yyyy”

We will be conducting interview after the training workshops. If you are interested, please share your:

Name: **Email:**

*Researcher will contact you

Consent to participate:

I have read and understood the description provided above; I have been provided with an opportunity to ask questions. By completing this questionnaire, you are agreeing to participate.

Participants are welcome to withdraw from the study at any time before or during the survey and up to 2 weeks following survey completion. However, participants need to share “Anonymous Participant Code” with researcher in order to remove their response.

Introduction:

1. What year are you?
    - 1st year undergrad student
    - 2nd year undergrad student
    - 3rd year undergrad student
    - 4th year (or more) undergrad student
    - Graduate student
2. What degree do you plan to complete at this institution?
    - Bachelor’s degree.
    - Master’s degree
    - Doctoral degree

- Other: (Please specify)

3. What is your current student status?

   - Full- time undergraduate student.
   - Full- time graduate student
   - Part- time undergraduate student.
   - Part- time graduate student.
   - Other: (Please specify)

4. In which academic college is your major at? (Drop down menu)
5. Do you have a child or children under age 18 for whom you are a primary caretaker?

   - Yes
   - No

6. Are you employed?

   - Yes, more than 40 hours each week
   - Yes, 20 to 11 hours each week
   - Yes, 10 hours or less each week
   - No

7. Is English your native language?
   - Yes
   - No

8. Do you have a disability or learning difficulty that may affect your learning?

   - Yes (Q9)
   - No

9. If you self-identified as a person with a disability(ies), which of the following apply? (check all that apply) [OPTIONAL question]

   - Prefer not to state
   - Physical
   - Deaf or hard of hearing (difficulty hearing even with hearing aid)
   - Blind or low vision (difficulty seeing even with eyeglasses)
   - Speech/communication
   - Neurodivergent (e.g. autism spectrum, dyslexia)
   - Cognitive (e.g. difficulties with memory or learning)
   - Psychosocial/mental health (e.g. chronic depression, bipolar)
   - Other

10. Learning Delivery methods:

    - Online
    - Face to Face
    - Mixed

11. How often do you access your course materials using a desktop or laptop? Linear scale

    Never 1 – 5 all the time.

12. How often do you access your course materials using a mobile device? Linear scale

    Never 1 – 5 all the time.

13. How often do you access your course materials using a mobile device? Linear scale

    Never 1 – 5 all the time.

14. How well do your course materials work with your preferred device(s)? Linear scale

    Not well at all 1- 5 Extremely well.

15. Do you feel you learn better when you can easily annotate and highlight your digital course readings? Linear scale

    No, not at all 1- 5 Yes, very much

16. Do you feel you learn better when you can both read and listen to course materials? Linear scale

    No, not at all 1- 5 Yes, very much

17. What are the main barriers you faced to access course materials directly from the LMS? (You can choose more than option)

    - Incompatible with screen readers

- Incompatible with speech to text tools
- Small text.
- The font style is difficult to read.
- Images are not accessible.
- Bad quality for the scanned document.
- Videos that are not captioned
- Other (Please specify):

18. What type of file do you found not accessible the most? (You can choose more than option)

- PowerPoint.
- PDF.
- Word Document.
- Excel file.
- Video
- Other (Please specify):

19. Which courses do you find that their materials are not accessible the most:

- Arabic Course.
- English Course.
- Math Course.
- Science Course.
- laboratory Course

20. What is/are the impact of not getting accessible course materials directly & immediately from the Blackboard? (You can choose more than option)

- Reduce your participation in class.
- Reduce your collaboration with your group.
- Reduce your productivity.
- Affect your grades
- Affect your self-confidence.
- Affect assignment submission data.
- Other

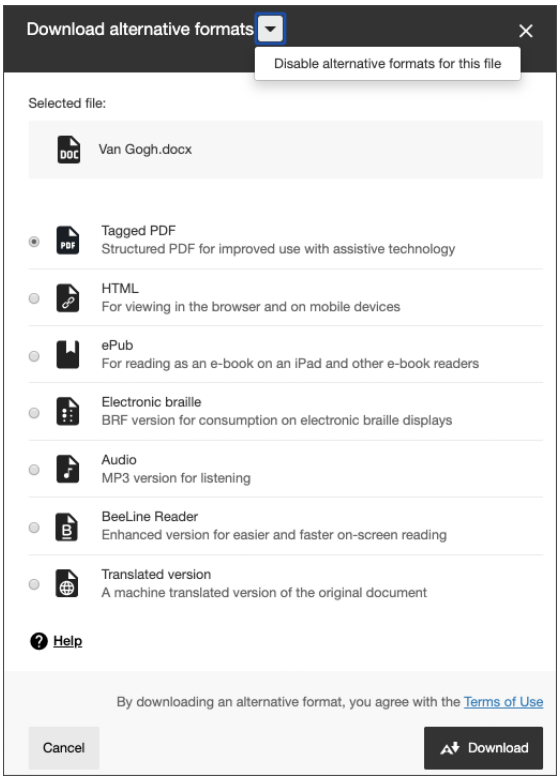
21. How often do you ask for course materials accommodation from disability support services? leave blank if you've never asked

- Very often
- Regularly
- Whenever required
- Seldom
- Never

22. What are the alternative formats you request? leave blank if you've never asked

- Accessible Word document.
- Printed Braille.
- Enlarged document.
- Tactile resources.
- Audio.
- Accessible PDF
- Other (Please specify):

23. How did you learn about downloading alternative formats of your course files?



- Instructor syllabus
- Instructor announcement
- Campus announcement
- Campus event
- Peer
- Training
- Never heard about alternative formats (Stop survey here)
- Other

24. How often do you download alternative formats of your course files?

- Never (Stop survey here)
- Once
- Several times
- Whenever they're available.

25. What alternative format do you download the most?
- None
- Tagged PDF
- HTML
- ePub
- Electronic Braille
- Audio MP3

26. Do you download formats based on the device you're using? Linear scale

No, never 10 5 Yes, all the time.

27. Did your instructor encourage your class to use the alternative formats? Linear scale

No, not at all 1- Yes, very much

28. How is the quality of the alternative formats you've downloaded? (Leave blank if you've never downloaded)

Very low quality 1- 5 very high quality

We will be conducting interview after the training workshop. If you are interested, please share:

Name **Email:**

Ally feedback survey for students – Post-Survey

Cover Page:

My name is Maisa Sami, and I am a PhD student studying at the Department of Educational Research at Lancaster University. I would like to invite you to take part in a research project: Institutional change for improving Digital access: Accessibility tools alongside training.
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About the Survey

This survey should take 10-15 minutes and includes 22- 28 questions (based on your responses).

Anonymous Participant Code

The main aim of the participant ID Code is to maintain confidentiality and link surveys from pre- to post is to anonymously.

Please fill in the space:

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- First letter of father's first name (A–Z)
- Birth month – "01–12"
- Birth year – "yyyy"

We will be conducting interview after the training workshops. If you are interested, please share your:

Name: **Email:**

*Researcher will contact you

Consent to participate:

I have read and understood the description provided above; I have been provided with an opportunity to ask questions. By completing this questionnaire, you are agreeing to participate.

Participants are welcome to withdraw from the study at any time before or during the survey and up to 2 weeks following survey completion. However, participants need to share “Anonymous Participant Code” with researcher in order to remove their response.

Introduction:

1. What year are you?

    - 1st year undergrad student
    - 2nd year undergrad student
    - 3rd year undergrad student
    - 4th year (or more) undergrad student
    - Graduate student

2. What degree do you plan to complete at this institution?

    - Bachelor’s degree.
    - Master’s degree
    - Doctoral degree
    - Other: (Please specify)

3. What is your current student status?

    - Full- time undergraduate student.
    - Full- time graduate student
    - Part- time undergraduate student.
    - Part- time graduate student.
    - Other: (Please specify)

4. In which academic college is your major at?
5. Do you have a child or children under age 18 for whom you are a primary caretaker?

    - Yes
    - No

6. Are you employed?

    - Yes, more than 40 hours each week
    - Yes, 20 to 11 hours each week
    - Yes, 10 hours or less each week
    - No

7. Is English your native language?
   - ○ Yes
   - ○ No

8. Do you have a disability or learning difficulty that may affect your learning?

   - o Yes (Q9)
   - o No

9. If you self-identified as a person with a disability(ies), which of the following apply? (check all that apply) [OPTIONAL question]

- o Prefer not to state
- o Physical
- o Deaf or hard of hearing (difficulty hearing even with hearing aid)
- o Blind or low vision (difficulty seeing even with eyeglasses)
- o Speech/communication
- o Neurodivergent (e.g. autism spectrum, dyslexia)
- o Cognitive (e.g. difficulties with memory or learning)
- o Psychosocial/mental health (e.g. chronic depression, bipolar)
- o Other

10. Learning Delivery methods:

    - o Online
    - o Face to Face
    - o Mixed

11. Have you used the alternative format available through Ally Software?
    a. Yes
    b. No

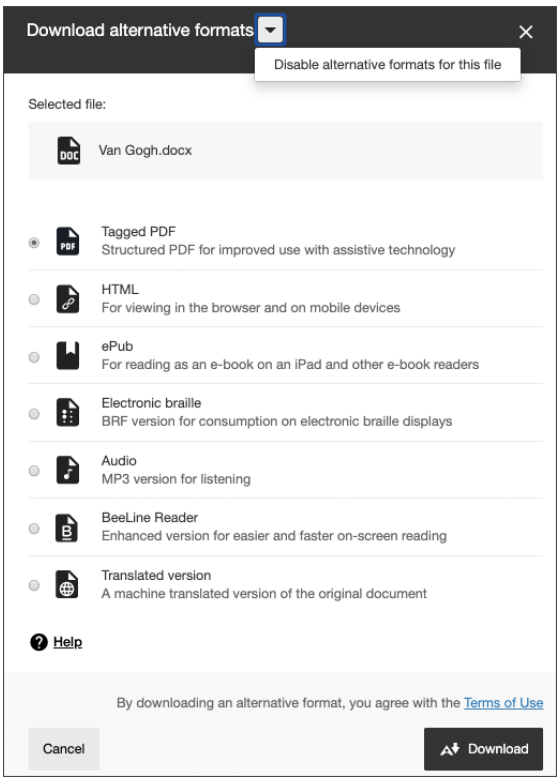
    If yes answer question 4.

    If No answer question 3. (Survey will end)

12. Why did you not use the alternative format available through Ally Software?

    - o Need training.
    - o The alternative format is not accessible.
    - o I need another type of alternative format. (example).
    - o Other

13. How did you learn about downloading alternative formats of your course files?



- Instructor syllabus
- Instructor announcement
- Campus announcement
- Campus event
- Peer
- Training
- Other

14. How often do you download alternative formats of your course files? *

- Very often
- Regularly
- Whenever required
- Seldom
- Never

15. How do you rate the accessibility of the alternative format offered to you using Ally software?

- Very satisfied
- Satisfied
- Neutral
- Unsatisfied
- Very unsatisfied

16. What are the most alternative formats you used?

    - Tagged PDF
    - HTML
    - Audio
    - ePub
    - Electronic Braille
    - BeeLine Reader
    - Translated Version

17. Which course did you find more accessible using the alternative format offered through Ally?

    - Arabic Course.
    - English Course.
    - Math Course.
    - Science Course.
    - laboratory Course.

18. Which courses did you find that their materials are not accessible **despite** the availability of Ally?

    - Arabic Course.
    - English Course.
    - Math Course.
    - Science Course.
    - laboratory Course.

19. What is the impact of getting accessible course materials directly from the Blackboard through Ally software?

    - Increase your participation in class.
    - Increase your collaboration with your group.
    - Increase your productivity.
    - Improve your grades
    - Improve your self-confidence.
    - Meet submission deadline.
    - Other (Please specify):

20. Do you download formats based on the device you're using? Linear scale

No, never 10 5 Yes, all the time.

21. Did your instructor encourage your class to use the alternative formats? Linear scale

No, not at all 1- Yes, very much.

22. How is the quality of the alternative formats you've downloaded? (Leave blank if you've never downloaded)

Very low quality 1- 5 very high quality

23. How often do you ask for course materials accommodation from disability support despite the availability of Ally? leave blank if you've never asked- OPTIONAL question.

- Very often
- Regularly
- Whenever required.
- Seldom
- Never

24. What are the alternative formats you request from support despite the availability of Ally? leave blank if you've never asked?

- Accessible Word document.
- Printed Braille.
- English Braille
- Arabic Braille
- Enlarged document.
- Tactile resources.
- Audio.
- Accessible PDF for Arabic file.
- Accessible PDF for English file.
- Other (Please specify):

We will be conducting interview after the training workshops. If you are interested, please share your:

Name: **Email:**

Appendix Three

Faculty Interview:

Questions

1. From your personal experience, what challenges do students face when accessing course materials?
2. What challenges do you face when trying to provide accessible course materials?
3. In your experience, what resources, tools, are most effective to promote better awareness of available supporting material and facilitate appropriate accessible materials?
4. In your experience what policies, producers are most effective to promote better awareness of available supporting material and facilitate appropriate accommodations?
5. What was your experience using Ally and Microsoft accessibility tools?
6. Have you attended the accessibility workshop? How many sessions did you attend? How do you feel about these sessions in terms support faculty creating accessible content?
7. Which alternative format do you think was downloaded the most by students? Why?
8. Ally may generate extra awareness and requests from teaching staff about accessibility. How do you feel about this?
9. What is the most common accessibility requests you asked disability support? (Before and after embedding Ally).
10. Do students perform better when accessible courses are provided by Blackboard Ally feedback? How do you know? What did you notice?
11. Overall, how would you rate Ally/ accessibility tools as a solution to help you ensure the accessibility of your course content? Last question.

Student focus group:

Moderator Introduction and Purpose of focus Group

Hello. My name is **Maisa Obeid**. I'd like to start off by thanking each of you for taking time to participate today. We'll be here for about 45- 60 minutes.

The reason we're here today is to gather your opinions and experience after the accessibility intervention to improve access for course content for all students using accessibility tools and training for you and your faculty.

I'm going to lead our discussion today. I will be asking you questions and then encouraging and moderating our discussion.

I also would like you to know this focus group will be tape recorded. The identities of all participants will remain confidential. Once we finish the session, the recording will be transcribed, and that data will be protected on encrypted devices and kept secure. Participants are welcome to withdraw from the study at at any time before or during the survey and up to 2 weeks following to the focus group session.

Ground rules

To allow our conversation to flow more freely, I'd like to go over some ground rules.

1. Only one person speaks at a time. This is doubly important as our goal is to make an written transcript of our conversation today. It is difficult to capture everyone's experience and perspective on our audio recording if there are multiple voices at once
2. Please avoid side conversations.

3. Everyone doesn't have to answer every single question, but I'd like to hear from each of you today as the discussion progresses.
4. This is a confidential discussion in that I will not report your names or who said what to your colleagues or supervisors. Names of participants will not even be included in the final report about this meeting. It also means, except for the report that will be written, what is said in this room stays in this room.
5. We stress confidentiality because we want an open discussion. We want all of you to feel free to comment on each other's remarks without fear your comments will be repeated later and possibly taken out of context.
6. There are no "wrong answers," just different opinions. Say what is true for you, even if you're the only one who feels that way. Don't let the group sway you. But if you do change your mind, let me know.
7. Let me know if you need a break.
8. Are there any questions?"

Introduction of participants

Before we start, I'd like to know a little about each of you. Please tell me:

1. Your name
2. What year are you?
3. What degree do you plan to complete at this institution?

Focus Group Questions (40 minutes)

1. What challenges do you face when accessing course materials from your experience?
2. Which courses did you find had the most accessible/inaccessible material? Why?
3. What are the alternative formats you request from responsible department of creating accessible materials before and after the intervention if you have these services available at your university? Why?
4. Why did you not use the alternative format available through Ally Software before the training session?
5. What are the most alternative formats you used? Why?
6. Ally may generate extra awareness and requests from teaching staff about accessibility. How do you feel about this?
7. What are the most common accessibility requests you asked from disability support center, if you are eligible for their services? (Before and after the intervention). OPTIONAL question
8. Did you perform better when accessible courses provided by alternative format?
9. Overall, how would you rate your experience accessing alternative format for you course content?

Closing (2 minutes)

Thanks for coming today and talking about these issues. Your comments have given us lots of different ways to see this issue. I thank you for your time.

Statement:

Document retrieved from the Partnerships in Dementia Care (PiDC) Alliance Culture Change Toolkit (**www.uwaterloo.ca/partnerships-in-dementia-care**) and modified based on the context of this research expect Ground rules which the researcher didn't do any change.

Appendix Four

Source:

https://help.blackboard.com/Ally/Ally_for_LMS/Administrator/Institution_Report/Overview

Ally Institution Report

The overview shows you how digital course content at your institution is performing by month, term, or academic year. It shows you the overall accessibility score, the total number of courses and content created, as well as accessibility issues found. Use the period type menu to view the report by month, term or academic year. Export the report for more details. Deleted courses appear in the month and academic reports only and are marked as deleted. Deleted courses don't appear in the term report.

Accessibility score

This line graph shows the accessibility score for all LMS course content over a select period. Select By month to compare over many months, by term to compare terms, or By academic year.

- **Month accessibility score:** The average of the accessibility scores of all content items that were added during that month.
- **Term accessibility score:** The average of the accessibility scores of all content items that live in courses associated to that term.
- **Only terms with associated courses** and content show in the report. Terms that don't have any courses or content are hidden from the report. This includes deleted courses. Deleted courses aren't in the term report or contribute to the term's accessibility score.
- **Academic year accessibility score:** The average of the accessibility scores of all content items that were added during that academic year.

The higher the score the better your content is performing. Point to a period on the line graph to see the scores in percentage %. You can also check or uncheck the boxes WYSIWYG, Files or Overall to compare specific data in any specific period.

- **WYSIWYG:** The average score for (HTML) content created through the Learning Management System (LMS) content editor.
- **Files:** The average score for uploaded file content. For example, PDFs, Word documents, PowerPoint presentations, images, and so on.
- **Overall:** The average combined accessibility score for both files and WYSIWYG content.

With your keyboard, press Tab to navigate through each period on the graph. Press Spacebar to select it.

Total courses and content created

View the total number of new and updated content items in the Total content created report. View the number of courses with new and updated content items in the Total courses report. Each report compares the current period to the period before.In the Total content created report, color represents different content types. Point to a content type to see the total number created and an accessibility score for that type. Screen reader users can press Tab to move through the hidden Total content created table. Select a new period from the Accessibility score line graph or current period menu to view a different period.

Overall accessibility score

View the accessibility score for the selected period. See how your content performs and if the overall score has gone up or down compared to the previous period. Select a new period from the Accessibility score line graph or current period menu to view a different period.

Accessibility Issues

See a list of accessibility issues found in the selected period. Select a new period from the Accessibility score line graph or current period menu to view a different period. Issues are listed in order of priority from severe to minor. Those at the top of  the list should be addressed first. Ally looks at the number of students impacted, how often the issue occurs, and the accessibility score to determine the priority. Select Severe, Major, or Minor to sort the issues by severity.

Severe. These issues are the greatest risk to accessibility and require the most attention.

 **Major.** These issues impact accessibility, and while not severe, require attention.

 **Minor.** These issues should be considered for a better accessibility score.

At-a-glance you can determine basic information for each issue.

- Content type and accessibility issue
- Severity
- Total number of content with the issue
- Select an issue to see a full description of the issue and the courses impacted.

From the Courses with this accessibility issue table, you see the course ID and name, the number of students enrolled and impacted by the issue, the number of items in the course with the issue, and the accessibility score. Select Back to overview to return to the Ally institution report overview. Select the report period menu to compare courses with this issue in a different period. Select a course to see the course items with this issue.

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Ally Usage Report

Source:

https://help.blackboard.com/Ally/Ally_for_LMS/Administrator/Ally_Institution_Report/Usage

The Usage reports shows details about how your students and instructors are using Ally. Find out how often students download an alternative format and instructors fix accessibility issues.

The report is a spreadsheet that is split into five worksheets.

1. Alternative Format Launches
2. Alternative Format Weekly
3. Instructor Feedback Launches
4. Instructor Feedback Weekly
5. Data

Instructor Feedback Launches

The Instructor Feedback Launches worksheet shows instructor feedback engagement and distribution over a certain date range.

Engagement with Instructor Feedback

The worksheet starts with details on how many times the Instructor Feedback panel was opened and how often instructors fixed an accessibility issue as a result. A conversion rate shows the percentage of fixes out of the total number of times the panel was opened.

Data

The Data worksheet shows specific details for each time a panel was opened, a format was downloaded, and an accessibility issue was fixed.

- ID: The unique ID for the row/event.
- Course ID: The course ID.
- Course Code: The course code.
- Course Name: The course name.
- Term ID: The term ID.
- Term Name: The term name.
- Content ID: The content ID.
- Event: Describes the action. For example, if someone opened the Alternative formats or Instructor Feedback panel.
- AFLaunch: Shows if someone opened the Alternative format panel or not. 1 means the panel opened. 0 means the panel stayed closed.
- Download: Shows if someone downloaded an alternative format. 1 means one or more formats downloaded. 0 means no format downloaded.
- IFLaunch: Shows if someone opened the Instructor Feedback panel or not. 1 means the panel opened. 0 means the panel stayed closed.
- Fix: Shows if someone fixed an accessibility issue from the Instructor Feedback panel. 1 means one or more issues were fixed. 0 means nothing was fixed.
- Timestamp: Shows when the event occurred. The timestamp is in the number of seconds since January 1, 1970.
- Client: The client ID.
- File Type: Identifies the file type in the event. For example, image or presentation.
- Format Type: Identifies the alternative format downloaded. Format Type is blank when Download is 0.

  Tts represents the audio format.

- Score Before: The accessibility score for the course before improvements to the content. Score Before is blank when Fix is 0.
- Score After: The accessibility score for the course after improvements to the content. Score After is blank when Fix is 0.
- Improved: Shows if the accessibility score improved after the file was fixed. 1 means the score improved. 0 means the score didn't improve. Improved is blank when Fix is 0.
- Week: Shows the first day of the week the event occurred. The week is in the number of days, to the start of the week, since December 30, 1899.
- AF: Shows activity with the Alternative Format panel. 1 means there was activity. The panel may have opened or a format downloaded. 0 means there was no activity.

- IF: Shows activity with the Instructor Feedback panel. 1 means there was activity. The panel may have opened or an issues fixed. 0 means there was no activity.

Appendix Five

CONSENT FORM

Project Title: Institutional change for improving Digital access: Accessibility tools alongside training

Name of Researchers: Maisa Sami Nimer Obeid Email: m.obeid1@lancaster.ac

Please tick each box

1. I confirm that I have read and understand the information sheet for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily	☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time during my participation in this study within 2 weeks for the interview and focused group after I took part in the study, without giving any reason. If I withdraw within 2 weeks of taking part in the study, my data will be removed. If I am involved in survey, I am free to withdraw at any time during my participation in this study and within 2 weeks for survey completion. And I will "participant ID codes with the researcher to delete my responses, my data will be removed.	☐
3. If I am participating in the focus group, I understand that any information disclosed within the focus group remains confidential to the group, and I will not discuss the focus group with or in front of anyone who was not involved unless I have the relevant person's express permission	☐
4. I understand that any information given by me may be used in future reports, academic articles, publications or presentations by the researcher, but my personal information will not be included, and all reasonable steps will be taken to protect the anonymity of the participants involved in this project.	☐
5. I understand that my name will not appear in any reports, articles or presentation without my consent.	☐
6. I understand that any interviews will be audio-recorded and transcribed, and that data will be protected on encrypted devices and kept secure.	☐
7. I understand that data will be kept according to university guidelines for a minimum of 10 years after the end of the study.	☐
8. I agree to take part in the above study.	☐

_____ _____ _____

Name of Participant Date Signature

I confirm that the participant was given an opportunity to ask questions about the study, and all the questions asked by the participant have been answered correctly and to the best of my ability. I confirm that the individual has not been coerced into giving consent, and the consent has been given freely and voluntarily.

Signature of Researcher /person taking the consent_____ **Date** _____ Day/month/year

One copy of this form will be given to the participant and the original kept in the files of the researcher at Lancaster University

Lancaster University

Participant information sheet

Title: Institutional change for improving Digital access: Accessibility tools alongside training

I am PhD student (Maisa Sami Obeid) at Lancaster University, and I would like to invite you to take part in a research study about: Institutional change for improving Digital accessibility access: Accessibility tools alongside training.

Please take time to read the following information carefully before you decide whether or not you wish to take part.

What is the study about?

The main purpose of this study is to measure the impact of embedding accessibility tools, such as Ally, and the associated training on how to use it, to courses on a digital LMS such as Blackboard. The study will focus on measuring the impact of accessibility of the course content from the perspective of the faculty and students. An experimental study approach will be adopted where a survey will be used before and after the training to determine the effect of the training on improving the accessibility of courses. Interviews with participants will be used to investigate the participant's experiences and opinions after the intervention. Moreover, Ally generated reports will be analysed before and after the training to measure the impact of Ally and training on improving the accessibility of the courses.

Why have I been invited?

I have approached you because you are student/ faculty at [name] university, and I currently doing my PhD thesis concerning the impact of accessibility tools and training for faculty and

students on improving digital access for all students. I would be very grateful if you would agree to take part in this study.

What will I be asked to do if I take part

If you decided to take part, this would involve the following:

1. Per& Post survey: This survey should take between 15-25 minutes based on your responses and if you are student or faculty).
   The first survey will take place before the intervention, and the main aim is to measure your awareness about course content accessibility from the perspective of the students and faculty.
   The post survey will be after the training session to measure the impact of training, and use of accessibility tool.
2. Training sessions: The number of training sessions will be determined based on the needs of your institution. For faculty members, the estimated training session will be 2-4 sessions and for students 1-2 sessions.
3. Optional interview for faculty and focused group for students after the post survey and training sessions. The main aim of the Interviews and focused group is to investigate in-depth your experiences and opinions after the intervention

What are the possible benefits from taking part?

All participants will get free training workshops during the study. These training sessions will support faculty to create accessible course content using the best practices. The students can increase their awareness about ALLY tool that is available at the university and how they can choose the alternative format based on your needs. Moreover, participating in this research will increase the participant's awareness about the digital accessibility which will positively impact the digital access which will reflect into better access to course content and provide equal access to all students, at least for the digital content.

Do I have to take part?

No. It's completely up to you to decide whether you take part. Your participation is voluntary. For students, if you decide not to take part in this study, this will not affect your studies and the way you are assessed in your course.

What if I change my mind?

If you change your mind, you are free to withdraw at any time during your participation in this study and within 2 weeks for the interview and focused group, without giving any reason. Consequently, your data will be removed. If you were involved in the survey, you are free to withdraw at any time during your participation in this study and within 2 weeks for survey completion. You need to share "participant ID codes with the researcher to delete your responses.

What are the possible disadvantages and risks of taking part?

It is unlikely that there will be any major disadvantages to taking part. Taking part in this study will mean investing 30- 45 minutes from your time for the pre & post survey and 50 minutes if you are participating in the interview or focus group. Faculty will not be assessed or judged based on the accessibility score of their courses and students with disability will still be eligible to receive services from disability/ accessibility centre.

Will my data be identifiable?

For the survey, all participants will generate their own Anonymous Participant Code for pre& post survey. After the interview and focus group, only I, the researcher conducting this study, will have access to the ideas you share with me. Additionally, interview and focus group, all data will be de-identified after data collection immediately.

Participants in the focus group will be asked not to disclose information outside of the focus group and with anyone not involved in the focus group without the relevant person's expressed permission.

How will we use the information you have shared with us and what will happen to the results of the research study?

I will use the information you have shared with me only in the following ways:

I will use it for research purposes only. This will include my PhD thesis, report for ZU higher management and publications in journal articles. I may also present the results of my study at academic conferences or maybe you will attend practitioner conferences or inform policymakers about your study.

When writing up the findings from this study, I would like to reproduce some of the views and ideas you shared with me. I will only use anonymised quotes (e.g. from my interview with you).

Although I will use your exact words, all reasonable steps will be taken to protect your anonymity in our publications.

How my data will be stored

Your data will be stored in encrypted files (that is no-one other than me, the researcher will be able to access them) and on password-protected computers. In accordance with University guidelines, I will keep the data securely for a minimum of ten years.

What if I have a question or concern?
If you have any queries or if you are unhappy with anything that happens concerning your participation in the study, please contact myself:

Researcher Name: Maisa Obeid
Researcher's Email Address1: m.obeid1@lancaster.ac.uk
Researcher's Email Address2: maisa.obeid@zu.ac.ae
Researcher's phone number: 00971501045999

Supervisor Name: Dr. Sue Cranmer

Supervisor's Email Address: s.cranmer@lancaster.ac.uk

If you have any concerns or complaints that you wish to discuss with a person who is not directly involved in the research, you can also contact:

Director of Studies, E-Research and Technology Enhanced Learning (thesis and coursework)

Professor Don Passey

d.passey@lancaster.ac.uk

Sources of support

This study has been reviewed and approved by the Faculty of Arts and Social Sciences and Lancaster Management School's Research Ethics Committee.

Thank you for considering your participation in this project.

Lancaster University

Letter of Invitation to Participate in Research

Institutional change for improving Digital access: Accessibility tools alongside training

Date: _____

Dear_____

We invite you to participate in a research study conducted by Maisa Obeid, students in the Lancaster University- Department of Educational Research- Doctoral Programme in E-Research and Technology Enhanced Learning.

The main purpose of this study is to measure the impact of embedding accessibility tools, such as Ally, and associated training on how to use it, to courses on a digital LMS such as Blackboard. The measures of impact will focus on the accessibility of the course content from the perspective of the faculty and students. This study will adopt an experimental study approach to understand the impact of embedding an accessibility tool to the LMS alongside a focused training for the faculty and students. We will ask you to complete per-survey, which should take approximately 15- 30 minutes. Then after that, you will be able to attend 2- 4 tailored accessibility training sessions. After the training, you will be invited to complete a post survey to measure the impact of these training session. Your responses will be anonymous and confidential.

Your participation in this study is completely voluntary. If you choose to participate or have any questions, please contact the researcher, Maisa Obeid- m.obeid1@lancaster.ac.uk

Phone number: 00971501045999.

Sincerely,

Maisa Obied

Appendix Six

Pre-Survey T University

Pre-Survey T University					
Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Learning Delivery methods	37.73	73.645	-.293	.707	.648
How many years have you been teaching in higher education?	36.73	55.245	.462	.897	.559
What courses are you currently teaching?	37.08	56.874	.406	.843	.572

How do you approach the accessibility of your digital course materials?	36.46	55.938	.372	.670	.578
How difficult would it be to create accessible course content for students with disabilities?	36.85	70.215	.005	.783	.630
How accessible would you consider your dig3al course materials to be?	38.50	62.500	.143	.507	.632
Have you ever modified or changed your course materials to make them more accessible?	36.81	65.762	.198	.656	.612
Have you attended an accessibility workshop or received accessibility training on Ally?	39.00	69.120	.036	.615	.631
How helpful was the workshop or training? (leave blank if 0 attended)	37.62	55.766	.337	.588	.588
How important do you think accessible digital content is to the learning experiences of all your students?	35.73	67.805	.212	.634	.613

Do you feel providing students with different ways of consuming content (like listening to a text or accessing a mobile-friendly version) is important for their learning?	35.62	69.286	.073	.775	.624
Alternative descriptions (alt-text) describe the content of a dig3al image, which can be read by screen readers. How do you use alt-text in your course?	37.42	53.774	.551	.887	.540
Using headings and styles when authoring documents:	37.15	61.895	.356	.696	.588
Tagging PDFs (Accessible PDFs) provide documents structure. How do you use PDFs in your course?	37.81	63.202	.290	.810	.598

Post-Survey T University

Post-Survey T University					
Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Learning Delivery methods	58.100	117.817	-.008	.706	.711
How many years have you been teaching in higher education?	56.967	108.930	.171	.878	.709
What courses are you currently teaching?	57.467	112.809	.043	.887	.726
Did Ally change how you approach the accessibility of your digital course materials?	57.467	120.257	-.192	.930	.718
Have you attended an accessibility workshop or received accessibility training on Ally?	59.267	118.202	-.041	.960	.713

How helpful was the workshop or training? (leave blank if 0 attended)	56.800	108.441	.204	.928	.704
How confident do you feel using Ally in your courses?	56.667	105.678	.493	.944	.681
Since implementing Ally, how often do you contact the Disability support Services to request materials for accommodation?	58.600	112.869	.046	.869	.725
Have you clicked on a Blackboard Ally "dial" indicator to access more information and to receive guidance in fixing an accessibility concern?	58.833	116.213	.147	.831	.706
How frequently did you use the Ally indicators to improve your course material?	59.633	108.033	.527	.908	.684
How did you first respond to seeing the Ally indicators in your course?	57.767	114.185	.063	.744	.715

How many files did you fix for instructors during the Fall 2021 term? (Fix refers to improving the file to a green Ally indicator or near 100% accessibil3y score)	58.900	108.438	.172	.867	.710
If you can't figure out how to solve an accessibility issue with the Instructor Feedback, what would you do next?	57.833	113.316	.174	.784	.704
How would you rate the Instructor Feedback for fixing accessibility issues?	56.767	105.771	.592	.826	.678
Adding descriptions (alt text) to your images:	57.800	97.338	.480	.842	.672
Using headings and styles when authoring documents:	57.233	100.806	.373	.745	.686
Using accessible PowerPoint templates	57.033	98.861	.484	.906	.673
Ensure that PDFs are accessibility	56.933	99.651	.543	.929	.669

How useful are Ally's "AFs" to your students' learning?	56.700	111.872	.284	.885	.697
How important do you think accessible digital content is to the learning experiences of all your students?	56.167	106.764	.575	.958	.680
Do you feel providing students with different ways of consuming content (like listening to a text or accessing a mobile-friendly version) is important for their learning?	56.000	108.897	.441	.919	.688
Overall, how would you rate Ally as a solution to help you ensure the accessibility of your course content? (If you have recommendations for improvement of Ally, please include them on the last question of this	56.667	104.506	.612	.927	.675

Pre-Survey S University

Pre-Survey S University					
Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
How many years have you been teaching in higher education?	31.095	53.590	-.146	.774	.608
What courses are you currently teaching?	29.000	49.000	-.014	.804	.635
How do you approach the accessibility of your digital course materials?	30.524	41.662	.428	.708	.514
How difficult would it be to create accessible course content for students with disabilities?	29.524	61.262	-.587	.827	.677

How accessible would you consider your dig3al course materials to be?	31.190	36.562	.609	.714	.455
Have you ever modified or changed your course materials to make them more accessible?	30.619	46.648	.295	.444	.551
Have you attended an accessibility workshop or received accessibility training on Ally?	32.000	45.400	.375	.801	.537
How helpful was the workshop or training? (leave blank if 0 attended)	30.429	35.257	.486	.825	.482
How important do you think accessible digital content is to the learning experiences of all your students?	28.476	48.762	.239	.833	.563
Do you feel providing students w3h different ways of consuming	28.238	49.290	.164	.632	.572

content (like listening to a text or accessing a mobile-friendly version) is important for their learning?					
Tagging PDFs (Accessible PDFs) provide documents structure. How do you use PDFs in your course?	30.857	42.129	.577	.784	.496
Alternative descriptions (alt-text) describe the content of a dig3al image, which can be read by screen readers. How do you use alt-text in your course?	30.667	42.633	.624	.626	.496
Using headings and styles when authoring documents:	29.952	49.848	.060	.653	.592

Post-Survey S University

Post-Survey S University					
Item-Total Statistics					
	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Learning Delivery methods	59.900	119.748	-.008	.	.698
How many years have you been teaching in higher education?	58.767	110.116	.191	.	.693
What courses are you currently teaching?	59.267	115.375	.027	.	.714
Did Ally change how you approach the accessibility of your digital course materials?	59.267	122.340	-.201	.	.705

Have you attended an accessibility workshop or received accessibility training on Ally?	61.067	119.926	-.027	.	.699
How helpful was the workshop or training? (leave blank if 0 attended)	58.600	110.041	.212	.	.690
How confident do you feel using Ally in your courses?	58.467	107.499	.494	.	.667
Since implementing Ally, how often do you contact the Disability support Services to request materials for accommodation?	60.400	114.317	.058	.	.709
Have you clicked on a Blackboard Ally "dial" indicator to access more information and to receive guidance in fixing an accessibility concern?	60.633	118.033	.156	.	.692

How frequently did you use the Ally indicators to improve your course material?	61.433	109.702	.537	.	.670
How did you first respond to seeing the Ally indicators in your course?	59.567	115.909	.069	.	.701
How many files did you fix for instructors during the Fall 2021 term? (Fix refers to improving the file to a green Ally indicator or near 100% accessibil3y score)	60.700	109.941	.182	.	.694
If you can't figure out how to solve an accessibility issue with the Instructor Feedback, what would you do next?	59.633	115.137	.178	.	.690
How would you rate the Instructor Feedback for fixing accessibility issues?	58.567	107.702	.586	.	.665
Adding descriptions (alt text) to your images:	59.600	99.145	.479	.	.658

Using headings and styles when authoring documents:	59.033	102.861	.366	.	.673
Using accessible PowerPoint templates	58.833	100.764	.481	.	.659
Ensure that PDFs are accessibility	58.733	101.513	.540	.	.656
How useful are Ally's "AFs" to your students' learning?	58.500	113.914	.275	.	.684
How important do you think accessible digital content is to the learning experiences of all your students?	57.967	108.654	.572	.	.667
Do you feel providing students with different ways of consuming content (like listening to a text or accessing a mobile-friendly version) is important for their learning?	57.800	111.269	.413	.	.676

Overall, how would you rate Ally as a solution to help you ensure the accessibility of your course content? (If you have recommendations for improvement of Ally, please include them on the last question of this	58.467	106.740	.591	.	.663
Have you informed your students about how to access Ally's AFs such as: ePub, audio only, tagged PDF, electronic braille, and HTML?	61.333	117.954	.104	.	.694
I still don't know how to use Ally	61.900	120.438	-.070	.	.698
Playing with it in my course	61.800	117.959	.188	.	.691
Through online help materials	61.900	120.645	-.095	.	.698
Through a workshop or training	61.667	120.575	-.076	.	.699
OTHER	62.000	121.310	-.247	.	.700

Appendix Seven

Paired Questions Mann Whitney U

Pre-survey	Post-survey	Questions
QH	QF	Have you ever attended an accessibility workshop or received accessibility training at your institution?
QI	QG	How helpful was the workshop or training?
QJ	QU	How important do you think accessible digital content of all students?
OK	QV	Do you feel providing students with different ways of consuming content (is important for their learning?

Appendix Eight

Student Survey - T University

Frequency Table

How often do you access your course materials using a desktop or laptop?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once	2	8.0	8.0	8.0
	More than once	1	4.0	4.0	12.0
	4	1	4.0	4.0	16.0
	5	21	84.0	84.0	100.0
	Total	25	100.0	100.0	

How often do you access your course materials using a Tablet					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once	8	32.0	32.0	32.0
	More than once	1	4.0	4.0	36.0
	I'm not sure	4	16.0	16.0	52.0
	4	3	12.0	12.0	64.0
	5	9	36.0	36.0	100.0
	Total	25	100.0	100.0	

How often do you access your course materials using a mobile phone					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Once	2	8.0	8.0	8.0
	More than once	6	24.0	24.0	32.0
	I'm not sure	7	28.0	28.0	60.0
	4	3	12.0	12.0	72.0
	5	7	28.0	28.0	100.0
	Total	25	100.0	100.0	

How well do your course materials work with your preferred device(s)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not well at all	2	8.0	8.0	8.0
	Not well	1	4.0	4.0	12.0
	average	4	16.0	16.0	28.0
	well	5	20.0	20.0	48.0
	Extremely well	13	52.0	52.0	100.0
	Total	25	100.0	100.0	

Do you feel you learn better when you can both read and listen to course materials?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No, not at all	3	12.0	12.0	12.0
	No, not really	2	8.0	8.0	20.0
	Neutral, not sure	4	16.0	16.0	36.0
	well	4	16.0	16.0	52.0
	Extremely well.	12	48.0	48.0	100.0
	Total	25	100.0	100.0	

Do you feel you learn better when you can both read and listen to course materials?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No, not at all	1	4.0	4.0	4.0
	Neutral, not sure	2	8.0	8.0	12.0
	well	8	32.0	32.0	44.0
	Extremely well.	14	56.0	56.0	100.0
	Total	25	100.0	100.0	

Descriptive Statistics						
	N	Range	Minimum	Maximum	Mean	Std. Deviation
How often do you download AFs of your course files?	25	3	1	4	1.84	1.179
How often do you download AFs of your course files?	11	4	1	5	3.64	1.748
Valid N (listwise)	11					

Pre-survey - QX. How often do you download AFs of your course files?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	15	41.7	60.0	60.0
	Once	3	8.3	12.0	72.0
	Several times	3	8.3	12.0	84.0
	Whenever	4	11.1	16.0	100.0
	Total	25	69.4	100.0	
Missing	System	11	30.6		
Total		36	100.0		

Post-survey - QN. How often do you download AFs of your course files?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	3	8.3	27.3	27.3
	Whenever	3	8.3	27.3	54.5
	Very Often	5	13.9	45.5	100.0
	Total	11	30.6	100.0	
Missing	System	25	69.4		
Total		36	100.0		

Frequency Table

Pre-survey - How did you learn about downloading					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Instructor syllabus	11	30.6	44.0	44.0
	Instructor announcement	5	13.9	20.0	64.0
	Campus announcement	1	2.8	4.0	68.0
	Other	4	11.1	16.0	84.0
	Peer	3	8.3	12.0	96.0
	Training	1	2.8	4.0	100.0
	Total	25	69.4	100.0	
Missing	System	11	30.6		
Total		36	100.0		

Post-survey - How did you learn about downloading					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Instructor announcement	1	2.8	10.0	10.0
	Others	1	2.8	10.0	20.0
	Peer	2	5.6	20.0	40.0
	Training	5	13.9	50.0	90.0
	Never heard about alternative	1	2.8	10.0	100.0
	Total	10	27.8	100.0	
Missing	System	26	72.2		
Total		36	100.0		

Frequency Table

Pre-survey - How often Request Course materials accommodation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	7	19.4	28.0	28.0
	Seldom	8	22.2	32.0	60.0
	Whenever required	6	16.7	24.0	84.0
	Regularly	2	5.6	8.0	92.0
	Very Often	2	5.6	8.0	100.0
	Total	25	69.4	100.0	
Missing	System	11	30.6		
Total		36	100.0		

Post-survey - How often Request Course materials accommodation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	7	19.4	63.6	63.6
	Seldom	1	2.8	9.1	72.7
	Whenever required	3	8.3	27.3	100.0
	Total	11	30.6	100.0	
Missing	System	25	69.4		
Total		36	100.0		

Frequency Table

Pre-survey					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	7	19.4	28.0	28.0
	Accessible PDF	3	8.3	12.0	40.0
	Accessible Word document	4	11.1	16.0	56.0
	Enlarged document	3	8.3	12.0	68.0
	Audio	1	2.8	4.0	72.0
	Tactile resources	1	2.8	4.0	76.0
	Others	6	16.7	24.0	100.0
	Total	25	69.4	100.0	

Missing	System	11	30.6		
Total		36	100.0		

Post-survey					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	9	25.0	64.3	64.3
	Accessible PDF for Arabic file	3	8.3	21.4	85.7
	Accessible Word document	1	2.8	7.1	92.9
	Braille	1	2.8	7.1	100.0
	Total	14	38.9	100.0	

Missing	System	22	61.1		
Total		36	100.0		

Appendix Nine

Student Survey - S University

Frequency Table

How often do you access your course materials using a desktop or laptop?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	4	7.4	7.4	7.4
	Rarely	2	3.7	3.7	11.1
	Sometimes	9	16.7	16.7	27.8
	Often	4	7.4	7.4	35.2
	All the time	35	64.8	64.8	100.0
	Total	54	100.0	100.0	

How often do you access your course materials using a tablet					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	25	46.3	46.3	46.3
	Rarely	5	9.3	9.3	55.6
	Sometimes	4	7.4	7.4	63.0
	Often	5	9.3	9.3	72.2

	All the times	15	27.8	27.8	100.0
	Total	54	100.0	100.0	

How often do you access your course materials using a mobile					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	5	9.3	9.3	9.3
	Rarely	5	9.3	9.3	18.5
	Sometimes	14	25.9	25.9	44.4
	Often	6	11.1	11.1	55.6
	All the time	24	44.4	44.4	100.0
	Total	54	100.0	100.0	

How well do your course materials work with your preferred device(s)					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Not well	2	3.7	3.7	3.7
	average	12	22.2	22.2	25.9
	well	17	31.5	31.5	57.4
	Extremely well	23	42.6	42.6	100.0
	Total	54	100.0	100.0	

Do you feel you learn better when you can easily an1tate and highlight your digital course readings?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No, not at all	2	3.7	3.7	3.7
	No, not really	4	7.4	7.4	11.1
	Neutral, not sure	14	25.9	25.9	37.0
	well	7	13.0	13.0	50.0
	Extremely well.	27	50.0	50.0	100.0
	Total	54	100.0	100.0	

Do you feel you learn better when you can both read and listen to course materials?					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No, not at all	1	1.9	1.9	1.9
	No, not really	5	9.3	9.3	11.1
	Neutral, not sure	8	14.8	14.8	25.9
	well	12	22.2	22.2	48.1
	Extremely well.	28	51.9	51.9	100.0
	Total	54	100.0	100.0	

$QQPOSTS Frequencies				
		Responses		Percent of Cases
		N	Percent	
SE what are the barriers[a]	Incompatible with screen readers	10	11.2%	18.5%
	Incompatible with speech to text tools	11	12.4%	20.4%
	Small text	13	14.6%	24.1%
	The font style is difficult to read	24	27.0%	44.4%
	Images are not accessible	13	14.6%	24.1%
	Bad quality for the scanned document.	12	13.5%	22.2%

	Videos that are not captioned	6	6.7%	11.1%
Total		89	100.0%	164.8%

Pre-survey - How did you learn about downloading					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Instructor syllabus	17	27.9	31.5	31.5
	Instructor announcement	8	13.1	14.8	46.3
	Campus announcement	3	4.9	5.6	51.9
	Other	16	26.2	29.6	81.5
	Peer	5	8.2	9.3	90.7
	Training	5	8.2	9.3	100.0
	Total	54	88.5	100.0	

Missing	System	7	11.5		
Total		61	100.0		

Post- survey - How did you learn about downloading					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Others	1	1.6	14.3	14.3
	Training	6	9.8	85.7	100.0
	Total	7	11.5	100.0	
Missing	System	54	88.5		
Total		61	100.0		

Pre Survey - Request Course materials accommodation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	48	78.7	88.9	88.9
	Once	1	1.6	1.9	90.7
	Several times	3	4.9	5.6	96.3
	whenever	2	3.3	3.7	100.0
	Total	54	88.5	100.0	
Missing	System	7	11.5		
Total		61	100.0		

Post survey - Request Course materials accommodation					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	5	8.2	71.4	71.4
	Once	2	3.3	28.6	100.0
	Total	7	11.5	100.0	
Missing	System	54	88.5		
Total		61	100.0		

Frequency Table

Pre-survey					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	17	27.9	31.5	31.5
	Accessible PDF	5	8.2	9.3	40.7
	Accessible PDF for Arabic file	3	4.9	5.6	46.3
	Accessible Word document	3	4.9	5.6	51.9
	Enlarged document	22	36.1	40.7	92.6
	Braille	1	1.6	1.9	94.4
	Audio	3	4.9	5.6	100.0
	Total	54	88.5	100.0	

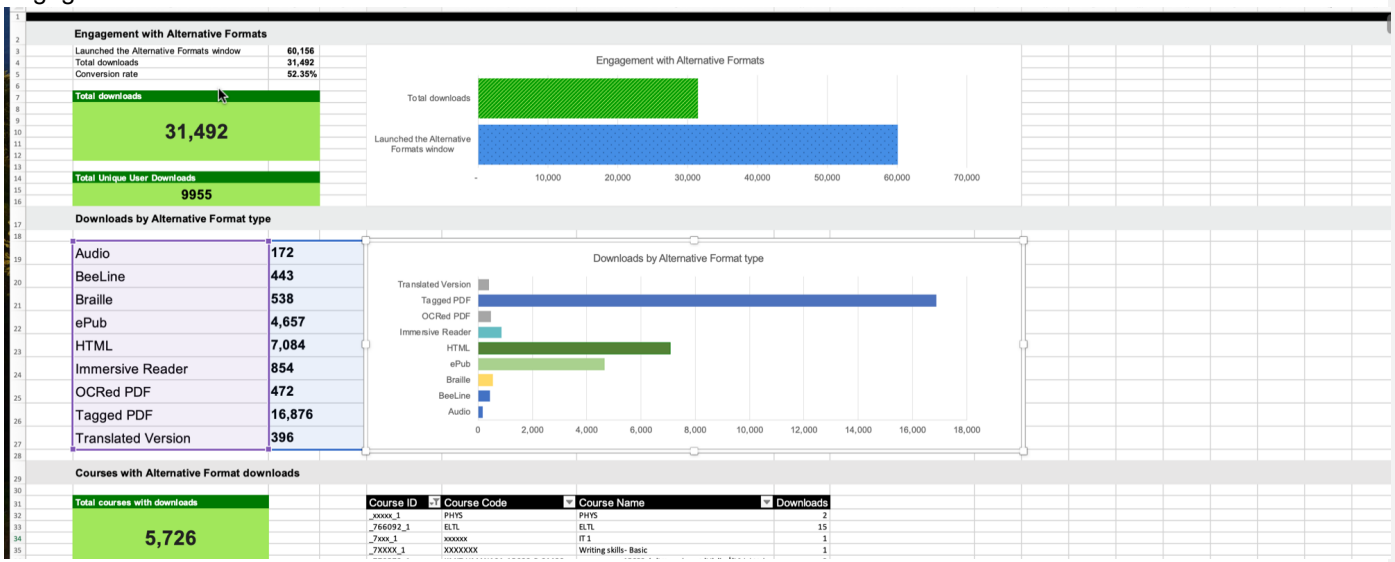
Missing	System	7	11.5		
Total		61	100.0		

Post-survey					
		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Never	4	6.6	57.1	57.1
	Accessible PDF	3	4.9	42.9	100.0
	Total	7	11.5	100.0	
Missing	System	54	88.5		
Total		61	100.0		

Appendix Ten

Ally report sample from the study

Engagement with Alternative Formats



Engagement with Alternative Formats

Launched the Alternative Formats window	60,156
Total downloads	31,492
Conversion rate	52.35%

Total downloads

31,492

Total Unique User Downloads

9955

Downloads by Alternative Format type

Audio	172
BeeLine	443
Braille	538
ePub	4,657
HTML	7,084
Immersive Reader	854
OCRed PDF	472
Tagged PDF	16,876
Translated Version	396

Courses with Alternative Format downloads

Total courses with downloads

5,726

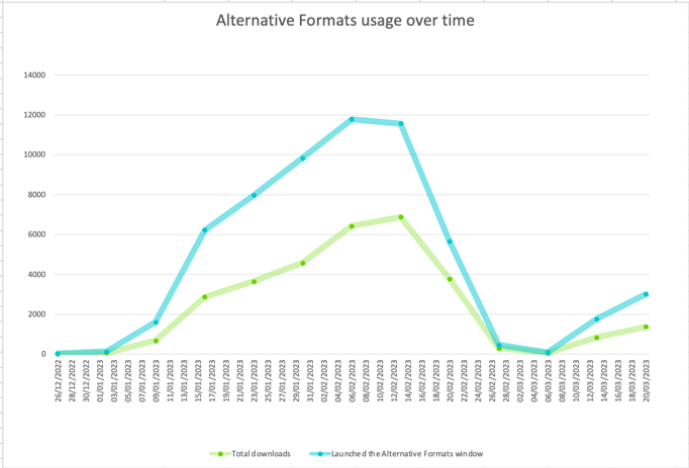
Course ID	Course Code	Course Name	Downloads
_xxxxx_1	PHYS	PHYS	2
_766092_1	ELTL	ELTL	15
_7xxx_1	xxxxxx	IT 1	1
_7XXXX_1	XXXXXXX	Writing skills- Basic	1

Alternative Format Weekly

January, 1 2023 – March, 23 2023

Alternative Formats usage over time

Week	Launches	Downloads	Total Unique User Downloads
26/12/2022	22	8	5
02/01/2023	132	68	32
09/01/2023	1609	673	353
16/01/2023	6228	2876	1335
23/01/2023	7967	3648	1755
30/01/2023	9837	4578	2124
06/02/2023	11788	6431	2434
13/02/2023	11569	6875	2333
20/02/2023	5669	3781	1106
27/02/2023	465	291	100
06/03/2023	97	51	23
13/03/2023	1767	836	429
20/03/2023	3006	1376	733



Engagement with Instructor Feedback

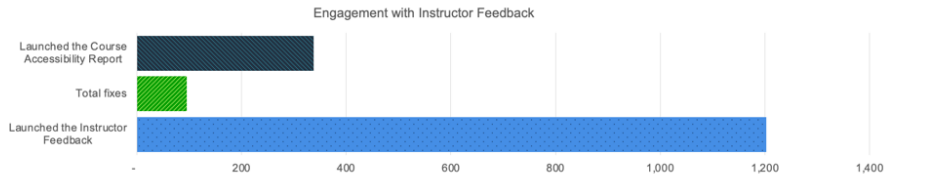
January, 1 2023 – March, 23 2023

Engagement with Instructor Feedback

Launched the Instructor Feedback	1,202
Total fixes	95
Conversion rate	7.90%
Launched the Course Accessibility Report	338

Total fixes

95



List of courses that have made an improvement

Total courses with fixes

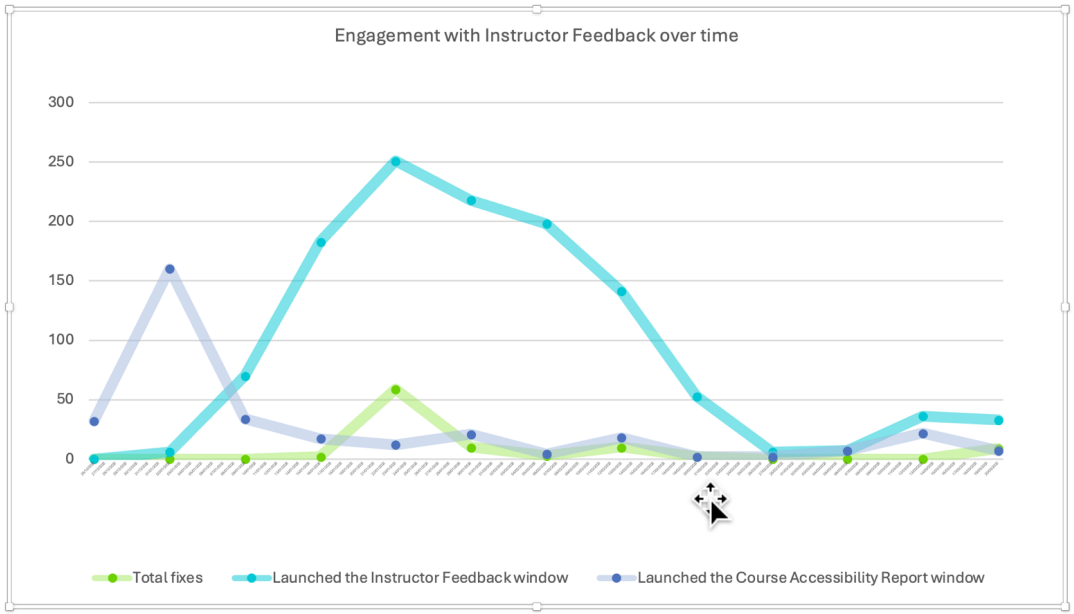
21

Course ID	Course Code	Course Name	Fixes	Launched Feedback	Launched Course Accessbility Report
[redacted]			3	3	0
			1	1	0
			9	7	0
			26	27	0
			1	1	0
			10	10	0
			5	1	0
			1	3	1
			8	2	0
			2	7	3
			1	2	0
			1	1	0
			2	2	0
			2	1	0
			1	1	0
			11	5	1
			1	2	0
			1	1	0
			1	1	0
			4	2	0
			4	3	0
Total			95	83	5

Engagement with Instructor Feedback over time

Week	Instructor Feedback Launches	Fixes	Course Accessibility Report Launches
26/12/2022	0	0	32
02/01/2023	6	0	160
09/01/2023	70	0	34
16/01/2023	183	2	17
23/01/2023	251	59	12
30/01/2023	218	10	21
06/02/2023	198	3	4
13/02/2023	141	10	18

20/02/2023	53	2	2
27/02/2023	6	0	2
06/03/2023	7	0	7
13/03/2023	36	0	22
20/03/2023	33	9	7


Engagement with Instructor Feedback over time
300
250
200
150
100
50
0
Total fixes
Launched the Instructor Feedback window
Launched the Course Accessibility Report window

Course Accessibility

Month	Number of courses	Total files	Total WYSIWYG	Overall score	Files score	WYSIWYG score	pdf	image	html-page	presentation	document	other	application/x-document	application/x-folder	application/x-item
2012-07-01	178	0	356	0.5		0.5	0	0	0	0	0	0	0	0	178
2012-08-01	178	356	0				0	0	0	0	0	356	0	0	0
2013-08-01	178	178	14	0.3046875	0.25	1.0	0	178	0	0	0	0	0	0	0
2014-02-01	178	0	3382	0.9894736842105270		0.9894736842105270	0	0	0	0	0	0	0	0	2492
2014-05-01	1	2	0	0.25	0.25		0	2	0	0	0	0	0	0	0

2014-06-01	1	1	0	1.0	1.0		0	0	0	0	1	0	0	0	0
2014-07-01	1	1	0	0.4729875	0.4729875		1	0	0	0	0	0	0	0	0
2014-08-01	1	26	0	0.6430769230769230	0.6430769230769230		0	12	14	0	0	0	0	0	0
2015-01-01	78	78	0	0.2708750000000000	0.2708750000000000		74	0	0	0	0	4	0	0	0
2015-08-01	185	4144	0	0.2645714487584230	0.2645714487584230		178	3788	0	178	0	0	0	0	0
2016-04-01	3	41	0	0.8512842266186050	0.8512842266186050		2	7	31	0	1	0	0	0	0
2016-07-01	1	1	0	0.6712170719922690	0.6712170719922690		1	0	0	0	0	0	0	0	0
2016-08-01	21	92	0	0.8089308612685430	0.8089308612685430		22	23	47	0	0	0	0	0	0

2016-09-01	1	1	0	0.6716075410719100	0.6716075410719100		1	0	0	0	0	0	0	0	0
2017-01-01	7	1287	0	0.25	0.25		0	1287	0	0	0	0	0	0	0
2017-02-01	72	0	144	1.0		1.0	0	0	0	0	0	0	0	72	72
2017-03-01	1	12	0	0.9742147067	0.9742147067		1	0	11	0	0	0	0	0	0
2017-05-01	1	1	0	0.25	0.25		0	1	0	0	0	0	0	0	0
2017-12-01	2	30	0	0.9740833340	0.9740833340		0	0	0	30	0	0	0	0	0

AlternativeText:2	Contrast:2	HeadingsHigherLevel:3	HeadingsPresence:2	HeadingsSequential:3	HeadingsStartAtOne:3	HtmlBrokenLink:2	HtmlCaption:2	HtmlColorContrast:2	HtmlDefinitionList:3	HtmlEmptyHeading:2	HtmlEmptyTableHeader:2	HtmlHasLang:3	HtmlHeadingOrder:3	HtmlHeadingsPresence:2
0	0	0	0	0	0	0	0	178	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	14	0	0
74	0	0	74	0	0	0	0	0	0	0	0	0	0	0
356	178	0	178	0	0	0	0	0	0	0	0	0	0	0

0	1	0	1	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

Appendix Eleven

Major quotes from Interviews

P2TU: “I have noticed that students tend to perform better when they have access to accessible courses provided by Ally's alternative format. The availability of different formats such as audio, ePub, and electronic braille has proven to be beneficial for students with diverse learning needs. It allows them to engage with the course materials in a way that suits their individual preferences and abilities”.

P4TU: “For faculty, understanding the needs of the students and ensuring equal access to education is crucial, in addition to training and utilizing all available accessibility tools. Yes, having multiple options allows students to access content in the way that best suits them. It saves time and effort, especially for those who are busy and need quick access to materials”.

P1TU: “It was noticed that students became less stressed and were willing to finish their tasks independently by using accessible course materials provided by Blackboard Ally. It is less time-consuming for them”.

P3TU: “Imagine the beauty of offering different alternative formats for the same content, allowing students to access it in various ways that cater to their individual needs. This inclusive approach would provide students with diverse learning

styles or accessibility requirements the opportunity to choose the format that best suits them. By providing alternative formats, such as audio, visual, or tactile options, we empower students to engage with the content in a way that enhances their understanding".

P5TU: "In my experience, students do tend to perform better when accessible courses are provided through Blackboard Ally feedback. The availability of alternative formats and accessibility features has allowed students with diverse learning needs to engage with the course content more effectively."" Providing alternative formats allows students to engage with the content in a way that enhances their understanding and learning experience. This flexibility can lead to improved grades and foster equitable access".

P6TU: "Based on my observation and feedback from students, the alternative format that is downloaded the most is the accessible PDF format. This format allows students to access the course materials in a visually consistent and structured manner. The accessible PDFs often include features such as text-to-speech functionality, allowing students to have the content read aloud to them. This feature is particularly beneficial for students with visual impairments or those who prefer auditory learning".

P7SU: “The impact of accessibility varies by subject and study level. For example, students in management benefit greatly from translation services and access to various formats. This is particularly important for international students. Tailoring accessibility training to address the specific needs of different fields can significantly enhance the learning experience. Since implementing these changes, I’ve noticed increased engagement and understanding among my students, which suggests that accessible courses do indeed improve performance.”

P9SU: “I’ve noticed increased engagement and understanding among my students, which suggests that accessible courses do indeed improve performance”.

P11SU: “Yes, having multiple options is beneficial. However, the quality of these files is often not good. Students are happy to see options, but they end up using PDFs because other formats have too many errors and technical issues”.