ACCESSIBILITY OF TESTS IN HIGHER EDUCATION ONLINE LEARNING ENVIRONMENTS:
PERSPECTIVES AND PRACTICES OF U.K. EXPERT PRACTITIONERS

by

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Abstract

This study is an investigation of the perspectives and practices of U.K. expert practitioners regarding the accessibility of tests in higher education online learning environments. As a growing area of concern in the higher education field, the accessibility of online tests is a particularly complex and challenging topic. To explore this topic further, twelve U.K. higher education expert practitioners were consulted. Five major themes that were identified by the participants included:

1. Requirement for balance between academic integrity and accessibility;
2. Need for inclusive design to better support the creation and delivery of accessible online tests;
3. Issues related to the mainstreaming of accessible online tests and testing processes;
4. Resources required to support the design and delivery of accessible online tests; and
5. Technology issues and approaches.

The participants shared their research findings, experiences, and reflections regarding their work related to different types of online tests and accessibility.
Acknowledgements

There are times when we have the opportunity to step back from the hustle and bustle of daily life, and to think and reflect on what we have learned and to seek out the wisdom and experience of others. The research process is expanded beyond what is reported in the literature and can encompass lived experience, with the advantages of being able to ask questions of, interact and share experiences with those from whom we seek counsel. Through conversations and interactions with the research participants, I was fortunate to discover and for a brief moment to enjoy the benefits of their many years of combined research, reflections, and insight. The process itself was not without its challenges, and I recognize that this is just one step in an ongoing journey forward.

Thank you first to the participants for their time and willingness to share their experiences and research with me. This study took place during a particularly challenging time in U.K. higher education, with severe cutbacks to funding, increases in tuition, and within a climate of uncertainty. This work is in part an effort to document a portion of the great strides forward that have been made by colleagues in the U.K., and to encourage continuation of the many conversations that will move all of us forward to shared understanding and collaboration. I would also like to thank Doug McDougall, my supervisor, and Eunice Jang, my second reader, for all their support, suggestions and guidance during this process. Finally, I wish to thank my family, friends, and especially my daughter Erin, for all of their understanding and support.
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Chapter One: Introduction

1.1 Introduction

This thesis is a study of the perspectives and practices of expert practitioners with regard to the creation and delivery of accessible tests in higher education online learning environments. An online test is a type of assessment that is used in higher education to determine "the quality of student work for purposes of identifying the student's level of achievement" (Mabry, 2005 cited in Williams, Howell & Hricko, 2006, p. 3). They are used in higher education online learning environments in many ways to support different types of student assessment including summative, formative, diagnostic, peer, self, and other. These types of tests may be created and delivered using a learning management system (LMS), an assessment management system or other information technology (IT) system. The use of IT to create and deliver tests online offers opportunities to customize and adapt these types of assessments to ensure their accessibility, which has been defined as "usability of a product, service, environment or facility by individuals with the widest range of capabilities" (ISO, 2008). Thus, an accessible higher education online test should support the learning assessment of individuals in ways that meet the accessibility requirements of both instructors and students.

I have chosen the United Kingdom (U.K.) as the location for this study as it has been a leader in the development and research of accessible online testing of individuals in the area of learning, education and training for several years (Ball, 2009). The U.K. includes England, Wales, Scotland and Northern Ireland. It is home to over 300 higher education institutions (of which 162 are publicly funded), including universities, colleges, and other institutions (HESA, 2013).
Although much work related to accessibility is ongoing within the K-12 sector and further education institutions, the focus of this study is mainly on publicly funded higher education institutions with an emphasis on U.K. universities. By working with leaders in the field, my hope is to gain an overview of the current situation and potential future directions needed to develop and deliver more accessible and inclusive tests in higher education online learning environments. In the next sections of this chapter, I provide the context and the research questions that form the basis for this study. In addition, the significance of the study and my background related to the topic are provided. Finally, the structure of the study is outlined in the last section of this chapter.

1.2 Research Context

The research context for this study is complex. Instructors have their own diverse perceptions, experiences, and practices regarding the accessibility of online tests. Instructors use tests and other types of assessments to "determine over time who learns what, when where, why, how, and how well" (Maki, 2010, p.1). Tests may be used for a variety of different purposes such as to determine prior learning, measure knowledge attainment or skill development, assess understanding, and more. Additionally, through the use of technology, online tests can be used to support storage, tracking and reporting of student results, consistency and sharing of test items and formats, advanced analysis of individual and cohort achievement over time, curriculum development and alignment for courses and programs of study, and evaluation of quality with respect to learning processes and products (Maki, 2010, p. 12, 294). Instructors create and deliver these types of tests within a variety of higher education contexts and in different online learning environments. Many of them play multiple roles themselves and also may have opportunities to interact with accessibility experts and advocates, software vendors, and
specification and standards developers. They work within varied organizational structures and must be continually mindful of the legislative and regulatory requirements within which they operate.

Instructors are experimenting with new learning approaches that integrate systematic methods to gather evidence and information about students' performance and interactions that are based on a defined process, student progress or a product (Joosten-ten Brinke et al., 2007). There is increased use of educational technology and technology tools to learn more about what and how students learn (Maki, 2010, p. 166). Higher education institutions seem to be exploring the use of learning analytics to support their activities in determining the accessibility of course components (Cooper, Sloan, Kelly, & Lewthwaite, 2012, p. 3 – 4). It also has been suggested that in large online courses it may be easier to gather statistically significant data related to what and how students with disabilities learn (Cooper, Sloan, Kelly, & Lewthwaite, 2012, p. 3), and this can in turn support course planning, implementation and evaluation. As well, there are increasing numbers of institutions that are exploring the use of simulations, adaptive testing, and other technology-enhanced learning activities. MOOCs and other types of online learning environments are being studied to determine how they can best support student learning.

Although new instructional and assessment approaches and technology delivery methods are being explored (Heinrich, Milne, & Moore, 2009; Hernández-Leo et al., 2008; Joosten-ten Brinke et al., 2007; Najjar & Klobučar, 2007; Sampson, 2009; Torrente et al., 2009; Williams, Howell, & Hricko, 2006), accessibility has been identified as a crucial challenge that needs to be addressed (Anido-Rifón, 2008; Ball, 2009; Draffan et al., 2010; Seale & Cooper, 2010; Ontario Ministry of Community and Social Services, 2009; U.S. Department of Education, 2008).
As increasing numbers of disabled students and older adults enter postsecondary institutions (Abreu-Ellis, Ellis & Hayes, 2009; Barnard-Brak et al., 2009; Concannon, Flynn & Campbell, 2005), the issue of accessibility of technology supported assessments is critical to student success. For those who graduate, the completion of postsecondary education has been found to have positive beneficial effects (Barnard-Brak et al., 2009; Michailakis & Reich, 2009). Postsecondary graduates are about twice as likely to be employed as those who graduate from high school (Murray et al., 2009). This suggests that, as a form of higher education assessment, online tests need to support the assessment of abilities rather than the impact of a disability, so that the longer term positive effects of a postsecondary education are available to all. Given the importance of academic success at the postsecondary level, technologies that are employed to facilitate assessment judgments of students must be integrated in a seamless manner and must meet the accessibility requirements of instructors and students involved in higher education online learning environments.

Coupled with this growing recognition of the importance of accessibility, the concurrent integration of technology with learning activities such as assessment within higher education presents new challenges and opportunities (Angeli & Valanides, 2009; Thiriet et al., 2002). Research has indicated that technology interacts with discipline specific subject matter and with the pedagogy employed to support the teaching of specific content (Angeli & Valanides, 2009). In different regions of the world instructors, students, and workers struggle to develop the knowledge and skills to integrate technology successfully within their teaching, learning, and work activities (Gravill, Compeau, & Marcolin, 2006; Koehler, Mishra & Yahya, 2007; Rodrigues, 2003 both cited in Angeli & Valanides, 2009; Schubert & Leimstoll, 2007).
Although there are some theoretical foundations and conceptual frameworks to guide and inform research in the area of accessible, technology-enhanced learning, there is a need for more concrete understanding of the perspectives and practices of those engaged in developing and using technologies for teaching and learning activities, such as online tests.

1.3 Research Questions

In this study, I examine U.K. expert practitioners’ perspectives and practices with regard to the accessibility of tests in higher education online learning environments and I focus on the following three questions:

1. What are the issues and barriers encountered regarding accessibility of tests in higher education online learning environments as noted by U.K. expert practitioners?
2. What are current strategies and practices used by U.K. expert practitioners to support accessibility of tests within higher education online learning environments?
3. How can accessibility of tests within higher education online learning environments be improved?

I have answered these questions by carrying out a study that involved twelve U.K. expert practitioners who agreed to participate by completing a consent form, demographic and background survey and by responding to questions during a semi-structured interview.

1.4 Significance of the Study

Within the general population, the United Nations estimates that there are more than 700 million people who have a disability, and that number is expected to increase (Aycinena, 2008). Within higher education institutions, it has been estimated that there may be as many as 1 in 11 post-secondary undergraduates who have a disability (Orr & Hammig, 2009). Although there is debate about the actual number of students who have a disability within higher education
institutions, it has been suggested that students with disabilities may well participate at lower rates and that the numbers of students with disabilities at higher education institutions may be underreported; as well, students with disabilities may experience higher dropout rates (Lombardi & Murray, 2011; Mamiseishvili & Koch, 2011).

New and emerging technologies are being developed to provide support to learners, such as mobile technologies that can be used to interpret sign language, run voice activated wheelchair command systems, provide speech synthesis software, and support other activities (Aycinena, 2008). Rather than being viewed as simply a homogeneous population, people with a disability first need to be viewed as individuals with unique requirements as even the same disability can impact quite differently (Wald, Draffan & Seale, 2009), necessitating an individualized approach to the delivery of content. Beyond assistive technologies and individualized approaches to content delivery, it has been suggested that what is really needed is fair and equitable access, as like everyone else, people who have a disability “just want to live their lives, to succeed, and be happy” (Aycinena, 2008, p. 12).

As part of the higher education experience, it is the student who takes on the responsibility for accessing accommodations that are needed to support learning (Abreu-Ellis, Ellis & Hayes, 2009). A post-secondary student who has a disability must (Abreu-Ellis, Ellis & Hayes, 2009; Elliott & Wilson, 2008),

- Self-identify;
- Meet the definition of “disability” within a new and unfamiliar environment;
- Provide the required documentation in order to qualify for services that may be available;
• Request the accommodation needed (which requires that the student have full understanding of the disability, the potential impact of the disability on her/his own learning within a post-secondary context, and a clear sense of the requirements to support her/his learning);

• Have the necessary skills to self-advocate (including initiative, assertiveness, etc.) for the help required;

• Pay attention to and address affective issues (anxiety, depression, etc.); and,

• Be knowledgeable about legislation that governs post-secondary education, as it can differ substantially from K-12 contexts.

When online tests are involved, these students must also

• Become familiar with the online testing environment and know what the options are in relation to the test they will be taking;

• Understand the methods of assessment that will be used in the online test in order to demonstrate their knowledge and understanding;

• Have the ability to communicate their needs to their instructors and to those who provide support for online tests; and,

• Be knowledgeable about current technologies that they need and that are available to them to support their interactions with the online test system that will be used.

In higher education settings, testing may be used to make decisions about the extent of someone’s knowledge, to grant or deny entry, to rank individuals, and to make judgments about individuals or groups according to specific criteria (Shohamy, 1998). Tests may determine the fates of individuals, and in high-stakes contexts, possibly destroy or build future careers (Noam, 1996 cited in Shohamy, 1998; Shohamy, 2001). The additional burdens on the individual
student during an online test situation can be overwhelming and can impact significantly on learning and performance (Abreu-Ellis, Ellis & Hayes, 2009; Barnard-Brak et al., 2009).

Supporting students within higher education online learning environments can be challenging, when the support also encompasses online tests then the stakes are even higher. Students then rely on the technology to be able to demonstrate what they know. The technology can be an unpredictable intermediary during a time that is critical to the individual student. Judgments of students’ abilities may be clouded by other factors that may have nothing to do with the ability, knowledge, or skills of learners. Rather than being an assessment of an individual's true abilities, there is a possibility that what is being measured is the student's ability to interact with the online test system. Specifically in test situations within higher education online learning environments, it has been suggested that the emphasis should not be on the sequence of key presses (Thomas & Milligan, 2003 cited in Draffan et al., 2010) but rather on the assessment of students’ true abilities with respect to clearly identified intended learning outcomes.

In addition to their work regarding higher education tests in online learning environments, expert practitioners from the U.K. have been involved in the development and constructive criticism of guidelines, specifications and standards, such as

- W3C web accessibility initiative's (WAI) web content accessibility guidelines (WCAG) (Seale & Cooper, 2010; Kelly et al., 2007);
- IMS Accessibility for Learner Information Package (ACCLIP) and AccessforAll Metadata (ACCMD) (Anido-Rifón, 2008);
- IMS Question and Test Interoperability (QTI) (IMS GLC Inc., 2009; Bacon, 2012);

and,

These guidelines, specifications, and standards may help to meet some of the technical challenges associated with ensuring the accessibility of tests within higher education online learning environments.

Although the U.K. has been strongly involved in the development of technical specifications and standards, changes to legislation have been a precursor to technical innovation and discovery. Over the course of almost twenty years or more, there has been a gradual introduction of legislation that has encouraged the broadening of participation within higher education institutions and within U.K. society more generally (May & Bridger, 2010; Phipps & McCarthy, 2001; Waterfield & West, 2010).

With time, the legislation has been progressively refined in an attempt to better define and promote more inclusive approaches to education and other aspects of U.K. society. Together with the legislative changes, there has been increasing recognition regarding the need for improved dissemination and broader implementation of accessibility approaches with regard to higher education. Although change can be difficult, it can also spur on new growth and innovation; and it can create an environment conducive to the exploration and thoughtful evaluation of current theory and practice.

The U.K. has many recognized world leaders in the field of accessibility of tests within higher education online learning environments (Ball, 2009). Many of these expert practitioners are instructors, accessibility specialists and advocates, standards and specifications developers, and software vendors. Some are also engaged in research regarding online testing issues and accessibility. A better understanding of U.K. expert practitioners’ perspectives and practices
could contribute to the further advancement of understanding regarding the accessibility of online tests within higher education online learning environments. The research results of this study could help to inform the development and implementation of projects within Canada and abroad.

1.5 Some definitions and key principles

A groundbreaking U.K. document, the EdExcel report, provides terms, definitions and guiding principles that are relevant to the field of accessible tests in higher education online learning environments. Two terms of particular relevance to this study are:

**disability**

A physical or mental impairment which has a substantial and long-term adverse effect on a person’s ability to carry out normal day-to-day activities

**discrimination**

Discrimination by a provider of services can be either:

- Unjustifiably treating a disabled person, for a reason which relates to his/her disability, less favourably than others to whom that reason does not (or would not) apply; or
- Unjustifiably failing to comply with a legal duty to make reasonable adjustments to practices, policies, procedures or physical features (e.g., of premises), which make it impossible or unreasonably difficult for disabled persons to make use of the services provided. (EdExcel, 2006, p. 7)

Four key principles to support the development of more accessible tests in online learning environments that were mentioned in the report include (EdExcel, 2006; Ball, 2009)

- **Anticipation** – a variety of accessibility requirements need to be anticipated by the developer and solutions and should be sought to minimize costs;
• **Reasonable accommodation** – although assessment providers can identify steps to improve accessibility of tests online, reasonable judgments need to be made regarding what might be possible during a specific timeframe;

• **Ongoing technology change** – organizations need to have a process of continuous review with regard to online testing products as there are many ongoing technology changes; and,

• **Corporate responsibility** – an organization’s leaders are responsible for ensuring that there is compliance with the legislation, and policies and training are in place to support accessible tests in higher education online learning environments.

1.6  **Background of the Researcher**

My personal interest in the topic of learning achievement testing in higher education online learning environments in blended and online contexts began during graduate school at the University of Toronto when I was completing my Master of Information Studies degree. As a graduate student, I had to complete several tests online. My experiences were not always positive as there were occasional issues with passwords, Internet connectivity, and software glitches. As well, due to my experience with the creation and use of online survey instruments, and previous research regarding cultural sensitivity, I was aware of some of the shortcomings of technology when it is applied across diverse communities.

After graduation, I was fortunate to begin a new professional career as an Instructional Technology Liaison Librarian at the University of Toronto Mississauga, and it was on a picnic bench one sunny day in August of 2004 that my interest in researching online testing originated. I met with a fellow Librarian who asked me if I had any ideas as to how she might assess if and what her students were learning from her instruction sessions. I had been working with
computer science students to develop an online testing system that could be used by faculty and librarians to quickly and easily develop questions to assess student understanding. I suggested that we partner to research this issue together.

Three months later, in November of 2004, I attended an afternoon session entitled “Why standards matter: The case for e-learning and business” at the University of Toronto. I was introduced to the world of standards, and in 2005, became a volunteer member of the Standards Council of Canada Mirror Committee (SMC) for the ISO/IEC JTC1 SC36 - Joint Technical Committee 1 (JTC1) Sub-Committee (SC) 36, Information Technology for Learning, Education, and Training.

I have been witness to ongoing discussions and developments in the field of accessibility that represent a paradigm shift in how accessibility within online learning environments is conceptualized and can be addressed by matching individual needs and learning resources. These efforts have been led by accessibility and other technical experts in the U.K., Australia, Canada, Denmark, Japan, Norway, South Korea, U.S., and many other nations and are testament to what is possible when groups of dedicated individuals work together to advance new approaches and ideas with a shared sense of purpose.

Since my initial foray into the world of online testing research and the development of specifications and standards, I have continued to work with faculty and students on issues related to online tests and other aspects of technology supported learning. I continue to provide assistance with and to learn about higher education assessments using a variety of different technology alternatives such as

- institutional learning management systems;
- in-house assessment systems;
• technology-supported classroom response systems;
• mobile enabled tests;
• collaborative approaches to online test creation and delivery; and,
• integrated learning analytics tools used to support assessment.

It is my hope that this research will contribute to understanding regarding issues related to accessibility of tests in higher education online learning environments, so that we can bridge where we currently are to where we need to be to ensure more equitable access to education for all learners.

1.7 Plan of the Thesis

There are five chapters in my thesis organized to describe the study in detail. Chapter One provides an overview of the thesis describing the research context and questions, researcher background information, and significance of the study.

A review of existing literature is found in Chapter Two, where I examine previous research conducted in this area. Conceptions of disability and the influence of architecture and urban planning on universal design for instruction (UDI) and universal design for learning (UDL) are presented and some guidelines, specifications, and standards relevant to the research topic are introduced. In addition, a brief overview of relevant U.K. legislation is provided and some of the identified issues in the field of accessibility of tests in higher education online learning environments are presented. Some barriers and issues from the literature are identified. Also, several strategies and practices are included from the literature, which are currently employed to address the issues related to online tests and their accessibility in higher education online learning environments.
Chapter Three describes the research design and methods used to carry out the study. The pre-defined criteria used to identify key informants for this study are provided. I also discuss the data collection and analysis methods that were used and the ethical considerations that were taken into account for the study.

The findings of the study, which are based on the interviews and survey responses of the twelve participants, are presented in Chapter Four. A discussion of the findings with regard to the research questions, limitations of the study, suggestions for future research, and researcher reflections are provided in Chapter Five.

Finally, a bibliography and appendices are provided at the end of this document. The appendices include the data collection tools, abbreviations and additional definitions.
Chapter Two: Literature Review

2.1 Introduction

Accessibility to education has been framed as "a 'rights' issue (Bohman, 2003), a 'moral' issue (Slatin, 2002), and an 'economic' issue (Jacobs, 2005). Accessibility has rarely been explicitly framed as a pedagogic or teaching issue that requires pedagogical responses and solutions" (Seale & Cooper, 2010, p. 1109). As a result, disconnects may be experienced by instructors and students between theory and pedagogical practice (Mirabella, Kimani, Gabrielli & Catarci, 2004 cited in Seale & Cooper, 2010).

2.1.1 Accessible tests as a pedagogical issue

Technology-enabled tests are increasingly being used in higher education, and will become even more prevalent as the underlying technologies used to create and deliver these types of assessments improve. A key pedagogical advance that is on the horizon for online tests in higher education includes having tests that monitor and allow for diagnostics regarding the patterns of decisions and strategies that are used by students (Maki, 2010). Adaptive testing has been available for decades and can be used to support students to successfully move from beginner level to mastery allowing by providing appropriate scaffolding for student learning with respect to a topic (Maki, 2010). The descriptive data from online tests that is gathered in IT systems can be used to inform pedagogy (Maki, 2010). Better and more descriptive data can help to inform educators about the learning pathways that are used by students as they seek to understand underlying concepts (Maki, 2010). As well, instructors can use the data and information to tailor instruction in ways that will be more effective to support student learning (Maki, 2010). These new technologies can assist with reflections regarding new discoveries from cognitive research regarding how people learn (Maki, 2010).
Framed as a pedagogical issue, instructors could be encouraged to view learner abilities from the perspectives of their own teaching experiences (Mirabella, Kimani, Gabrielli, & Catarci, 2004 cited in Seale & Cooper, 2010). A holistic approach could consider learning outcomes (Kelly, Phipps & Swift, 2004 cited in Seale & Cooper, 2010), principles that support alignment of outcomes, assessment, and activities (Biggs, 2003 cited in Seale & Cooper, 2010; Fink, 2004), and effective organization of content and other elements of optimal course design (Biggs, 2003 cited in Seale & Cooper, 2010; Passman & Green, 2009).

Research following this approach considers the development, implementation, and evaluation of pedagogical tools that effectively mediate instructor actions, provide detailed and clear principles regarding learning that can be readily translated into pedagogical practice (Seale & Cooper, 2010). It supports the linking of practice with theory and helps instructors to move from abstract pedagogical concepts to concrete practice (Seale & Cooper, 2010).

2.1.2 Benefits of online tests for students with disabilities

Technologies can support new ways of assessing by allowing for reduced stress, increased affordances, leveraging of user familiarity with technology, and integration of information critical to the learning process. It has been suggested that technologies have the "ability to level the playing field for disadvantaged learners and can play an important role for such individuals in extending their life chances" (Beevers & John, n.d., p. 8). Tests that are created and delivered online using various technologies have the potential to be less stressful for some students who have disabilities compared to paper-based tests when learners have the ability to display the test in a way that will meet their accessibility needs (e.g., ability to change backgrounds, fonts, letter spacing, flexible navigation, etc.) (JISC, 2007; Sloan & Walker, 2008). There is evidence that dyslexic students may find online assessments less stressful particularly if
the tasks required have less emphasis on spelling and grammar (Ricketts & Wilks, 2002 cited in Sloan & Walker, 2008).

Data input supports also can help those students who have other types of disabilities (Sloan & Walker, 2008). Online tests can allow for increased flexibility through alternative methods to input test responses (e.g., audio and tactile interactions can be supported respectively through screen readers and braille displays (Sloan & Walker, 2008)). Learners may be better supported when all windows, menus and dialogue boxes are usable by keyboard navigation and by ensuring that keyboard focus is not restricted to one area of the page (e.g., in a media player or rich text editor) (Draffan, Wald, Newman, Skuse & Phethean, 2010). New innovations such as the integration of learning analytics tools, the broad adoption of new devices and Web 2.0 tools, and increased user familiarity with virtual learning environments have the potential to be beneficial for learners with a full range of differing ability levels and presentation requirements (Cooper, Sloan, Kelly & Lewthwaite, 2012; Middlemas, 2010).

2.1.3 Key players

There are a number of key players who support learners with disabilities who take online tests including instructors, accessibility advocates and specialists, and software, specification and standards developers. Of these three groups, instructors and accessibility advocates and specialists may have the most direct contact with students who are taking online tests. Software, specification and standards developers provide some of the underlying software and infrastructure that support test creation and delivery. There also are many other players who are crucial to student success and provide much needed support for continued academic development and growth. However, for the purposes of this study, the main input has been provided by instructors; accessibility advocates and specialists; and, software, specification and standards developers.
2.1.3.1 The critical role of Instructors

The faculty-student relationship can make a difference in the success of a student who has a disability in a higher education setting (Hartman-Hall & Haaga, 2002 cited in Orr & Hammig, 2009). Students are more likely to seek help when they have had a previous positive experience receiving assistance from an instructor (Hartman-Hall & Haaga, 2002 cited in Orr & Hammig, 2009). Although instructors may wish to help their students, they may be reluctant to engage with students more fully if they feel they do not have the knowledge or resources to support their students (Mull, Sitlington, & Alper, 2001; Muller, 2006 both cited in Orr & Hammig, 2009; Seale & Cooper, 2010).

According to the literature, there are several approaches that faculty can take to ensure student success, such as using multiple presentation alternatives, employing inclusive instruction and assessment strategies, providing learner supports, individual learning plans, and instructor empathy and approachability (Matthews, 2009; Orr & Hammig, 2009). Prior training regarding issues related to accessibility has been shown to have a beneficial impact on instructor attitudes and perceptions that in turn may positively impact on students’ learning (Murray, Lombardi, Wren & Keys, 2009).

As well, the development of validated tools such as the ExCEL Survey can be used to measure faculty willingness to accommodate and employ Universal Design principles (Lombardi & Murray, 2011). Instructors can use these types of tools to self-test and receive feedback as to where improvements could be made in instruction delivery and planning (Lombardi & Murray, 2011). Administrators can use these types of tools in order to plan targeted professional development training for instructors (Lombardi & Murray, 2011).

Once test questions have been developed and piloted, they can help to save valuable instructor time and resources through automated grading (Maurice & Lissel, 2006) and the
provision of pre-determined feedback. Multimedia content, such as video, audio, and graphics, can be incorporated (Maurice & Lissel, 2006) in a manner that is relevant to the subject matter. Students may be allowed to retake the quiz and to determine their own progress in relation to the course learning outcomes (Maurice & Lissel, 2006).

As test creators, instructors play an important role in students learning experiences. Instructors may gather online test items from a variety of sources and use different delivery methods. For example, instructors may create online tests from item banks that they develop themselves, collaboratively with other instructors, or from publisher-developed item banks. Instructors can migrate test items across different IT systems; and they can make use of textbook publisher item banks by importing packages of questions into learning management systems, for example (Johnson & Huczynski, 2006). In order to do this efficiently, the tests and test items must adhere to specific technical standards.

It is the instructor who creates an effective learning environment and is an important source for educational change (Hargreaves, 1992 cited in Condie & Livingston, 2007) and student success. In addition to using technologies to assess the student attainment of learning outcomes in an accessible manner, instructors (among other activities) may (Markauskaite et al. cited in Markauskaite, 2007), among other things, analyze student ICT support requirements, and plan for and manage ICT used in their own classrooms. Also, instructors often need to evaluate different instructional and technology alternatives and integrate ICT within learning activities. Following the use of an online test, the instructor also critically evaluates instructional practices and the technologies used to support teaching and learning.

With regard to online tests it is important that instructors (Ashton, Beevers & Thomas, 2008) know and understand enough about e-assessment to address issues that might arise. As well,
they need to be aware of and understand assessment best practices. It is helpful if instructors have the technical skills to create tests that are valid and reliable. In addition, they need to be provided with access to resources and tools that are easy to use. As well, instructors need to have access to good quality professional development opportunities.

2.1.3.2 Accessibility Advocates and Specialists

Although instructors have a primary role in supporting student learning, there are other accessibility experts and advocates within higher education institutions who assist students by helping to determine their requirements and by providing resources to facilitate access to information. For example, accessibility advocates may provide and assist with resources for students who have disabilities, such as technologies like magnification and/or speech output software (e.g., JAWS), large monitors, electronic notetakers, head pointers, keyboard or mouse accessibility utilities, keyboard overlays, predictive word processors, touchpads, trackerballs, joysticks, voice recognition software, and many other devices, hardware and software (Becta, 2000; Waterfield & West, 2008).

Accessibility advocates and specialists may provide advice and guidance to students (Elliott & Wilson, 2008). They raise awareness and provide training for instructors and other teaching staff, such as teaching assistants, regarding issues and experiences of students with disabilities; in addition, they explain strategies that can be used to support teaching and learning (Elliott & Wilson, 2008). They can be involved in the testing and evaluation of software and highlight many issues that need to be addressed to support more accessible creation and delivery of online tests (Draffan, Wald, Newman, Skuse & Phethean, 2010).

2.1.3.3 Software Vendors, Specification and Standards Developers

Accessibility advocates and specialists, together with software vendors, specification and standards developers, may make suggestions regarding improvements needed to software and
underlying IT systems that are needed to support instructor and learner use of technology for online tests (Bacon, 2012; Sloan & Walker, 2008; Young, 2011). Guidelines, checklists, specifications and standards may be specifically developed for those who provide software and that impact on tests that are created and delivered using technology (Draffan, Wald, Newman, Skuse & Phethean, 2010; Sloan & Walker, 2008). In addition, vendors and developers can take a leadership role in incorporating accessibility into their online systems (Sloan & Walker, 2008) and provide practical experience and insight into the development of supportive structures such as specifications and standards.

2.1.4 Higher education context

These three groups of key players work within an environment undergoing constant change where there are (among many other factors) (Jamieson, 2012; Waterfield & West, 2010) ongoing debates regarding issues such as assessment validity, marker reliability, alignment of assessments with intended learning outcomes. As well, there are pressures regarding the establishment of competency-based achievement measures that are reliable, efficient, and minimize plagiarism. In addition, institutional challenges exist to meet instructor interest in and also resistance to new views of integrating assessment as a form of learning (e.g., in some cases rigid institutional rules have been created that favour standardization through the use of traditional forms of assessment (such as examinations) and there are examples where newer forms of assessment have been approved at an institutional level). There are also increased student demands for assessment approaches, course structures, and delivery modes that are more innovative and flexible.

These demands, challenges, pressures, and debates are occurring in environments where there are new and emerging technologies that need to be integrated. This can be particularly
challenging when there are transitions to shorter information cycles and the introduction of interdisciplinary practice where new knowledge needs to be understood, considered, and evaluated. Higher education instructors and staff must negotiate and integrate diverse information, guidance, and opinions regarding pedagogical theory and application. They must be aware of and conform to regulatory and legislative requirements. They themselves may experience barriers and issues regarding accessibility of the technologies they use to assess. As well, the institutions in which they work are experiencing increased fiscal pressures (Jamieson, 2012), which can impact on availability of resources available to support their assessment activities.

2.2 Disability, accessibility and online assessments: An overview

Theoretical understanding of disability has been framed from different perspectives such as 'medical', 'social', and 'capability' (Dubois & Trani, 2009), and as well understanding of accessibility has been informed by ideas from the field of architecture. These differing perspectives provide insight and alternative viewpoints that may inform instructor practice and the way that software, standards and specifications are developed, ultimately impacting on learner interactions with online tests.

2.2.1 'Medical', 'social' and 'capability' perspectives of disability

Adherents of the 'medical' approach view disability as a physical condition in which the disabled individual deviates from what might be considered as a physical norm (Amundson, 2000; Marks, 1999; Pfeiffer, 2001 all cited in Dubois & Trani, 2009). Prevalence of disability is measured by categorizing individuals into distinct groups with well-defined boundaries (e.g., blind, paraplegic, etc.) (Dubois & Trani, 2009). In the 'medical' view, professionals, such as doctors, nurses, teachers, teaching assistants, etc., are seen as those who provide rehabilitation
Research that is based on this perspective focuses on health aspects and is characterized by detailed classification approaches that focus on documentation, structured frameworks, and categorization of individuals (Dubois & Trani, 2009).

Those who focus on a 'social' perspective view disability as being the result of the economic and social environment (Dubois & Trani, 2009). Instead of physical or cognitive measures, prevalence of disability is understood in terms of the social attitudes encountered and whether the environment is able to meet the needs and requirements of the disabled individual (Hahn, 1986 cited in Dubois & Trani, 2009). Research that is based on this perspective focuses on barriers that are encountered by disabled individuals in social contexts, and the focus is on redesigning society to meet the needs of individuals (Oliver, 1996 cited in Dubois & Trani, 2009). In addition, specific attention may be given to individuals who are oppressed or discriminated against (Barton, 1993 cited in Dubois & Trani, 2009).

Theorists who have developed the 'capability' approach envision each individual as having a 'capability set' that allows the person to function and achieve using resources and alternative choices available (Dubois & Trani, 2009). Based on the work of Amartya Sen (an economist) and further developed by Martha Nussbaum (a philosopher), the 'capability' approach views disability from a sociopolitical perspective (Nussbaum, 2000; Sen, 1999 both cited in Dubois & Trani, 2009). In this view disabled individuals may not be able to perform the same actions or achievements as others given the same set of available commodities (Sen 1985 cited in Dubois & Trani, 2009). Research that is based on this theoretical perspective gathers data related to individuals' potentialities, accomplishments, and vulnerabilities with respect to a defined 'capability set' (Dubois & Trani, 2009).
2.2.2 The influence of architecture on pedagogical approaches to accessibility

Disciplines such as architecture have informed understanding of pedagogical approaches like inclusive design and universal instructional design (Orr & Hammig, 2009; Passman & Green, 2009; Smith et al., 2010). One of the major influences of accessibility research is the work of architect Ronald Mace, who emphasized the need to eliminate architectural barriers for those who have physical disabilities (Center for Universal Design, 1997; Scott et al., 2003 both cited in Orr & Hammig, 2009). Mace has greatly influenced thinking regarding the development of instructional resources and activities within online learning environments.

The implementation of universal instructional design principles and strategies, such as the 'curbcut' approach, encourage the use of instructional practices that are straightforward and intuitive to support flexible and equitable teaching (Orr & Hammig, 2009). The idea behind the 'curbcut' approach is that a small and easily integrated change, such as a curbcut in a sidewalk, can benefit not only individuals with disabilities but all individuals, thus making sidewalks much easier to traverse for those with bicycles, skateboards, shopping carts, strollers, etc. Similarly, when technology is used, a small change such as adding alternative text to images can be used by those who have a visual disability as well as by individuals who have turned off images in their web browser. Similarly, described and captioned video is useful for individuals who, for example, wish to search and access video information content quickly and efficiently; are learning another language; may be working in environments that are noisy; as well as, have difficulty hearing.

Approaches such as Universal Instructional Design emphasize the importance of critical changes that can be incorporated to make learning resources, activities, and assessments more inclusive and accessible. Resources may be provided in multiple formats in order to make
instruction more accessible to a broader range of individuals regardless of their abilities (Orr & Hammig, 2009; Passman & Green, 2009). These resources may be developed over time during successive iterations of a course or a program.

### 2.2.3 Considerations related to Tests in Higher Education Online Learning Environments

Computer Assisted Assessment (CAA) has been used within higher education in various ways including objective testing, adaptive testing, discussion board content analysis, and essay marking (Burstein et al., 2001; Christie, 1999; Latu & Chapman, 2002; Macdonald & Twining, 2002; Mills et al., 2002; Pain & Le Heron, 2003; Sim et al., 2003; Walker & Thompson, 2001; Whitfelt et al., 2002 all cited in Sim, Holifield, & Brown, 2004). It involves using computers in order "to deliver, mark, or analyse assignments or exams" (Sim, Holifield, & Brown, 2004, p. 217). An e-assessment refers to one or more items marked, delivered, or analyzed through the use of one or more technologies (e.g., computer, mobile device, tablet). A test that is created and delivered using one or more technologies is a type of e-assessment.

### 2.2.4 1st, 2nd, and 3rd Generation e-assessments

It has been suggested that the pedagogic acceptance of e-assessments has been influenced by the availability of technologies that can be used to assess higher order thinking skills and a full range of educational objectives (Ashton, Beevers & Thomas, 2008). Bennett (1998 cited in Ashton, Beevers & Thomas, 2008) predicted that the development of technology would enable progress through three generations of e-assessments. Observations regarding the characteristics that would mark each of the three generations of e-assessment are provided below (Ashton, Beevers & Thomas, 2008, pp. 4 – 7) and include "traditional questions converted to electronic format; an increasing use of interactive multi-media to open up new possibilities; and breaking
down the barriers between assessment and learning – students assessed as they learn through complex interactive environments."

With regard to 1st generation questioning, there are many current systems that support selected response (multiple choice) questions; however, there are many other types of traditional question types such as constructed response questions (Ashton, Beevers, & Thomas, 2008) that may not be as well supported. In addition to technological limitations of the test software, a key issue for 1st generation e-assessments is the need for training regarding how to prepare pedagogically sound questions that avoid pitfalls that have been well-documented (Ashton, Beevers, & Thomas, 2008).

In e-assessment systems that are characterized as being 2nd generation there are new types of question formats that incorporate the use of multimedia to extend traditional methods of assessment. For example, learners may be required to view a video or listen to an audio file and answer questions using text, audio, or video media. Other activities they may be required to do include creating a website that meets specific criteria using information that has been gathered by them or provided to them or interacting with animations or simulations and providing a reflection on their experiences. In a 2nd generation e-assessment, learners may be asked to participate with the instructor and other learners using discussion boards, wikis, or blogs. The pedagogical impact of these types of assessment needs to be carefully considered, as increased media use may change construct validity depending on the original intention of the instructor who created the test (Ashton, Beevers & Thomas, 2008).

The 3rd generation of e-assessment is characterized by a high degree of learning and assessment personalization (Ashton, Beevers & Thomas, 2008). Assessment is completely integrated into the learning process and is closely linked to the personal needs of the student and
the learning context (Ashton, Beevers & Thomas, 2008). It is integrated into teaching and learning processes and available on demand (Ashton, Beevers & Thomas, 2008). The test system is adaptable and provides learning content that helps to reinforce knowledge, builds on learner strengths, addresses areas for improvement, and suggests new topics for exploration (Ashton, Beevers & Thomas, 2008). It represents the reinvention of assessment and reduces the barriers between assessment and learning (Ashton, Beevers & Thomas, 2008).

2.3 Barriers to accessibility of online tests and related issues

There are challenges associated with creating and delivering tests online for students with disabilities that need to be balanced with the benefits that have been noted above. The presentation of online tests can have an impact on cognitive demands with respect to online reading of items, navigation through content, and use of multimedia and graphical question types (Draffan, Wald, Newman, Skuse & Phethean, 2010; Sim et al., 2004 cited in Sloan & Walker, 2008).

If online tests are not designed properly then accessibility challenges can be introduced inadvertently (Sloan & Walker, 2008). Certain question types, such as jumbled sentence, free text response, and drag and drop may be problematic for students with disabilities (Ferl/TechDis, 2003 cited in Dunn, 2003; Smith, 2008 cited in Sloan & Walker, 2008). Timed quizzes can be especially challenging as a previous study indicated that some learners with screen readers took essentially one third of their time completing assessment tasks, and the remaining test time was spent navigating and accessing test content in the virtual learning environment (Evans & Sutherland, 2002 cited in Dunn, 2003). Students with keyboard only access also have been found to have difficulty accessing content contained in rich text editors or within blogs, wikis, and other Web 2.0 services (Draffan, Wald, Newman, Skuse & Phethean, 2010). As well,
custom settings and additional tools may not be available to students on network campus computers (Draffan, Wald, Newman, Skuse & Phethean, 2010).

As class sizes increase, instructors find it difficult to assess the progress of large numbers of students, and to provide constructive and timely feedback that can be used to support learning achievement assessment (Angeli & Valanides, 2009). Although tests created and delivered in online learning environments can help, the use of computerized assessments may impact significantly on students who have a disability (Abreu-Ellis, Ellis & Hayes, 2009; Ball, 2009; Enjelvin, 2009). For example, depending on the technology affordances available it can take a blind student twice the time it takes for a sighted student to complete an assessment delivered using a computer (Enjelvin, 2009). Students with disabilities may prefer to take specific courses in certain subject areas (e.g., dyslexic students may prefer to take a biology course rather than a course in computer science or mathematics (Richardson, Taeko & Wydell, 2003 as cited in Badge, Dawson, Cann & Scott, 2008)). They may prefer alternative formats (e.g., video, audio, images, etc.) instead of large sections of text (Sloan, Stratford & Gregor, 2006 as cited in Badge, Dawson, Cann & Scott, 2008).

Accessibility issues may surface when tests or test items are shared and re-used within and across different institutions. For example, when item banks are used for e-assessments there may be potential issues with equivalency and comparability (Bennett et al., 1999; Clariana & Wallace, 2002 both cited in Sim, Holifield, & Brown, 2004; Ball, 2009).

Unlike other types of activities, assessment skills require that students can decode information, remember information, and present their responses in a coherent and organized way during the assessment (Abreu-Ellis, Ellis & Hayes, 2009). Research suggests that some disabled students may require additional supports to develop and exercise these skills (Abreu-Ellis, Ellis
& Hayes, 2009). As well, when students' disabilities are identified later when they attend a higher education institution, then they tend to struggle more with developing learning strategies to cope with test-taking than those who have had their disability identified earlier on at the secondary or primary levels in their academic career (Abreu-Ellis, Ellis & Hayes, 2009; Barnard-Brak et al., 2009; Madaus & Shaw, 2004; Scott, 1991).

It has been acknowledged that online tests do have their advantages; however, there are also challenges to the successful use of technology to support assessment activities in general and online tests specifically. Online assessments do take more effort and time to prepare (Jerry, 2000; Klass & Crothers, 1999 both cited in Maurice & Lissel, 2006). Students often only participate in online assessments when they are mandatory (Klass & Crothers, 1999 cited in Maurice & Lissel, 2006). This suggests that, when online tests are being used, it may be effective to assign a small portion of a final grade, such as a participation mark, for the successful completion of assessment components. Instructors may introduce additional accessibility challenges through inappropriate assessment designs (Sloan & Walker, 2008).

To support the formative assessment component of online testing, it may be helpful that technologies incorporate more discrete information related to student responses such as measures of confidence (Stankov & Crawford, 1996). Providing the option to have sequential or simultaneous presentation of items is another functionality that can be useful in an online testing situation. Students sometimes indicate that the sequential presentation of items in a test is more "difficult" as they rely on short-term memory and do not allow for re-checking of answers (Stankov & Crawford, 1996).

Finally, anxiety levels and lack of test strategies may be more pronounced for students who have a disability. For example, using the Learning and Study Strategies Inventory (LASSI)
Anxiety Scale, it was discovered that students who have a learning disability tend to exhibit anxiety at higher levels specifically related to success and performance at the postsecondary level (Abreu-Ellis, Ellis & Hayes, 2009). It has been suggested that this anxiety may stem from "lower self-efficacy, and their self-perceived levels of competence and their actual achievements" (Helman, 2006 cited in Abreu-Ellis, Ellis & Hayes, 2009, p. 32). Although some anxiety may be viewed as a positive motivator, at higher levels anxiety can become problematic for academic performance (Cassady & Johnson, 2002; Elliott & Wilson, 2008; Furlan, Cassady & Pérez, 2009; Wachelka & Katz, 1999 as cited in Abreu-Ellis, Ellis & Hayes, 2009). As well, students who have a disability scored lower on the Test Strategies component of the LASSI, and furthermore, a statistical difference was discovered between those who had their disability identified earlier in their academic career compared with those who have had their disability identified later in their academic career (Abreu-Ellis, Ellis & Hayes, 2009).

2.3.1 Other challenges of online tests

There are a number of other challenges with respect to online tests that are provided to students with disabilities. Some of these other challenges that are noted in the literature include lack of awareness regarding accessibility and disabilities, limited management support, no access to instructional design support, and time constraints for course development (Dunn, 2003). Additionally, it was suggested that the online learning environment in which the test is being provided may not be equipped with adequate technical support, may not provide access to appropriate authoring tools (e.g., might produce poorly structured HTML) (Dunn, 2003; Sloan & Walker, 2009 cited in Draffan, Wald, Newman, Skuse & Phethean, 2010).

There may be limited or no cooperation between instructors and other teaching staff, accessibility advocates and specialists, and technical support specialists (Dunn, 2003). Another
issue that was noted was the possible lack of central coordination to check and verify the accessibility of tests in online learning environments (Dunn, 2003). There may also be challenges with regard to technical (software/hardware reliability, authentication, security), proper dissemination of procedures and guidelines for accessible online tests, insufficient staff understanding and skills, and lack of specialist and administrative support regarding legal matters (e.g., data protection, intellectual property rights, plagiarism) (Ashton, Beevers & Thomas, 2008; Harper & Chen, 2012).

2.3.2 Pedagogical challenges

A key concern is assuring that online tests provided to students with disabilities do not compromise academic requirements that have been determined by higher education institutions (SWANDS, 2002). There is concern that in some cases the use of accessibility functionalities could conflict with or threaten validity, and in order to address this issue it is important to understand the test objectives (Ashton, Beevers & Thomas, 2008; Strobbe, 2006 cited in Draffan, Wald, Newman, Skuse & Phethean, 2010). Validity is defined as the "degree to which accumulated evidence and theory support specific interpretations of test scores entailed by proposed uses of a test" (AERA, APA & NCME, 1999, p. 184). Any alternate forms of an assessment need to balance the accommodation of the student's functional requirements arising from a disability with the objectives of the test. Various functional differences could include items such as communication methods, physical considerations, learning styles, etc. (SWANDS, 2002). An alternate form is defined as (AERA, APA & NCME, 1999),

Two or more versions of a test that are considered interchangeable, in that they measure the same constructs in the same ways, are intended for the same purposes, and are administered using the same directions (p. 171).
The intent is that the assessment results reflect the students' ability and not the impact of the disability (SWANDS, 2002), this is also referred to as construct irrelevant variance, which can lead to test bias (E. Jang, personal communication, January 12, 2014). To assist with alternative assessment strategies there are at least three aspects to consider, including (SWANDS, 2002, p. 86) first, "the range of assessment methods currently applied within the course or module"; second, "the viability of alternatives for assessing the learning outcomes of the course"; and, third, "the impact of the disability on the particular individual". Other pedagogical challenges include insufficient information regarding evidence-based practice (e.g., how to author, mark and report an online test), limited information regarding validity and reliability issues, and ensuring that the online test is structured to be accessible to a diversity of different learners (Ashton, Beevers & Thomas, 2008; JISC, 2007) as well as being in alignment with the curriculum.

2.4 Strategies and practices to create and deliver accessible online tests

Tests may be used to monitor progress and provide useful information to students and instructors regarding background knowledge, current knowledge levels, and gaps in understanding. Instructors can develop and share test bank questions that may be delivered to students (Maurice & Lissel, 2006) electronically outside of class time. The results of the tests can highlight problem areas and can help instructors to tailor their instruction sessions to topics with which students are experiencing difficulty (Maurice & Lissel, 2006). Supporting communication between student and instructor is an important requirement, and relates to another way that technology can be used to blend learning and assessment and more specifically to support the use of online tests. Guidelines, specifications, standards, and other helpful resources can address and help to overcome some of the identified issues and barriers. As well,
practices and strategies have been developed at various levels to attempt to meet the accessibility requirements of students.

2.4.1 Strategies and practices specifically targeted to accessibility requirements of students

There are a variety of strategies and practices that can be used to support students who have accessibility requirements and are taking tests in higher education online learning environments. During an e-assessment session there are many different variables that may impact on student performance such as monitor, text display, monitor reading speed, single question versus all-at-once display (Dyson & Kipping, 1997; Liu et al., 2001; Mayes et al., 2001; Schenkman et al., 1999 all cited in Sim, Holifield, & Brown, 2004). Students who have disabilities may be provided with an accommodation or modified questions in order to facilitate assessment of learners' abilities, knowledge, skills, etc. (Waterfield & West, 2008).

2.5.1.1 Accommodation

Accommodation tends to be of a procedural nature and is usually customized to an individual learner’s needs. Accommodations may include things such as increased time, quiet segregated location, assistive technologies such as screen reader or text enhancement software, voice-over, alt-text, a reader for exams, captioned or described video, etc. (Abreu-Ellis, Ellis & Hayes, 2009; Ball, 2009; Enjelvin, 2009; Waterfield & West, 2008). Accommodations may be employed to ensure that students have the necessary supports in place to complete the online test. In these situations, the accommodation is used to assure equity and fairness particularly when e-assessments are being used to establish competency with respect to a qualification or certification (Ball, 2009).
Much of the research regarding students who have disabilities and assessment strategies that are inclusive seems to focus on testing accommodations and how they impact on test performance (Sireci, Li & Scarpati, 2003 as cited in Roach et al., 2010). Previous research findings have been inconsistent and challenging to interpret (Ketterlin-Geller, Yavonoff, & Tindal, 2007 as cited in Roach et al., 2010) as the research designs used varied; there were differences in the procedures used to implement the accommodations; and, there were limitations related to the student samples.

Additionally, research has been completed regarding learners’ perceptions related to utility and fairness of accommodations (Elliott & Marquardt, 2004; Fulk & Smith, 1995; Kosciolek & Ysseldyke, 2000; Lang, Elliot, Bolt, & Kratochwill, 2008; McKevitt & Elliot, 2003; Nelson, Jayanthi, Epstein, & Bursuck, 2000 all cited in Roach et al., 2010). These studies used a variety of methods such as interviews, rating scales, questionnaires, open-ended questions and found, for the most part, that both students who had a disability and those who did not perceived testing accommodations implemented for students with disabilities and for other students who needed them as being fair (Lang et al., 2008; Nelson et al., 2000; Polloway, Bursuck, Jayanthi, Epstein, & Nelson, 1996 all cited in Roach et al., 2010).

2.5.1.2 Test Item Modifications

According to the Standards for Educational and Psychological Testing (Standards for Testing) (AERA, APA & NCME, 1999, p. 183 as cited in Roach et al., 2010) modifications are “changes made in the content, format and/or administration procedures of a test in order to accommodate test takers who are unable to take the unmodified test under standard test conditions” (p. 62). In the Standards for Testing chapter that is focused on disabilities it is noted there is, “No connotation that modification implies a change in the construct(s) being measured
is intended” (p. 101 cited in Roach et al., 2010, p. 62). There are different types of modifications that can be used to support students with disabilities (Roach et al., 2010).

Alternate test items are created when modifications are made to the actual anatomy of the test item (alternate modified) (Roach et al., 2010). Although these seems to be some research literature focused on accommodations, there seems to be limited research articles focused on the use of response data from students to assist with test construction (Roach et al., 2010).

Stakeholders, such as students, can provide information that enhances both evidence validity and improves test accessibility (Roach et al., 2010).

Alternate modified questions tend to be based on the documented needs of a specific group of students. Alternate modified questions include modifications that tend to be structural and under the control of test developers through pilot testing with a target audience (Roach et al., 2010).

Some examples of alternate modified changes to questions include (Roach et al., 2010): language simplification (e.g., item stem, response options or initial passage); additional visual and graphic support; reading supports, such as bolding of key terms related to vocabulary and comprehension; and, increasing white space for response options.

Modified alternate test items may be developed through testing with the target learners as noted in the Standards for Testing 10.3, which states that:

Where feasible, tests that have been modified for use with individuals with disabilities should be pilot tested on individuals who have similar disabilities to investigate the appropriateness and feasibility of the modifications. (AERA, APA & NCME, 1999, p. 106 as cited in Roach et al., 2010, p. 63)

In addition, different procedures and tools can be used to assist with the development of alternate modified questions, such as think-aloud protocols, alternate item development processes (e.g., the Consortium for Alternate Assessment Validity and Experimental Studies (CAAVES)
project), item databases (e.g., Discovery Education Assessment (DEA) database), models and
guides (e.g., Webb’s Depth of Knowledge model) (Roach et al., 2010).

2.4.2 Guidelines, Specifications, and Standards

As instructors experiment and explore test options and combine tests with newer methods
of assessment, such as learning objects, games, and other activities, there may be requirements
for technical interoperability so that assessment information can be captured, stored, and
presented within learning environments such as course management systems (Torrente et al.,
2009). There are a number of guidelines, specifications, and standards and other tools that can
be used to support accessibility of tests in higher education online learning environments. For
example, the W3C Web Accessibility Initiative (WAI) has developed the Web Content
Accessibility Guidelines (WCAG), which may be used to ensure that web-based content is
delivered in an accessible manner (Seale & Cooper, 2010). Guidelines specific to e-assessment
have been developed by JISC (Joint Information Systems Committee) TechDis service (Ball,
These guidelines may be used by instructors and instructional technology specialists in order to
develop institutional best practices and to inform the development of e-assessments.

Specifications, such as IMS Question Test Interoperability (QTI), IMS Content
Packaging, IMS Common Cartridge, IMS Access-for-All metadata specification, and
Accessibility Learner Information Profile (ACCLIP) (Anido-Rifón, 2008; Ball, 2009; IMS,
2012; IMS, 2009, Joosten-ten-Brinke et al., 2007; Seale & Cooper, 2010; Young, 2011) provide
a technical basis for the interoperability to support the migration and exchange of e-assessment
tests, items and related content. Finally, at the national and international level standards have
been published (e.g., BS 8878; ISO/IEC 24751) and can be used to support accessibility and
interoperability (ISO, 2008; IMS, 2012; BSI, 2013). The development of standards at this level has the potential to support the transnational exchange of online tests and test items to support human development across different regions.

However, it should be noted that the use of a standard or a specification does not necessarily mean that a technology is accessible or that it meets certain quality levels (Ball, 2009). Technology itself is continually changing and advancing (Ball, 2009), which can impact significantly on accessibility. Additionally, the testing of current accessibility and interoperability or data sharing capacity seems to be mainly ad hoc with little formalization (Ball, 2009).

2.4.3 Other technical functionalities

There are other technical functionalities that can support assessments in general and online tests more specifically. For example, a timer can be used to help students to gauge whether they have grasped the material sufficiently to respond given time constraints (Maurice & Lissel, 2006). In addition, parametric questions (Maurice & Lissel, 2006) and randomization can be used to help generate unique online tests for each student; this can provide students with more honest and objective feedback information and can reduce the temptation to cheat.

Other considerations that apply to online assessments more generally are the need to recognize that students have varying technical skills and learning disabilities. It is essential that technology be carefully designed, user-friendly, and easy to access to reduce stress and anxiety and to promote a positive learning environment (Jobst & Wahlstrom, 1984; Schacter, 1999 both cited in Maurice & Day, 2004; Maurice & Lissel, 2006) and that alternatives be provided to meet the needs of students.

Prior knowledge and learner control have the potential to impact positively on the effectiveness of learner tests (Nicol & Macfarlane-Dick, 2006) for online tests and for other
forms of assessment. Students must draw on their prior knowledge (Nicol & Macfarlane-Dick, 2006) and experience in order to determine the relevance of learning within a personal context. Sequencing decisions and branching options afforded by technologies need to support and adapt to the learner's individual characteristics (Gogoulou et al., 2007), background experiences, and preferences especially during online test activities. As well, the possibility for students to make choices that will impact on outcomes can help to promote intense, sustained effort (Lepper, 1985 cited in Gogoulou et al., 2007).

2.6 U.K. approaches to disability, accessibility and online tests

2.6.1 U.K. Legislative and Regulatory Requirements

Disability issues are recognized at the international and national levels. At the international level, organizations such as the UN and UNESCO have developed formal conventions, statements, and frameworks that indicate disability should not be a barrier to education (e.g., through the UN Convention on Rights of Persons with Disabilities (2007 cited in Dubois & Trani, 2009,) and the UNESCO Salamanca Statement and Framework for Action on Special Needs Education (1994 cited in Michailakis & Reich, 2009)). At the national level in the U.K., there are several examples of legislation that govern responsibilities for higher education institutions such as the Special Educational Needs and Disability Act (2001 cited in Sim, Holifield, & Brown, 2004), which is part 4 of the Disability Discrimination Act (U.K.) (1995 cited in Enjelvin, 2009), and more recently the Equality Act, which was published in 2010.

It should be noted that legislation regarding disability in different parts of the world requires that higher education instructors by law must make sure that the content and technologies they use and develop are accessible (Her Majesty's Stationary Office, 2001; United States Department of Labor, 1973 both cited in Seale & Cooper, 2010). However, few
instructors are aware of the processes that can be used to make their technology-supported content accessible (Seale & Cooper, 2010).

In the U.K. the Special Educational Needs and Disability Act (SENDA) 2001, Part 4 of the Disability Discrimination Act provides a framework for provision of higher education services to students. Under SENDA higher education institutions acquired 'anticipatory duties' with respect to assessment and other aspects of teaching and learning (Waterfield & West, 2010, p. 6). SENDA provides a platform from which compliance regarding higher education institution activities can be audited and establishes a model of "inclusivity through 'good practice'" (Waterfield & West, 2010, p. 6). It essentially changed the higher education environment from being predominantly reactive to move towards a requirement for proactive action. As of September 2002, it became an offence for these institutions to discriminate against students who have a disability (Seale, 2003). The expectation was that equity was to be embedded in all functions of higher education institutions (May & Bridger, 2010).

Although governing bodies were seen to be accountable according to the law, all staff were expected to participate (Dunn, 2003; Ferl/TechDis 2003). Instructors and other teaching staff were required "to make reasonable adjustments to their teaching practice and teaching materials to ensure disabled students can participate in the learning environment" (Dunn, 2003, p. 24 – 25; Ferl/TechDis, 2003, p. 2, 3). The responsibility for the implementation of a holistic approach across the institution was declared to be a responsibility that would be shared by everyone at the institution (May & Bridger, 2010). This new focus was included in the Disability Discrimination Act when it was amended in 2005 and also within the Code of Practice developed in 2006 (and further described below in section 2.5.2).
Specifically SENDA requires that all education institutions (Dunn, 2003, p. 21): make reasonable adjustments to allow for the accommodation of students with disabilities; not treat students less favourably than others; and, act in an 'anticipatory capacity'.

Exemptions to SENDA include adjustments that might (HMSO, 2001 cited in Dunn 2003, p. 24): impact negatively on academic standards; cause financial hardship for the higher education institution; infringe on health and safety legislation; and, adversely impact on other students.

Newer legislation, such as the U.K. Equality Act (2010), also impacts on how instructors assess their students. The changes have spurred the strategic review and revision of higher education institution systems and practices with the intent to eradicate discrimination and to share responsibility and accountability for inclusion and equality (May & Bridger, 2010, p. 17). Many higher education institutions have established ongoing professional development programs. In addition, they have encouraged 'buy-in' from instructors and support staff to further develop understanding about how the legislation impacts on roles and practices (May & Bridger, 2010, p. 17). At the regional and higher education institutional levels, there are policy, guidelines and practice documents that have been developed to guide higher education instruction in response to these changes within the U.K. legislative and regulatory framework.

2.6.2 Other U.K. approaches

In 2006, a report entitled, *Accessibility in e-Assessment Guidelines Final Report* was commissioned by JISC TechDis for the E-Assessment Group and the Accessible E-Assessment Forum. The report was intended for all organizations in the U.K. that designed and developed e-assessments (2006). In the report, accepted practices were outlined, such as (EdExcel, 2006, p. 5) ensuring that the e-assessment system have accessibility features and the ability to store learner preferences regarding those features required to support learners taking the test; and, established rules in place regarding whether the questions are able to be accessed equally and if
not then how rules related to accommodations and modifications would be applied so that all learners would have the opportunity to have their abilities measured equitably.

The report was intended to stimulate discussion and debate and it provided (Ball, 2009, p. 22 – 31; Edexcel, 2006, pp. 7 – 31): the context set against the legislation of the time; a set of terms and definitions; underlying principles; practical steps regarding compliance; the development process for e-assessments; and, cost-benefit analysis.

In addition, detailed question guidelines were provided in Appendix 2 of the EdExcel report (2006). Of particular interest in the report is the test specification, which indicates that (Edexcel, 2006, p. 12)

In relation to qualifications the DDA makes a key distinction between an awarding body’s duty to make reasonable adjustments to the assessment process and its right not to adjust the competence standards inherent in a qualification. The specification must (among other things) therefore address two key issues:

- Complete clarity on the competence standards underpinning a qualification and which of these are mandatory – hence this establishes at the outset what justifications may exist for providing a non-accessible assessment
- Definition of whether the competence standards require testing via e-assessment. If this is not the case, alternative equivalent means of assessment (e.g. a paper assessment) may be considered as one method of ensuring accessibility. (Ball, 2009, p. 24)

TechDis, the advisory service on disability that commissioned the EdExcel report, has created and published a wide variety of different tools that can be used to support accessibility. In addition TechDis has supported the development of many different projects and initiatives that support the accessibility of tests in online learning environments. Some examples of this work are provided below in section 2.5.4.

In addition to this landmark Code of Practice, subsequent work, such as the Disability Rights Commission Code of Practice recommends that assessment and other learning and teaching practices should be designed with accessibility in mind right from the outset and
minimal adjustments be made that are based on the requirements of individuals (Elliott & Wilson, 2008). Higher education institutions have been asked to focus on the requirements of a range of learners and to plan proactively. Revisions made to the QAA Code of Practice for Disabled Students (2010) also focuses on inclusivity and emphasizes the need for flexibility in how opportunities are provided to allow students to demonstrate acquisition of learning outcomes (Waterfield & West, 2010). Thus, instead of focusing on 'disabled' or 'non-disabled' U.K. higher education institutions have been asked to recognize that learners are individuals with different learning requirements, which impacts on how assessment is both organized and delivered in academic programs (Waterfield & West, 2010).

One common practice across U.K. colleges and universities is the use of the University and College Admission Service (UCAS) form to invite prospective students to disclose their disabilities. The UCAS form includes nine disability categories that have been medically defined (Matthews, 2009). Students identify themselves according to the different categories and the information is gathered and may be shared with module or course instructors and disability welfare services (Matthews, 2009). The information provided at this point is viewed as a starting point and may be provided as a list to instructors or administration and supplemented by additional information, such as educational psychologists' assessments (Matthews, 2009).

### 2.6.3 Types of test systems and tests identified in the U.K.

In addition to legislation and other approaches, such as Codes of Practice, related to accessibility of tests in online learning environments, the U.K. has defined a Framework for Reference Model for Assessment (FREMA), which indicates the variety of different IT systems that may be used to deliver different types tests. Different IT systems that are used to deliver include (FREMAWiki, 2006; Millard et al., 2005),
• Learning Management System – “Assessment which takes place within an overarching digital environment in which the candidate learns and interacts with other learners as well as sitting assessments; virtual learning environments such as WebCT and Blackboard.”

• Assessment Management System – “Assessment which takes place within a discrete digital environment dedicated to the delivery of assessments; systems such as TOIA and Questionmark.”

• Component based system – “Assessment which takes place within a digital environment constructed from separate segmented elements often connected by web services; exemplified by the linking of specialised assessment systems such as AiM, STACK, ASSIS, APIS and ASAP using the Remote Question Protocol.”

• Other systems – Assessment that takes place using a computer and software but does not fit under one of the other types of IT systems.

One or more of these different types of assessment systems may be used by instructors and students within higher education environments.

The types of assessment that have been identified in the U.K. include (FREMAWiki, 2006),

• Formative – “Assessment undertaken to support the learning process, such as mid-unit self-tests, which may not receive a mark or where the mark achieved does not count towards the final formal grade for the course of study.”

• Summative – “Assessment undertaken to provide formal evidence of learning at the end of a course or course component, or which contributes to a candidate's overall grade for a course or course component.”

• Diagnostic – “Assessment undertaken before the start of a course of learning in order to evaluate the candidate's prior knowledge and possible support requirements.”

• Self – “An assessment which the candidate chooses to undertake and self-administer for formative purposes, and in which the result may remain private to the candidate.”

• Peer – “An assessment in which the candidate's mark is determined by other members of their cohort; candidates may also be evaluated by course staff on their performance in evaluating their peers.”

• Continuous – “An assessment approach under which all assessment undertaken by a candidate throughout a unit of learning is formally assessed and contributes to an accumulated end of unit grade. In some cases candidates may be permitted to 'drop' their lowest mark.”
• Adaptive – “Uses algorithms to present the candidate with items drawn from an item pool based on the candidate's previous performance within that assessment instance.”

• Other – Other types of assessment that may not come under one of the previous categories (e.g., certain types of surveys).

Instructors may use one or more of these different types of assessment depending on the higher education context for which the test has been created and will be delivered for students.

2.6.4 Some examples of U.K. accessible online assessment projects and initiatives

There are many examples of U.K. accessible online assessment projects, systems and initiatives that are inspirational and innovative. JISC TechDis has been an instrumental force to propel U.K. forward through funding initiatives such as the Heat Scheme (JISC TechDis, n.d.). In addition to creating some very useful resources such as SimDis, which allows individuals to experience simulations that reveal some of the impacts of several disabilities, JISC TechDis has funded projects such as EASiHE, where design and development for services such as QTI Engine, Peer Pigeon, QTI Migration Tool, Edshare, and LexDis were initiated (Bacigalupo, Warburton, Gilbert & Wills, 2010). The OASES Project is another exciting project that is based on a six-stage 'accessibility maturity model' (Ball et al., 2010; May & Bridger, 2010) and supports anonymous institutional benchmarking. Other examples include (but are not limited to) the Aim Higher Project (Elliott & Wilson, 2008), the COLA project (JISC, 2007), the Teachability project, the IDEAS project, and the DEMOS project (Dunn, 2003).

U.K. projects do not necessarily focus only on technology, but also on processes and procedures that can better support accessible assessments. The SPACE Project involved 800 students, some who had disabilities and others who did not (Waterfield & West, 2010). A total of 480 participants participated in pilot programs to explore the use of alternative and inclusive
assessments that were developed incrementally (Waterfield & West, 2010). Learners could select from four different assessment modes for identical learning outcomes including an end of module test, portfolio, weekly summative tests, and course work (Waterfield & West, 2010). Although increased staffing resources were required to manage the student assessment choices and to develop a consistent framework to support marking reliability, there was a reduction in the demand for 'special arrangements', and a marked increase of students who received grades of over 60% (Waterfield & West, 2010). In addition to maintaining academic standards, the project helped instructors and teaching staff to better understand student preferences for different assessments (Waterfield & West, 2010).

Similar to the SPACE project, at Roehampton University funding from a JISC HEAT3 program was used to obtain audio and video recording devices that were used to support equivalent and alternative multiple format assessments to replace assignments that were text-based (Middlemas, 2010). Although there was interest in exploring technology supported alternatives, both students and staff were reluctant to discontinue traditional essay assignments (Middlemas, 2010). Allowing students to have a choice in assignment format was seen to be a way of improving employment skills (Middlemas, 2010). Presentation recordings were used to create a permanent record of the assignments for grading (Middlemas, 2010). Several challenges were noted, such as the need for clarity regarding requirements and grading, time needed to complete assignments and the availability of support staff to assist students (Middlemas, 2010).

2.7 Summary

The literature suggests that accessible tests in higher education online learning environments may be viewed as a pedagogical issue. Assessment is considered to be an essential part of the 'making meaning' process of learning, and including accessibility considerations can be helpful so that instructors can connect their own teaching experiences together with the
learning requirements of their students. The use of technology can be leveraged to support the
display and input requirements of students so that online assessments can be adapted and
personalized to meet the requirements of learners. At the same time, online tests may introduce
new challenges such as increased cognitive load for students and present unintended design
issues that impede access.

The student experience is greatly influenced by the interactions of key players, such as
instructors, accessibility advocates and specialists. Learners and the key players who support
them can provide input that is helpful to software vendors, specification and standards
developers who develop the underlying systems used for online testing. These key players
interact within complex and ever changing higher education contexts that are influenced by
many different factors. They may view disability through a 'medical', 'social', 'capability', or
other lens. In addition, they may or may not be aware of various approaches to accessibility,
such as inclusive design and the 'curb cut' approach.

Those who are involved in higher education environments may use Computer Assisted
Assessment in various ways through the use of computers for marking, delivery, or analysis of
exams or assignments. Online tests themselves may be directly transferred from paper to online
(1st generation), include multimedia and be based on 'performance' within more authentic
scenarios (2nd generation), or be more closely aligned with 'assessment as learning' where
performance is assessed as students interact within more complex learning environments (3rd
generation).

Some of the barriers and issues regarding the creation and delivery of tests has been
identified in the literature include accessibility issues when test items are shared and re-used
within and across different institutions, problems with equivalency and comparability,
requirements for additional supports. Pedagogical challenges include concerns that accessibility functionalities that may compromise validity, the use of alternative assessment strategies, the need to separate the measurement of students' abilities from the impact of the disability, and others.

There are a variety of different strategies and practices that have been identified in the literature to meet the accessibility requirements of learners who are taking online tests. For example some strategies include the use of accommodations (mainly procedures, such as increased time, that are customized to an individual learner's needs), test item modifications, and other technical functionalities. As well, guidelines, specifications and standards may be used to assist with improving accessibility and interoperability of online tests.

The U.K. is a leader in the area of tests in higher education online learning environments. Over time successive improvements to the legislation have established the responsibilities of higher education institutions vis-à-vis online tests. Legislation, such as SENDA (2001), requires that educational institutions make accommodations for learners with disabilities and be proactive by developing 'anticipatory capacity'. They are also required not to treat learners with disabilities less favourably than others. Further guidance documents, such as the Accessibility in e-Assessment Guidelines Final Report (2006) indicate the need for clarity regarding competence standards that are mandatory and underpin a qualification. This emphasis on competency standards suggests that it may be challenging in certain contexts to make an assessment accessible and to determine what potential alternative equivalents of assessment may be used. The U.K. has defined a Framework for Reference Model for Assessment (FREMA) that can be used to identify different IT systems that are used to deliver online assessments and different types of assessments that may be used by instructors. As well, the U.K. is home to many IT systems and approaches that incorporate accessibility requirements of instructors and students and support the advancement of
knowledge and understanding through evidence-based practice in this area. Research regarding different methods and approaches to the creation and delivery of accessible tests is an ongoing activity of interest and exploration.
Chapter 3: Methodology

3.1 Introduction

This study focuses on the lived experiences of U.K. expert practitioners with regard to the accessibility of tests in higher education online learning environments. A mixed methods research methodology was used to better understand some of the commonalities in experience and practice in order to better understand both "what they [the expert practitioners] experienced and 'how' they experienced it" (Moustakas, 1994 as cited in Creswell, 2007, p. 59; Creswell, 2009). Information regarding the experiences and practices were gathered through direct data collection methods including interviews and surveys and was interpreted by the researcher. Significant statements and quotes were highlighted and clusters of meaning were developed into themes (Creswell, 2009; Creswell, 2007). As the researcher, I also reflected upon my own experiences, contexts, and situations (Creswell, 2009; Creswell, 2007).

In the subsequent sections of this chapter, I outline the research design and context, participants, research approach, and ethical considerations for this study.

3.2 Research design

Mixed methods approaches combine different forms of inquiry (quantitative and qualitative) and can lead to a multi-faceted, enriched view of what is being explored through research. The combination of both forms of inquiry is greater than the use of two methods on their own (Creswell, 2009). Mixed methods research has been developed within the field of psychology and was first used to develop a matrix that included multiple methods to investigate psychological traits (Campbell & Fiske, 1959 cited in Creswell, 2009). Their initial research is said to have inspired subsequent researchers to mix different methods by combining qualitative and quantitative data (Sieber, 1973 cited in Creswell, 2009). This type of research often has an
end purpose to converge and triangulate qualitative and quantitative data sources (Jick, 1979 cited in Creswell, 2009). Other purposes for the use of mixed methods approaches include (Caracelli & Greene, 1993):

- complementarity (where qualitative and quantitative approaches are used to illustrate or enhance facets of the phenomenon under investigation),
- development (where the results from one method are used to inform or develop another method),
- initiation (where questions or results are compared or contrasted with those from another method),
- expansion (where the range and breadth of research is extended by using different methods for various components) (p. 196).

For this particular study, the three research questions are as follows:

1. What are the issues and barriers encountered regarding accessibility of tests in higher education online learning environments as noted by U.K. expert practitioners?
2. What are current strategies and practices used by U.K. expert practitioners to support accessibility of tests within higher education online learning environments?
3. How can accessibility of tests within higher education online learning environments be improved?

The purpose of the mixed method approach was complementarity, - to use both qualitative and quantitative approaches to enhance and illustrate the facets of the research results. In this study, a survey was first administered to the participants that gathered both quantitative and qualitative data. The survey provided me with an opportunity to learn more about the participants, - their demographic information and background, their attitudes towards accessibility, their experience
with different types of test systems. The adaptation of a standardized tool for a portion of the survey allowed me to gather information about some of their perspectives and practices when supporting students with disabilities in a consistent manner. Following this, qualitative data was gathered through interviews with the participants. Prior to the interviews I reviewed the responses to the survey. This helped to familiarize me with the context of the participants. This aspect of the study is described as an embedded explanatory sequential approach. Following this, the data was analyzed together after the data collection was complete, allowing me to determine where the qualitative and quantitative data were complementary and to examine more closely the facets of the participants' perspectives and practices. Data transformation was used by expressing some of the qualitative data quantitatively through coding. As well, the data was examined to determine if there were outliers.

3.3 Research Context

The purpose of the research was to explore and identify barriers issues, strategies and practices that are used, and improvements that need to be made regarding the accessibility of tests in higher education online learning environments. The data collection for the research occurred at a time of change within U.K. Higher Education with shifts in policy, funding cuts, increases to student fees, institutional re-organization, and increased pressures from many different sources (Department for Business, Innovation and Skills (BIS), 2011 cited in Jamieson, 2012).

With regard to my personal research context, I acknowledge that research is a process that is framed by the perspective and worldview of the researcher. My own experiences and research regarding the use of technologies to support assessment and my volunteer work on the development of international standards influence this work. The worldview that has guided me
during this research process could best be described as “pragmatic” (Creswell, 2009). This means that I am interested in applied research, - with "what works – and solutions to problems" (Patton, as cited in Creswell, 2009, p. 11). I am also drawn to Dewey's view of truth as "warranted assertability", - in other words, the truth of an assertion can be determined by how well it helps us to understand the world (Schwandt, 2007, p. 301).

Honderich suggests that the "pragmatic theory of truth" (1995, pp. 709-710), can be viewed as being understood within the realm of practice; viewed as a relationship between belief and reality that is further clarified through action, future experience, etc.; and the "ultimate outcome of inquiry by a 'community of investigators', an outcome of 'settled' 'habits of action'" (Peirce, cited in Honderich, 1995, p. 710).

There are a myriad of different perspectives and we come to a clearer understanding of truth through action and experience. Truth is something that we strive for within a community of individuals who also are seeking truth from their own perspectives, experiences, and actions.

3.4 Participants

The purposive snowball sampling of twelve key informants (U.K. expert practitioners) was based on pre-defined criteria as noted below. The participants had experience as instructors who used tests in higher education online learning environments in one or more U.K. higher education institutions, as well as knowledge of one or more of the following topics: accessibility issues; online tests; online test accessibility. As well, participants were recognized experts in the field of accessibility and/or tests in higher education online learning environments with established contributions to research in the field through conference presentations, publications, etc.; and, were referred at a minimum by one other expert in the field of accessibility and/or online testing.
During the study, three of the participants indicated that, although they had years of teaching experience, they felt that they had a different primary role. Two of the instructor participants indicated that they had many years of teaching experience, but one was retired and the other had moved to a new position as an accessibility advocate as recently as 6 years ago. Both of these participants indicated that their responses to the survey and interview questions would be based on the participants’ respective previous teaching experiences. As well, referrals were made to additional people who had experiences with accessibility and online testing. As a result, additional data was gathered from two additional pools of study participants including accessibility advocates and experts, and software, specification and standards developers.

The findings have been structured to reflect these separate participant groupings. The participants have been clustered together in groups according to the primary role they indicated they had at the time of the study. A sample size of twelve key informants is low, as typically for this type of study twenty to thirty participants would be invited to be interviewed (Cresswell, 2007). The number of participants was not determined prior to commencing with the data collection, and the low number of participants is a reflection of the difficult times that were being experienced in the U.K. at the time of the study. The grouping of the participants reflects the exploratory nature of this study. Further discussion of this is provided in the limitations section of this study.

As many of the participants had more than one role, they were further grouped to be adjacent to the groups they indicated as their secondary roles. For example, one of the participants indicated that, although this person had the primary role of instructor, this person was also a software developer, so I placed this participant in the instructor group. As well, those participants who had instructor experience at a higher education institution but who indicated
that they had a different primary role at the time of this study were grouped in the findings section apart from the instructor grouping.

3.5 Research Approach

The research approach used for the data collection of this study was an embedded explanatory sequential approach as both quantitative and qualitative data were gathered and then a comparative data analysis was completed. Regarding timing, weighting, mixing, my approach involved (Creswell, 2009): timing - Sequential quantitative and qualitative data collection; weighting – More of a focus on qualitative; and, mixing – Mixing occurred at the data collection stage with a survey that included both quantitative and qualitative questions and also during the data analysis. The mixing at the data analysis stage involved some quantitative strategies with the qualitative data, such as coding of comments to determine if there is consensus from the participants regarding different themes or topics.

3.5.1 Data Collection

For the purposes of this study, I used a Demographic and Background Survey (see Appendix C) to collect data initially. A section of the survey was adapted with permission from the creators of the ExCEL validated survey tool (Lombardi & Murray, 2011) in order to gather information regarding willingness to accommodate students with disabilities and to adopt Universal Design principles. The survey was delivered using Survey Monkey. Two of the participants chose to complete the survey by completing a Word document. The participants were asked not to respond to questions that, in their opinion, did not apply to them.

The majority of the surveys were completed prior to the interview; however, one of the participants completed the survey following the interview. All participants completed a Semi-Structured Interview (see Appendix D) (synchronously using mutually agreed upon technologies...
(e.g., Skype, phone). Data verification procedures (e.g., participant checking of own interview transcript, consciously trying to avoid “researcher effects”, etc.) were used. A figure representing the data collection process is provided below.

3.5.2 Data Collection Process

A preliminary list of potential interviewees was prepared, and individuals were contacted via email. Initial contacts were made. Potential participants were identified, contacted and informed about the purpose and scope of the study. A copy of the invitation to participate is provided in Appendix A. Those who decided to participate in the study were asked to complete an online consent form (please refer to Appendix B). One participant withdrew from the study due to time constraints. Only data from those participants who remained in the study was collected, analyzed and used.

Those who agreed to participate were asked to complete a Demographic and Background Survey consisting of thirty-one questions to provide some background and contextual information. The surveys were completed very close to the interview time, and a majority of the participants completed the survey prior to the interview and one participant completed the survey after the interview. The participants then were interviewed during mutually convenient times using a semi-structured interview format (please see Appendix D) using Skype™ and Call Recorder for Skype software. The twelve interviews were then transcribed into Word documents totaling 155 pages of text. The interviewees were then sent a copy of their interview transcripts to ensure the accuracy of the transcription. Any changes indicated by the interviewees were made to the final versions of the transcripts.
3.5.3 Data Analysis

Responses to the pre-interview Demographic and Background Survey were analyzed using statistical software (i.e., Excel and NVivo 10). Responses to the Semi-Structured Interviews were transcribed into textual form, distilled, reviewed, and analyzed using research support software (i.e., NVivo 10). For the content analysis, the ‘block and file’ approach (Grbich, 2007) was used in order to retain the contextual information of the responses made by the participants. A variety of mixed methods strategies were used for data collection and analysis, such as data transformation (one type of data is transformed to a different type), typology development (where categories or types extracted from one type of data are used with another type of data), extreme case analysis (where extreme cases are identified and further analyzed), and data consolidation/merging (where multiple types of data are integrated and new variables are created through the merging of both quantitative and qualitative data) (Caracelli & Greene, 1993, p. 196 – 202). The data analysis approach is noted graphically in Figure 1 below and it follows a concurrent triangulation design with complementarity as a main focus.

![Figure 1: Data analysis approach for this study](image)

3.6 Ethical Considerations

The Ethics Review Protocol process at the University of Toronto was followed. An Ethics Review submission was submitted in April 11th and final ethics approval was received on
April 21st, 2011. The names of the interviewees were anonymized. For purposes of analysis and discussion, the participants' responses were coded and they have been organized according to identified groupings. In-text references to data provided by the interviewees have been referred to by alphanumeric reference (e.g., ASA1 = Accessibility specialist and advocate #1; INST1 = Instructor #1; SSSD1 = Software, Specification and Standards Developer #1). All individuals who agreed to participate in the study were informed that participation was voluntary and that they could withdraw at any time without explanation. With their anonymity intact, knowledge of the scope of the study and consent to participate without obligation, the participants were exposed to minimal risk.
Chapter 4: Findings

4.1 Introduction

The results of the data analysis from both data collection instruments are provided below.

4.2 Roles and years of experience

The participants had a wide range of different roles within higher education environments, with some having more than one role (Table 1). The data indicates that

- Over half of the participants (seven out of twelve) were or had been instructors;
- Two were or had been in Higher Education Administration;
- One had been involved with Higher Education Governance;
- Two self-identified as being liaisons with Higher Education institutional instructional technology support; and,
- Ten participants indicated that they had an ‘Other’ role.

During the interviews, participants ASA3, SSSD1, and SSSD2 indicated that, although they had been instructors, they felt that their primary roles should be considered as the ‘Other’ roles they had identified. As these participants also had teaching experiences, they have been situated in their own categories as close as possible to the instructor grouping as shown in Table 1 below. The ‘Other’ roles identified through the survey and during the interview included: Accessibility Advocacy Representative (AAR); Research Fellow specializing in accessibility, assistive technology and disability (RF); IT Manager in support of assessment module (ITM); Software developer (SD) (x3); Software developer and Vendor (SDV); Head of e-Assessment (e-A); e-Assessment system programmer (e-A SP); and, IT standards and specifications developer (ITSSD) (x2).
<table>
<thead>
<tr>
<th>Participant Code</th>
<th>Instructor</th>
<th>Administration</th>
<th>Governance</th>
<th>Institution Tech. Support</th>
<th>Liaison</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accessibility Specialists and Advocates</strong></td>
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<td></td>
</tr>
<tr>
<td>ASA1</td>
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<td></td>
<td></td>
<td></td>
<td>* (AAR)</td>
<td></td>
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<tr>
<td>ASA2</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td>* (RF)</td>
<td></td>
</tr>
<tr>
<td>ASA3</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td>* (ASR)</td>
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</tr>
<tr>
<td><strong>Instructors</strong></td>
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<tr>
<td>INST1</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td>* (ITM)</td>
<td></td>
</tr>
<tr>
<td>INST2</td>
<td>*</td>
<td>*</td>
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<td></td>
<td></td>
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<tr>
<td>INST3</td>
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<td>*</td>
<td>*</td>
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<td></td>
</tr>
<tr>
<td>INST4</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
<td>* (SD)</td>
<td></td>
</tr>
<tr>
<td><strong>Software, Specification and Standards Developers</strong></td>
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</tr>
<tr>
<td>SSSD1</td>
<td>*</td>
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<td></td>
<td></td>
<td>* (H e-A, SD)</td>
<td></td>
</tr>
<tr>
<td>SSSD2</td>
<td>*</td>
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<td></td>
<td></td>
<td>* (ITSSD)</td>
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<tr>
<td>SSSD3</td>
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<td>* (SD, ITSSD)</td>
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<tr>
<td>SSSD4</td>
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<td>* (SDV)</td>
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<tr>
<td>SSSD5</td>
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<td></td>
<td>* (e-A SP)</td>
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</tbody>
</table>

Of the seven participants who indicated that they are or have been instructors at higher education institutions either on the survey or during the interview (Table 2),

- Two indicated that they have a minimum of 6 – 10 years of teaching experience;
- Three indicated that they have 11 – 20 years of teaching experience; and,
- Two indicated that they have over 20 years of teaching experience.

Only one participant had not done any research in the area of accessibility issues. The breakdown of the other participants:

- Five indicated that they have 0 – 3 years of research experience;
- Two indicated that they have 4 – 5 years of research experience;
- Three indicated that they have 6 – 10 years of research experience; and,
• One indicated that over 20 years of research experience had been acquired.

Table 2: Participant and years of teaching and research

<table>
<thead>
<tr>
<th>Participant Code</th>
<th>Years Teaching</th>
<th>Years Researching</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASA1</td>
<td>6 – 10</td>
<td>6 – 10</td>
</tr>
<tr>
<td>ASA2</td>
<td>0 – 3</td>
<td>0 – 3</td>
</tr>
<tr>
<td>ASA3</td>
<td>6 – 10</td>
<td>0 – 3</td>
</tr>
<tr>
<td>Instors</td>
<td></td>
<td></td>
</tr>
<tr>
<td>INST1</td>
<td>11 – 20</td>
<td>0 – 3</td>
</tr>
<tr>
<td>INST2</td>
<td>11 – 20</td>
<td>0 – 3</td>
</tr>
<tr>
<td>INST3</td>
<td>20 +</td>
<td>20 +</td>
</tr>
<tr>
<td>INST4</td>
<td>20 +</td>
<td></td>
</tr>
<tr>
<td>Software, Specification and Standards Developers</td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSSD1</td>
<td>6 – 10</td>
<td>6 – 10</td>
</tr>
<tr>
<td>SSSD2</td>
<td>11 – 20</td>
<td>0 – 3</td>
</tr>
<tr>
<td>SSSD3</td>
<td></td>
<td>6 – 10</td>
</tr>
<tr>
<td>SSSD4</td>
<td></td>
<td>4 – 5</td>
</tr>
<tr>
<td>SSSD5</td>
<td></td>
<td>4 – 5</td>
</tr>
</tbody>
</table>

4.3 Primary educational background and prior training

Data regarding the primary educational background and training of participants was gathered through the survey and is provided below in Table 3. Information regarding background and prior training also was gathered during the interview process. Nine participants indicated that their educational background was in the sciences. The three remaining participants indicated that their educational backgrounds were in Communication and Assistive Technologies, Computer Science, and Maths/Computer. One of the participants noted, “The principles cross subject domains, this is education not training”. With regard to their own education and prior training regarding accessibility as it relates to tests in online learning environments (Table 3), the participants responded during the interview that:
• Ten had participated in informal training such as accessibility workshops, seminars and sessions; reading; consultations with other experts; working with instructors and learners who have specific accessibility issues; commissioned evaluation reports; work experience developing the software; reviewing relevant legislation; developing courses on this topic; through committee and volunteer work; writing research book chapters and articles; giving conference presentations; and, implementing online assessment systems within an institution and across several institutions;

• Three had taken formal courses at a higher education institution; and,

• Two participants indicated that they provide workshops to others in higher education institutions, and one of the two taught courses that included this topic.

Table 3: Participant, educational background, and prior training

<table>
<thead>
<tr>
<th>Participant Code</th>
<th>Educational Background</th>
<th>Prior Training</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accessibility Specialists and Advocates</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ASA1</td>
<td>Sciences</td>
<td>Informal</td>
</tr>
<tr>
<td>ASA2</td>
<td>Communication and Assistive Technologies</td>
<td>Informal</td>
</tr>
<tr>
<td>ASA3</td>
<td>Sciences</td>
<td>Informal, Formal, Provide Workshops</td>
</tr>
<tr>
<td><strong>Instructors</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>INST1</td>
<td>Sciences</td>
<td>Formal</td>
</tr>
<tr>
<td>INST2</td>
<td>Sciences</td>
<td>Informal, Provide Workshops and Courses</td>
</tr>
<tr>
<td>INST3</td>
<td>Sciences</td>
<td>Informal</td>
</tr>
<tr>
<td>INST4</td>
<td>Sciences</td>
<td>N/A</td>
</tr>
<tr>
<td><strong>Software, Specification and Standards Developers</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SSSD1</td>
<td>Sciences</td>
<td>Informal</td>
</tr>
<tr>
<td>SSSD2</td>
<td>Sciences</td>
<td>Informal</td>
</tr>
<tr>
<td>SSSD3</td>
<td>Maths/Computing</td>
<td>Informal</td>
</tr>
<tr>
<td>SSSD4</td>
<td>Computer Science</td>
<td>Informal, Formal</td>
</tr>
<tr>
<td>SSSD5</td>
<td>Sciences</td>
<td>Informal, Formal</td>
</tr>
</tbody>
</table>
4.4 Online Testing Purposes and Types of Systems Used by Participant

The participants were asked to identify the purposes for which they had used assessments in an online environment and the types of different systems they had used as identified by the U.K. Framework for Reference Model for Assessment (FREMA) introduced in section 2.5.3 above. The participants indicated that

- Eight had used online tests for both formative and summative assessment;
- Six had used them for self-assessment;
- Five had used them for diagnostic assessment;
- Three had used them for peer assessment;
- Three had used online tests for continuous assessment;
- Two had used them for other purposes, - to evaluate a system (E), and for surveys (S);
- Two of the participants had not used online tests for specific purposes within a higher education online learning environment.

The participants indicated that they had used a several different types of systems to deliver tests in online learning environments. A total of

- Seven had used an “Assessment Management System” (Assessment);
- Six had used a “Learning Management System” (LMS);
- Two had used “Other” systems (Other);
- One indicated a “Component based system” (Component) had been used; and,
- One indicated “Don’t Know”.

The results indicate that the participants had a variety of experience with the types of tests and with the types of technologies used to create and deliver online tests.
4.5 Importance and Conceptions of Accessibility

Participants were asked to rate the importance of accessibility to them with regard to the creation of tests and gathering of eAssessment data from tests within online learning environments. Eight of the participants indicated that accessibility is very important and four indicated that accessibility is important.

During the semi-structured interview, participants were asked what accessibility means to them (Question #2). A cluster analysis based on word similarity for the responses received using NVivo 10 was used as an initial step to reviewing the main concepts. Further analysis revealed several main concepts that grouped together, as well as several additional topics. The main clusters of topics regarding accessibility included concepts, number of coded references, and the relevant quotations were more closely reviewed and the concepts related to accessibility seem to cluster into three main topics, namely

1. What accessibility means - Broadening access to as many people as possible (ASA1, ASA2, INST2, INST3, SSSD1, SSSD2, SSSD3, SSSD5);

2. What accessibility involves - Enabling and enhancing access to as many individual learners as possible who form a target audience (ASA3, INST1, SSSD3, SSSD5);

3. Accessibility in relation to assessment - Assessment as a judgment of ability including limitations of assessment and issues of reasonableness, pragmatism, fairness, validity and reliability (ASA1, SSSD2, SSSD4).

These qualitative observations can be compared with the quantitative data from the initial demographic and background information survey. In Figure 2 below participants were asked to rate their confidence regarding their understanding of the legal definition of disability in the U.K.
The responses indicate that the Accessibility Specialists and Advocates seemed to be most confident in their understanding of the legal definition of disability, the Instructors also seemed to be relatively confident, and the least confident group seemed to be the Software, Specification and Standards Developers.

Similar patterns were noted with regard to the specific U.K. legislation including the Equality Act (2010) as noted in Figure 3 and SENDA as noted in Figure 4 below, with the Accessibility Specialists and Advocates and Instructors indicating that they have more confidence regarding their understanding of the legislation compared to the Software, Specifications & Standards Developers.

**Figure 2:** “I am confident in my understanding of the legal definition of disability”
It is interesting to note that in Figures 2, 3, and 4 above the instructor INST4, who is both an instructor and a developer seemed to respond in a manner that is closer to the responses made by the Software, Specification and Standards Developer group. Similarly, SSSD1, who is both a Head of e-Assessment and a software developer and was an instructor previously, seemed to
respond to these questions in a manner that more closely represents the responses made by the Instructor participants. The only variation in the responses between Figure 3 and Figure 4 seems to be for INST2 and SSSD2. INST2 had a greater familiarity with the Equality Act (2010) rather than SENDA (2001) and SSSD2 had a greater familiarity with SENDA (2001) than with the Equality Act (2010).

4.6 Participant Experiences and Comfort Levels with using Technology for Tests

4.6.1 Functioning of Current Technology

Participants were asked their level of agreement with the following statement, "The technology that I currently use to support the delivery of tests in an online learning environment works well" (Question 27 on the survey). Two of the twelve participants indicated that they strongly agree (INST3, SSSD1), three indicated they agree with this statement (INST4, SSSD4, SSSD5), five indicated that they agree somewhat (ASA1, ASA2, ASA3, INST1, INST2), one person strongly disagreed (SSSD2), and one person did not answer this question (SSSD3).

4.6.2 Comfort Levels Creating and Gathering Data from a Test

Participants were asked to indicate their comfort levels when creating and gathering data from tests in online learning environments (where 1 = very uncomfortable and 6 = very comfortable). A majority of the participants (seven out of twelve) felt very comfortable both creating tests and gathering data from tests deployed in online learning environments (INST1, INST2, INST3, INST4, SSSD1, SSSD4, SSSD5), and one participant (ASA2) felt comfortable with both types of activities. Two of the participants (SSSD2 and SSSD3) indicated that they felt very uncomfortable creating or gathering data from tests deployed in online learning environments. Two of the participants (ASA1 and ASA3) felt somewhat comfortable creating
tests, but somewhat uncomfortable gathering data from tests deployed in online learning environments.

4.6.3 Migrating Test Questions from one Online Learning Environment to Another

Participants were asked, on the survey and in the interview, to share their experiences with migrating test questions from one online learning environment to another where both systems indicated that they are compliant to the same level of technical specification or standard. There were

- Five of the twelve participants who indicated that they had migrated questions from one system to another (INST1, INST4, SSSD2, SSSD3, SSSD4). All five participants indicated that although some question types seemed to be migrated successfully, other types did not. It was noted that there did not seem to be robust support for the migration of media associated with test questions.

- One of the twelve participants indicated that they were unsure of the migration experience as only migration between different versions of the same system had been experienced (INST3).

This question was also raised during the semi-structured interview in order to probe more fully into the issue of migration of test questions in online learning environments. With regard to accessibility, one of the Instructors who is also a software developers (INST4) indicated that, when designing the system an effort is made to ensure that accessibility considerations are in place, such as ensuring the HTML is correct and test question structuring guidelines have been followed (e.g., that checkboxes are presented to the right of question options ). However, users are left to select the browser that is right for them and to ensure that the personal settings on their own computers support their accessibility requirements. This participant also indicated that lack
of resources was an issue to ensuring that accessibility features were built into the system. Another participant (SSSD5) indicated that, in terms of accessibility, there were some problems encountered with the IMS QTI (Question Test Interoperability) specification. Although multiple choice questions seemed to be migrated successfully, there were issues with accessibility and with formatting for other types of questions, such as ‘Drag and Drop’ questions (INST1).

There were several other issues that were raised during the semi-structured interviews with regard use of the IMS QTI specification. One participant (SSSD3) indicated that improvements have been made to the accessibility of this specification in version 2 compared to the previous version 1.2. One of the participants (INST3) indicated that there were some discipline-specific limitations encountered in using the specification for mathematics. Several of the participants noted the ambiguity of the previous version 1.2 of the IMS QTI specification, which seemed to result in differing interpretations on the part of software vendors, making migration process challenging. Five of the participants indicated that the ambiguity was perceived negatively due to the problems resulting from inconsistent implementation of the specification by software developers (INST2, INST3, SSSD3, SSSD4, and SSSD5). One of the participants (INST4), who is both an instructor and a software developer, viewed the ambiguity present in the former version of the specification as being a positive as it easily allowed for the addition of extensions, which made it possible to further analyze the question data (e.g., for precision and accuracy).

The ability of IMS QTI to support adaptive or alternative step questioning so that students could have multiple pathways to support their learning was another issue that was identified. One participant (INST4) indicated that the specification supported adaptive questioning, and another participant indicated that it was not supportive of adaptive questioning
(INST3). One of the participants (SSSD5) indicated that it would be helpful if the specification could be more concrete with plenty of examples and opportunities to test exporting and importing across systems for developers. Another of the participants (INST3) stated that it was important that education drive the types of questions that are defined by the specification rather than technology.

Related to the IMS QTI specification issues, there were several participants who indicated that there are problems with the use of LMSs to deliver accessible online tests. Continuing to discuss the IMS QTI specifications, these participants provided details regarding specific LMSs that had inconsistently implemented the IMS QTI specification (INST2, INST4), resulting in problems with migration of questions, duplication of effort as questions needed to be re-added into different systems (INST2, SSSD3, SSSD5). Another participant (SSSD3) had been involved in the development of the previous version of QTI and noted that a lot was learned from the development process around the use of testing tools. One of the participants (INST4) had developed a tool that could import and export questions from different systems. Several participants noted similar types of conversion tools that could be used to assist with migration of test questions (INST1, INST4).

With regard to other standards and specifications, two of the participants expressed their concerns regarding resources, process and time involved. One of the participants (INST2) indicated that it is very resource intensive for higher education institutions that must hire additional programmers to make the systems work to meet the requirements of the instructors and students. Another participant (SSSD3) indicated that it takes both time and resources to upgrade an LMS or another type of assessment system and to implement new standards and
specifications especially in higher education environments. This participant (SSSD3) noted the timescale for higher education institutions is quite compressed as noted below:

Take something like a learning management system for example in a university, I mean that is typically a big project to do an upgrade, which is often a maximum of once a year and sometimes less. Now you can do patches and things, but if you have a bigger change to your software from a changing spec, you might have to wait for the next timeline.

As well, concerns were expressed regarding the efficacy of the standards development process (INST2) and it was noted that private companies may not be as motivated to implement standards and specifications for various reasons (INST2). Two participants (INST2 and SSSD3) noted that the standards and specifications development process may sometimes be focused more on academic research. In the words of one of the participants (SSSD3):

There are plenty of people in universities who are happy to be engaged in the research part of it, but when you are implementing a spec, you have got to be clear about whether you feel like this is research, or whether you have now got this distilled wisdom and it is expressed in this spec.

Several suggestions were made to make improvements. To address some of the issues raised, one of the participants (ASA3) suggested that it would be helpful for instructors and developers to have a set of question examples that indicate how to approach specific accessibility issues, along with technical details. One of the participants (INST4) indicated that the system developed allowed for categorization and metatagging of questions. (e.g., to flag potential accessibility issues, question difficulty level, create associations with specific topics, competency frameworks and taxonomies).

4.7 Barriers and Issues

Participants were asked to identify the barriers or issues that they or their colleagues may have encountered with respect to the accessibility of tests in higher education online learning
environments. There were five main categories of barriers or issues that were identified. These included:

1. Requirement for balance between academic integrity and accessibility;
2. Need for inclusive design to better support the creation and delivery of accessible online tests;
3. Issues related to the need for increased dissemination and broad implementation of accessibility approaches with regard to online tests;
4. Resources required to support the design and delivery of accessible online tests; and
5. Technology issues and approaches.

The findings from the content analysis with respect to the five main categories of barriers and issues are provided in the sections below.

4.7.1 Requirement for balance between academic integrity and accessibility

A total of eight participants noted that they have experienced or encountered concerns that addressing accessibility means that academic standards may in some way be compromised (ASA1, ASA2, INST1, INST2, INST3, SSSD1, SSSD3, SSSD5). The three main concerns that arose from the participant comments regarding this issue were the potential impacts of accommodations and alternatives; challenges with equivalency; lack of agreement regarding validity and reliability. These issues seemed to be closely related.

When an individual learner requires accommodation or alternatives to assist them in completing an assessment, the provision of the required assistance may render the assessment invalid. For example, as noted by SSSD5:

The audio clip we used in medicine was some sort of respiratory complaint, and the whole point of that question was to see if the student could hear the wheezing and work out what the presenting condition was. Now if you cannot hear the wheezing at all, you
need to have some sort of alternative question, and academically you get into the problem of, is your alternative question the same as the normal question?

Another example provided by SSSD5 was the provision of graphics, such as an image of a tibula. As stated by SSSD5:

   In medicine, we will put up a graphic and we will say, “What is this condition?” and we will put up an x-ray. Although you can use an alt tag on the image, if you say alt is “an x-ray” it does not tell you that much, if you say “x-ray of a fracture of the tibula” you could be giving away the answer.

Similar types of situations were cited by others (ASA2, SSSD1, SSSD2 and SSSD3) who also noted that labeling visual images to assist students with a visual disability could give the answer to the question to the student. Another participant, ASA2, an accessibility specialist and advocate, noted that if a student is relying on someone else to provide human assistance to complete a test:

   In particular, if you have a language test where actually the academic probity of that test might be violated or affected by the lack of independence, and that is no fault of the student, which is because of the way it has been designed, that someone has to help them.

   Several of the participants noted that there are barriers and issues they have experienced, or experienced by their colleagues, with relation to equivalency of questions in tests within higher education online learning environments. With regard to equivalency, one of the participants, (SSSD1) indicated that, there “are an awful lot of people who think that it has to be the same rather than equivalent”. This participant stated that:

   You know people will say to us, “Well, how would so and so do that assessment?” well they would not. You know if it is something that is a visual assessment that is not appropriate for somebody who has never been able to see in their life but that does not mean that we throw that assessment out for everyone else.

   Another participant, SSSD3, noted even though a student has a disability the service provided may be equal service but not the same. With regard to alternatives that would be equal, discussion was prompted by considering language alternatives as equivalent forms required by
different learners. This participant suggested that the data items could be stored as a single question with multiple forms (similar to acceptable variants on a test that has been translated into different languages). This would be similar to the idea of separating website content and delivery through the use of cascading style sheets, which allow the website content to be presented in different formats. Looking at the pedagogical application of this approach, the rubric could be considered the content, and the alternate forms of the associated questions could be presented through various mediums.

However, there were concerns from the participants about validity and reliability as there may be smaller groups of individuals who have a disability requiring a specific alternate question form, the numbers may be so low that it can impact on the statistical calculations. One of the software, specification and standards developers who was previously an instructor (SSSD2) noted that:

The validity of high-stakes assessment seems to be something that people care about, that organizations care about. Being able to discuss the validity and to demonstrate the validity of tests is very important to people working in that area (at least as far as I knew it was). It becomes difficult to deal with disabilities because built into dealing with disabilities is a kind of a personalization approach. It has got to be. You cannot treat everybody as an amorphous mass of people and do statistics on them. It does not work, there are not enough, and people are too varied. Organization A at that time was saying that the problem with doing accessible assessment is that you cannot know that you have done it, because you cannot talk about the validity of tests except in terms of large numbers of tests. If you want to talk about accommodations to people, you do not have the numbers needing the same accommodation, so you cannot do the statistics.

This was also echoed by Participant SSSD3, who mentioned that when discussing the topic of creating alternative test questions to support students with disabilities with an expert in assessment:

We were saying was how can we go about measuring what kind of effect we are having by making this change? He was certainly of the view that even if it was ethical to do this kind of experiment, the reality is that you could probably never get enough numbers to
have anywhere close to a reasonable level of confidence about the outcome of your research.

This participant did not think that there was anyone who would have large enough numbers of people with the same disability to be able to make more comprehensive statistical analyses to determine impact of changes made to the questions. This person also noted that, although it would be possible to study the impact in a psychology lab, it would be much more difficult to determine what the affect might be in the field.

One of the Instructors, INST3, stated that with regard to “validity and reliability, I think they hide behind that a little bit”. This instructor noted that, in terms of a subject such as mathematics, “multiple choice is not the right way to assess. You can use it in places, but not predominantly over a wide range of question types.” With regard to the strong focus on validity and reliability, this instructor stated, “people have made their reputations on that … I am not convinced.”

With regard to equivalency and fairness, one participant, SSSD3 said:

In that case it is one thing to say, we are going to offer you an equal service regardless of any accessibility issues you may have, it is another thing to say we are going to treat you all exactly the same in this statistical distribution, regardless of the method by which you got the stimulus and responded because that might not be valid, and it might upset the way that we do grading and calculation of statistics, which have a direct impact on your score and whether or not you pass.

In the words of another participant SSSD1, it is vital that students develop their skills and strategies to use assistive technologies, and as long as they are able to develop those skills then that can provide students with “a mechanism for them to fairly access learning and assessment.”

4.7.2 Need for inclusive design

There were many design challenges for instructors who are trying to create accessible tests for their students that were noted by all of the participants except for two (INST4, SSSD4). Some of the challenges or barriers to design for accessible tests that were identified by
participants included lack of awareness and understanding; limited recognition of the need for inclusive design; and, lack of integration of student needs and requirements for personalization.

One of the participants (ASA1) noted that currently guidelines for the creation of accessible tests seem to be separated out and considered to be a supplement to already established guidance documents. Instead, this participant suggested that accessibility should be incorporated into good curriculum design, including the creation and delivery of accessible tests. Another (SSSD2) noted that a colleague had mentioned the difficulties encountered in teaching computer science to students who had the disability of dyslexia. This participant noted that, as computer science is a discipline that requires the use of structured languages, it was very challenging for students with dyslexia to develop code and to match patterns.

Another participant (ASA3) noted that it may be helpful to abstract the academic competency from the formats of responses that might be required. This participant stated that it was important to:

… identify the academic competency that you are trying to assess, and try and abstract that from any other demand on sensory or physical ability or even cognitive ability that is not directly related to the intellectual attainments of this knowledge.

One of the participants, ASA2, noted the tensions that may exist when trying to accommodate different types of disabilities. This participant stated:

What you make easy for one person may put a barrier up for somebody else. So the dyslexic student who wants a very clear amount of white space, who needs a lot of pictorial evidence to help them, who likes to use the mouse, is not going to be working in the same way as a visually impaired person, or a blind person. Someone who needs physical access, who has great difficulty using the mouse, and wants keyboard access for a different reason, they need to know there is a skip navigation link. They need to know, they need to be able to see the very elements that you might have put in place for a blind person, but they may not be aware of because they are not listening to the text.

As another example, this participant noted that:
If there is someone who is dyslexic goes and uses text-to-speech and they forget to turn off the alt tags, or they do not alter the text-to-speech, it might read everything else as well. Then they get a verbosity that they do not want.

With regard to other barriers, one of the participants (INST1) noted that lack of time, planning skills, professional development opportunities, and staff attitudes may all be items that need to be addressed. Many instructors are strapped for time and may not have the necessary curriculum planning skills. This person noted that instructors may have limited or no access to professional development opportunities with regard to inclusive design. They may regard the number of students who have a disability as proportionate with the amount of time that will be spent on a project. So for example, “let us say that they have a class where they have 2% of students with a disability, it then becomes 2% of their planning and development time for that course”. Instructor INST1 noted that the expectation and the reality can vary, as sometimes even though students with a disability may be 2% of the total population, in reality more time may be required to ensure course content is accessible. This participant noted that for him re-writing assessment questions was not required because “usually they have been written with basic accessibility in mind, you know clear labeled diagrams and things like that”.

In addition to accessibility being a lower priority during the development phase for some instructors and others, six of the participants noted that awareness and understanding of issues related to inclusive design seems to be another barrier that must be overcome. According to one of the participants (SSSD1):

We have a huge lack of people who have technical and educational understanding combined, and that is really the kind of people you need to work in this area, otherwise you have just got too many cooks and it takes too long.

Another participant, INST1, observed that:

For staff to understand what the real problem is for the student, can be difficult. A blind student is very easy to understand, a deaf student is very easy to understand. However, a
partially sighted student and a partially deaf student have a different access. So in my experience, how a disability manifests itself in class is not always clearly understood by other staff.

In addition to a lack of combined educational and technical knowledge, several participants noted that with regard to the curriculum development process the development of the questions for an assessment is a complicated process, and the problems experienced can be compounded because software developers, accessibility experts and specialists may not have the more in-depth knowledge of instructors’ experiences. Assumptions may be made by developers or accessibility experts about the goals of instructors. One of the participants (SSSD3) remarked that “accessibility reviewers often assume that the assessment writer goal is total transparency, and of course that is true for the stimulus, but it is not necessarily true for the document taken as a whole”. One of the Accessibility Specialists and Advocates (ASA3) acknowledged that, even though end user testing was valuable, there are sometimes time and cost restraints that mean that end user testing within the institutional context may not happen.

Several participants noted that designing accessible tests can be one way to create a more inclusive curriculum and learning environments, not only for students for disabilities but also for others, such as international students, who may require that information be provided in alternate forms (INST1, INST2, SSSD1). One of the participants (INST1) mentioned that:

International students are a very good example of students without a disability in the medical sense, but there is an inclusion problem, and international students are usually a large proportion of those with accessibility needs in a student cohort. There might be 20% of students from other cultures, and if you can prepare for those in mind, then you actually are preparing for those with disabilities too.

At times, there is reliance on locally available assistance with specific expertise to help with inclusive curriculum design and methods of delivery when inclusive design integration into the software has not been possible due to various constraints (SSSD1). One participant (INST2)
asserted that inclusive design needs to be part of established university course development processes.

Five of the participants noted the importance of recognizing that each student is an individual with their own needs and requirements (ASA2, INST1, SSSD1, SSSD2, and SSSD5). One participant (ASA2) stated that, when “we start talking about personal preferences … we need to be aware that the disabled person is as much of an individual as you and I might be”. An instructor, INST1, declared that, even though it is important to address personal preferences, this can be particularly challenging in a class of several hundred. This instructor also remarked that there are differences in terms of needs and requirements even for two students who have the same disability; this person commented that “I discovered a lot more about autism with a recent student because it is such a large spectrum of disability. You cannot regard two autistic students the same”. Another participant, SSSD5, observed that changes made to the online assessment system in order to accommodate the identified requirements had to be made on a case-by-case basis. This participant indicated that the curriculum alignment process was greatly improved as instructors linked test questions with identified learning outcomes from the curriculum. In this way, they discovered and then were able to rectify the fact that students were being assessed for an item that was no longer being taught during the class (SSSD5).

4.7.3 Mainstreaming issues

Although change is underway there are still many barriers and issues related to the mainstreaming of accessibility of tests within higher education online learning environments. Some of these included a lack of innovation coupled with the persistence of more traditional approaches to accessibility; limited understanding and awareness regarding legislation; partial or no consistency of approaches to online tests within higher education online learning
environments; issues identified regarding policies and procedures; and, negative impacts of politicization of accessibility and related issues.

There are only a few examples of innovative approaches to accessibility of tests in higher education online learning environments. For example, one of the examples is the development of validation panels at universities. As noted by ASA1:

The new difficulties being faced are things like validation panels in universities. A lecturer might want to move away from a written exam and they might want to do video presentations, but in order to get that authorized, they have to go through a validation process, and maybe the people who validate are not really aware of some of the possibilities and some of the issues.

Although there are several examples of innovative approaches, these seem to be centered within teaching-focused institutions according to ASA1. Compared to industry, higher education institutions can be quite conservative and risk adverse (SSSD3). Another participant (INST2) noted that innovation and even remaining abreast of the changing technology landscape can be extremely cost prohibitive for higher education institutions in this new climate of fiscal restraint and accountability.

There were three participants (INST2, SSSD1, SSSD3) who indicated that there were mainstreaming issues and barriers with regard to legislation. Not all higher education institutions have a climate that fosters and reinforces the integration of legislation into teaching and learning activities (INST2). As well, it was noted that there are inconsistencies across institutions with regard to support for interpretation and compliance with legislation (SSSD3). Although instructors may have heard of legislation such as SENDA, according to one of the participants (SSSD1), “people are aware at a very surface level, but really do not understand what they should be looking out for, so do not always know when they should be doing something”.

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Related to issues regarding legislation, there seems to be limited consistency regarding the approaches to accessible tests within higher education online learning environments. A challenge noted by one participant (SSSD4) was the fact that there does not seem to be consistency in the legislation from one country to the next. This can be problematic particularly for students with specific learning requirements such as those with disabilities, who are learning abroad within new and unfamiliar higher education learning contexts.

In addition, it was noted by several participants that higher education institutions could benefit from a more consistent approach to providing accommodations such as the provision of note takers (ASA1, INST1) for example. One of the participants, ASA1 noted:

"If we can get agreement with them saying in 90% of exams it is perfectly okay to use a human scribe and it is perfectly okay to use an automated notetaker, whichever the student prefers, the only exams where that would not be acceptable are this one, this one, and this one. And to try and get all of the awarding bodies to agree to this so that all of the learners know exactly what is possible and what is not possible. They can look over here in advance which exams they are doing and what kind of adjustments are allowed or are not allowed."

The participant INST1 stated:

"A common overall solution was for students with accessibility needs to be provided with an amanuensis, or somebody to read the questions to them, and the thing is that a human being deployed in that way can be extremely flexible, so it can be a sort of a de facto standard that once you have somebody with an accessibility issue you get the amanuensis in, because they can cope with all sorts of different issues, which means that you are not trying to cope with them all yourself."

It was noted by one of the participants (INST4) that it can be difficult to reach agreement regarding a consistent approach when multiple players are involved.

Another issue that was identified by three of the instructor participants (INST1, INST2, and SSSD3) was policies and procedures. One of the participants (INST1) indicated that the problem was not a lack of policies and procedures, but a surplus of them. This participant said that:
There are so many policies and procedures that affect to those teaching at the coal face, that at times, and I am talking here about my colleagues and myself, there are times that you are aware that you do not know the full level of detail of all of the policies that are available to you, because you will read these six months in advance of an issue or a problem coming up. So you know that they are there to refer to, if only you can find the right policy. You know there is an assessment policy, there is a disability policy, there is a technology use policy.

In addition to the large number of different policies, this instructor stated that often the policies are not integrated, and another issue is that:

The type of disability that academic staff learn to deal with, how those disabilities manifest themselves in a teaching situation, is not always clearly understood by the policy. You know, some empirical knowledge of fellow staff who have dealt with somebody who has autism, can have far better information content than reading what the rule says one has to do. So types of disabilities and how they manifest themselves in teaching is not as well understood as it could be.

According to this participant, instructors may not have opportunities to discuss the implications of disability on teaching and learning and how to interpret institutional policies and procedures with their colleagues. Unsupportive institutional culture and lack of information regarding ways of better integrating procedural knowledge regarding the use of technology are other potential barriers that were identified by participants INST2 and INST3.

Several of the participants noted that there are negative impacts related to the politicization of accessibility and related issues. For example, within higher education contexts, the selection and implementation of a learning management system can be a highly political process (INST2). Competing priorities can mean that accessibility is something that may not be considered to be part of the academic mission of the university (INST2). Institutional priorities can take precedence over issues such as accessibility (INST3).

4.7.4 Resources

A total of 9 of the 12 participants (ASA1, ASA3, INST1, INST2, INST3, INST4, SSSD1, SSSD3, and SSSD5) indicated that they had encountered barriers and issues with respect to
resources for accessibility of tests in higher education online learning environments. Some of the main issues that were identified with respect to resources were funding and cost issues; time constraints and lack of skilled personnel; instructors being overwhelmed by other tasks; and a lack of support networks.

With regard to funding and cost issues, at the time of the study the U.K. higher education system was undergoing many cuts to funding including, according to ASA1:

- Funding ended for approximately 70 Centres for Excellence in Teaching and Learning (CETLs) (they were funded from 2005 – 2010); several did find additional funding to continue;
- Closure and liquidation of the British Educational Communications and Technology Agency (Becta), the lead agency for the integration of information and communication technologies within education (effective March 31, 2011);
- End of funding for 24 Higher Education Academy Subject Centres, which was announced in 2010.

There is also the cost of losing the decades of research and resources that were developed with respect to higher education topics such as accessibility of tests in higher education online learning environments (ASA1).

There seemed to be inconsistencies with regard to the level of support and the number of skilled staff available to work on these issues across different higher education institutions. Several participants (ASA1, INST1, INST4, SSSD1, SSSD2, and SSSD5) noted that there were issues related to the level of support and the availability of staff with specialized skills. Other participants (ASA2, ASA3, INST2, and INST3) noted that there was a good level of support provided to instructors at the higher education institutions where they worked or had worked.

With regard to the level of support for students, the responses were similar except for SSSD5 who indicated that although instructors may not receive the support they need, students receive a good level of support at the higher education institution where SSSD5 works. Although several of the participants did not answer the survey question related to support
(ASA3, INST4, SSSD1, and SSSD3), for those who did answer the survey question, their survey responses confirmed their interview responses, with a mixture of participants indicating that they had sufficient support, and others saying that they did not.

Of those who noted that they had a good level of support, INST2 remarked that they employ specialized staff to assist with agile software development methodologies in order to mitigate the problems related to the cost of changing software. This person stated:

Some of the barriers I guess that we have, one is cost, for example for changing software. That is a really big barrier. But what we try to do is that when we are building new software whatever it is, we do developmental testing, we are good at agile methods, and we have the labs, and a specialist.

Other participants who had a good experience with levels of support noted that they had access to learning technologists, disability IT specialists, web accessibility advisors, student support units, and other disability office staff.

Of those who indicated that they had experienced challenges with regard to these types of resources, one participant, INST1, remarked that planning was a key skill that instructors need to develop in order to be able to get the help they need from people with the right type of expertise at the time they need the help. This person declared:

Expertise, - there is always somebody somewhere who is an expert, within higher education you can usually find them, but then once you have done that, they either have not got the time to help, or if they do have the time to help, they have just lost that time themselves to some other purpose.

This person also suggested that the timing of the support was critical. INST1 stated that, with regard to resource issues:

Time is the biggest one. Staff development units, - they are quite good, they help. But you have got to find the right person at the right time. At this time of year, many staff will be thinking about how they are going to deliver next year’s course based on their experiences that they have had this year. But you then might go to a staff development unit and say, “Right I am now re-writing my course, can you give me some support on blah-de-blah-de-blah”, and they will say, “Well actually we do not run those courses until
September when everyone gets back”. Now at that time you are already teaching. So the timing of the resource support is key.

SSSD1 commented:

I think there is a huge issue in terms of resources. People who are at the chalk face, as it were, are too busy dealing with all of the changes in curriculum, students are turning up at their door, to actually spend enough time on new approaches and deal with them in terms of issues like accessibility as well.

SSSD1 asserted that infrastructure resources and issues related to the nature of technology can have a negative impact on the accessibility of online tests in higher education online learning environments:

We underestimate how easy it is for computers to crash, networks to slow, a mouse to not work, a plugin not to be on a computer. Any of those things, they happen all the time. We do not have the infrastructures or the technology for that not to be an issue, and I do not think that is going to go away because we just improve the technology, improve the expectations and there is always someone stuck at the bottom.

This participant mentioned that related to the issue of resources and specialized support, there is the issue of instructor overwhelm as noted below:

If an instructor goes out and does something like a multiple choice eAssessment, that is a huge amount of their time and energy trying to work out how to best do that. And if they have got to deal with browser compatibility, booking rooms, and accessibility and all of these things on top of it, a lot of them just do not go any further.

Another potential barrier that was identified by four participants (INST1, INST2, INST3, and SSSD3) was the lack of support networks. Both informal personal support networks and more formalized networks are needed that may be organized around disciplines or logical discipline groups. There is a lack of discipline-specific away days, tutorials; and, there is a need to leverage local knowledge regarding these issues (INST1). Although it is important to have technical solutions in place, the human support network needs to be there as accessibility is not a separate issue (SSSD3). Another often overlooked issue is the lack of student support networks that can help learners to better understand how their disability may be impacting on their
learning and to help them to develop more effective learning strategies and approaches (INST2). In addition to the support of a community within a discipline sometimes other partnerships are overlooked (INST3). There may be limited or no contact with other research groups and companies, which can become partners and help to augment the numbers and the perspectives of people who are working on the same issues (INST3).

4.7.5 Technical Issues and Approaches

Technical issues and approaches were identified by all twelve of the participants as being a barrier with regard to online tests in higher education online learning environments. The main topics regarding technical barriers and issues were lack of understanding, limited technical awareness, and standardization challenges. With regard to lack of understanding and limited technical awareness for online tests in higher education online learning environments, participants indicated that the main issues centered on problems encountered by instructors using technology to create and deliver student assessments, and also issues encountered by the learners. Software, specification and standards developers indicated that technical issues and approaches present some challenges to supporting the creation and delivery of accessible online tests in higher education environments as well.

One of the participants (SSSD4) acknowledged that, “I think a challenge as a software developer who is not an expert in accessibility is that it is hard to know what it is that is wanted and what is important and what is not important.” In addition, this participant noted each higher education environment can be quite different. Although direct contact may be made with people who control or offer online tests, it can be very infrequent for the software developer to have direct contact with end users.
Although there have been some improvements and standardization in this area, there are still inconsistencies in the way that standards and specifications have been implemented, approaches that are used to support customization / personalization of the user experience, learning platforms, and migration amongst various types of systems continue to be issues. These increase the challenges and complexities of ensuring that the creation and delivery of tests is accessible both to instructors and to learners.

With regard to problems that are encountered by instructors and their students, one of the participants, ASA3, stated: "I am aware of a number of different shortcomings with the tools that we have used in terms of how accessible the assessments are to people with different disabilities and also how well the tools support accessible authoring". Several question types, such as drag-and-drop, matching questions, and hotspot questions, may be problematic for students who have disabilities (ASA2, ASA3, SSSD3), but instructors may not be aware that these types of questions may pose accessibility challenges for their students. According to participant ASA3:

So there is an issue of the accessibility of certain question types and the availability of information that allows test authors to make an informed choice, and I think that could certainly be improved in the tool I have been most closely working on.

ASA2 confirmed this same issue, “if a lecturer does not realize about the accessibility issues, they will choose any survey and not think about it. And that can cause problems”. Similarly, SSSD3 observed:

I would say really it is often that the technology does not address the issue at all, so it is left to an author to decide whether to create something that is accessible or not, and the technology cannot help, it cannot recognize something that is inaccessible and it likewise cannot recognize good practice.

Unfortunately, students also may experience their own technical challenges. Keyboard accessibility, poor navigation, lack of alternative input options, lack of a practice test, lack of
accommodation for increased time requirements, use of Flash in a manner that is inaccessible, lack of screen readers and other assistive devices, lack of user control over presentation/display elements such as font, colour, and contrast were all barriers that were identified by participants (ASA2, ASA3, INST2, INST4, SSSD3, SSSD5).

Additionally, students may have technological dependencies, not be able to use the technology optimally, and may have hidden disabilities of which they are unaware. As noted by ASA2:

Students themselves may not have the technological knowledge to be able to cope with it either, if that makes sense to you? In other words, they may not be able to control the various assistive technologies that you have put into place or the access that you have put in place. They may not be able to make best use of it.

This observation was confirmed by another (INST1), who stated:

I had another student who was autistic and insisted that everything could only be understood to him if it was through a Macintosh computer, because that was what he had learned to work with. Everybody had informed him that anything he needed to do, he could do on a Macintosh. Unfortunately they failed to tell the staff that, and therefore, materials that we had developed that were Windows based were very difficult. So you could regard that as a technical issue in that he had an operating system dependence, which I would not have expected.

As well, SSSD1 found that for students:

If you have a mechanism that you have always used, let us take for example something as simple as a screen reader, if you have always used the screen reader you know all the shortcuts, how it works, you have got your right tone of voice and speed, you want to carry on using that, you do not want an assessment that reads itself out to you.

In addition to having dependencies that may interfere with the optimal use of assistive technologies, sometimes students do not realize that they have a disability that may impact on their experience taking an assessment in an online learning environment. For example, SSSD5 found:

We have been using audio clips in a few of our exams and occasionally we have people who cannot hear them very well. And we have had some students who do not know that
they have got a hearing impairment. So that becomes a challenge … it is one of those things that students often will declare that they are dyslexic or get assessed for dyslexia, but some of the other problems that they have, they do not often think to get those problems checked out, - like their hearing.

Issues related to lack of awareness and understanding may be compounded by standardization challenges that have cost implications. There may be limited options to customize or personalize the display of the authoring environment and the assessment itself for instructors and students respectively. Another key problem is the lack of standardization of web browsers, which may be used to deliver or present tests in higher education online learning environments and to gather the responses from students (ASA3, INST1, INST3, INST4, and SSSD1). The lack of persistence of student preferences or profiles for the display of tests also seems to be an issue within higher education online learning environments as noted by ASA3:

Somebody who is used to using a particular display setup when they access any campus PC as part of their profile, that display setting may not be preserved when they move to a particular assessment … [students should not be] time penalized because they have to spend the first few minutes figuring out how to change the text size, or change the colours, or whatever, so that they can actually read the questions.

There also seem to be challenges with multimedia elements (e.g., lack of labeling) and multimedia players, as participant ASA2 noted, “It depends on which system you are using, but sometimes that labeling system, the alt text, is not very good”. This person also stated:

They forget that actually the player itself may not be accessible. So it may be that they can get to the player, but maybe they cannot actually get into the player and then they cannot access the controls. They need the mouse to get into the player, but it depends on the browser they are using.

Unfortunately, online tests also may be cluttered and too long (ASA2). They may not provide learners with the same basic affordances of a paper-based test, namely the ability to jump forward or backwards in the test, and to have a clear indication as to how much of the test is
completed and how much remains (ASA2). Problems with secure browsers and the inability to zoom into the text may impede the accessibility of tests (ASA2, INST1).

There are various national standards and specifications, legislation and regulations specifically targeted to improving accessibility (ASA3, SSSD3, SSSD4), such as the British National Standard 8878, W3C WCAG2, W3C ATAG 2.0. These may or may not have been implemented to support the creation and delivery of accessible online tests in higher education institutions.

With regard to the creation of accessible tests within a higher education online learning environment, one of the participants (ASA3) noted during the semi-structured interview that it would be helpful if software developers would follow the W3C ATAG (Authoring Tool Accessibility Guidelines) in order to assist instructors with disabilities to be able to use test creation software and also in order to assist with the creation of more accessible tests. As well another participant noted that there may be lack of standardization regarding assistive technologies such as screen readers (SSSD4). Several participants (INST3, INST4, SSSD1, and SSSD4) identified issues that make it difficult for assessment software developers to create software that supports accessible tests in higher education online learning environments, such as:

- Lack of alignment across standards and specifications;
- Limited software testing tools;
- Limited knowledge of issues related to the separation of content and presentation (e.g., MathML);
- Little support for adaptive testing; and,
- Lack of guidance regarding accessibility.
Attempts may be made to create profiles and flag students within the system with specific requirements, but the approaches may result in the over-codification of requirements with limited resulting functionality. According to SSSD3:

By having that people information, or demographic information that enables somebody to be flagged up to make sure that, you know if it is just more time that they need then they are given more time, but often it is not as simple as that … you should be designing things so that it is a real exception rather than constantly designing things that 20% of the population need accommodation for, and as a result trying to codify everything and sort of put people in boxes and make automatic decisions is probably not a very constructive way of dealing with it, and it could just lead to frustration, because somebody might have sight which varies significantly from one day to another, or some other kind of, it does not really matter what kind of disability, but conditions do vary a lot, and if they feel they are being denied access to something that might have been more appropriate at a particular time just because of an overly simplistic rule, that would be frustrating I think.

Another apparent concern mentioned by participants was problems in a standardized approach to separating the purpose of the question from its delivery. SSSD2 expressed:

So you might have a question in a topic that did not at all involve vision, you did not need to be able to see to answer the question, but it was delivered in a mode that did require vision to answer the question. But because the purposes and what was required for the question have not been separated out from the question itself, you could not do anything; you could not actually deal with it. So question authors were going okay, here is that, I would like to do that online, without any consideration of what were the aspects that were sort of intrinsic to the delivery system and what were intrinsic to the question. They had not identified what was intrinsic to the question. So if you wanted to build systems that dealt with accessibility of questions and their delivery, you needed to be able to talk about the purposes of the questions.

There may also be issues with learning platforms, such as virtual learning environments. For example, transitioning to a new system can be problematic, particularly if the newer system does not have all of the functionality that was available to instructors and students in the previous product (INST2). The various learning management systems may have different question types and proprietary software that locks instructors into the system (INST4). Learning management systems may not capture all of the metadata (e.g., tagging related to question accessibility, the purpose of the question) that was available in the previous system that was used (SSSD2).
may structure the questions differently, and, even when a specification is used by various
learning management system companies, the coding used to support question types may not
easily transfer (INST4). These problems can surface when one learning management system is
being replaced by another, or when test questions are being migrated from one system to another
(INST2, INST4).

4.8 Top Priorities with regard to Accessibility

Participants were asked to identify their top priorities in terms of accessibility. In terms
of themes, the top priorities identified seemed to be related to many of the barriers noted in 4.7.

4.8.1 Top Priorities with regard to Academic Integrity

Four of the participants (ASA2, ASA3, INST2, and INST3) remarked on the need to
ensure that accommodations and alternatives need to be fair and to meet the academic rigor
required in higher education contexts. One of the participants (ASA3) stated:

Generally, the assessment should be designed in a way that is fair, that places the
appropriate level of intellectual demands, but not additional unnecessary cognitive load in
figuring out what is being asked, and how to select the correct option, and how to enter
the correct answer.

Another participant (ASA2) confirmed this concern:

You must never get rid of academic rigor, there is a reason for it, and it serves everyone
very well. The last thing you want is someone feeling that they have been given an easier
test because they are disabled. They will not have been, but they may sometimes feel it.
Some students have said, “Well if you change it then it does not represent the same test”.
So we have got to be very, very careful that everyone is judged in the same way for their
abilities. So it is providing tests that allow students to be tested on the participant that
they are learning, rather than being tested on their technological skills.

Another priority that was mentioned by participants was ensuring that there is a
justifiable purpose or reason for using a particular type of assessment (e.g., audio) (ASA3):

Audio, - people who are hearing impaired should not be unjustifiably excluded because
of the need to be able to hear some sound in order to be able to answer a question. So for
example, if a question requires somebody to listen to a piece of audio or watch and listen
to a video, then answer some questions about it, then if somebody cannot hear the audio, there should not be any unjustifiable need for somebody to be able to listen to content in order to be able to demonstrate their competency in a particular topic.

At the same time, one of the participants (INST2) acknowledged that there is a need to be pragmatic and reasonable:

Well my top priority is to make sure that everybody is tested in the same way about the same things. But I think that when you are dealing with these issues, you have got to be pragmatic as well … Now there are certain questions that you really need to ask, and so you say, “Okay, is there an alternative?” Then you say, “What would be the next best?”, that I need to put this out, you know, because you have got to move forward. So “Is there a complete equivalent?” But I am pragmatic, if I have not got a complete equivalent, I will do the next best.

4.8.2 Top Priorities with regard to Inclusive Design

Four of the participants (ASA1, INST1, INST2, and SSSD1) highlighted inclusive design as one of their top priorities. INST2 indicated that it was important to separate out the concept from the test question when designing the test and also the importance of structuring and organizing learning materials:

When you are designing it [the test], you are thinking what are the range of disabilities that we could encounter here? … it does not matter if it is audio or some other form if that is what is happening and you want to get that through and you are actually testing the right concept. But if it is audio, you have got to make sure that you have not got too much script, because if that is the question, and we also know from our research, where you must put the question, the key words. If you put them at the end, then they will miss it. It is giving information, if it is key information that you want the students to know, do not put it at the end of an audio sequence, because by about ¾ of the way through you are tapering off.

Similar to traditional tests, instructors need to structure and order information (SSSD1) and to consider:

Any data they may need to work with or background information, the answer that they are going to submit, any feedback, any marks from that, that is a huge amount of information to think about, - what order to present that, how to let them navigate around it.
4.8.3 Top Priorities with regard to Mainstreaming

There were several top priorities associated with bringing accessibility issues into the mainstream. ASA1 emphasized the importance of ensuring that inclusive design becomes part of the course design and review process. This participant suggested that benchmarking could be used by institutions to assist in the development of accessible curriculum and also to allow institutions to compare their progress over time and with other institutions. Another key focus mentioned by two participants (INST1 and SSSD4) was to focus on the “customer experience”. In this case, the end users (i.e., instructors and students) are key stakeholders. In the words of one participant, INST1, “enabling online assessments to work for everybody involved, all participants, that was my top priority”. Two of the participants (ASA1, INST1) stated that encouraging people to think differently about the online test process through training and awareness were additional priorities to assist with mainstreaming accessibility of online tests.

4.8.4 Top Priorities with regard to Resources

Five of the twelve participants (INST1, INST2, INST3, SSSD3, and SSSD4) indicated that they had top priorities with regard to resources to support online tests in higher education online learning environments. A key point mentioned by one of the participants (SSSD4) was “to apply an appropriate amount of resources to this”. INST3 emphasized the importance of partnership relationships that could be established beyond higher educational institutions to include others such as companies and professional organizations external to the university to leverage resources and innovative approaches to online tests. From the developers’ perspectives (SSSD3, SSSD4) a critical success factor is having access to:

clear best practice, - if there is a 1- or 2-page document that you can hand to a developer and say, “Read this to understand the key issues around accessibility, and then apply this to the way that you develop software” … I think somewhere where people can go to kind
of quickly get to the truth or at least our current understanding of the truth. That would
be the most helpful thing for developers I think.

4.8.5 Top Priorities with regard to Technology Tools and Issues

Technology tools and issues were identified by eleven of the twelve participants as being
a top priority. A concern was to ensure that the technology supports understanding of the test
content and does not obstruct or impede student performance (ASA3). As noted by ASA3:

My top priorities, - well keyboard accessibility for sure. I think that is absolutely critical.
It should be possible for somebody to navigate through an assessment and enter data and
select answers without having to use a mouse … I think it is very important to make sure
that somebody can complete an assessment without being able to see it, so that it makes
sense when it is read out … That it is possible for somebody to listen to the content and
be able to select an answer that they have chosen because it best matches their intellectual
understanding of the question rather than a sort of best guess as to what is being read out
to them … it is critical that anybody who needs to change the display of a screen is able
to do that in a way that does not affect their understanding of the assessment, and
therefore there should not be a reliance on colour perception, unless there is an academic
reason for doing so.

This was confirmed by ASA2 who also expressed concern that:

Some of these online tests are not just testing the quality of their knowledge for the
particular subject, but they are also, by the way they are delivered, testing a certain
technological expertise … you know, are they a good mouse user, or are they quick
even enough to get the answer in, or can they use drop down boxes accurately enough, all that
sort of stuff, it is not helpful.

In addition to ensuring that the accessibility functionalities, such as assistive
technologies, are user friendly and enhance understanding of the test items, another top priority
that was mentioned by several participants (SSSD1, SSSD2, SSSD3, SSSD4, SSSD5) was
standardization of technical aspects, such as web browsers (SSSD1), metadata (SSSD2), and
code development (SSSD5) (e.g., prioritizing technical support required for accommodations)
and quality (SSSD3, SSSD4) (e.g., through the use of code test suites). Another top priority that
was stated by participants INST1, INST2, INST3, SSSD3, SSSD5 is the identification and
dissemination of best or good practice with respect to the creation and delivery of accessible tests in higher education online learning environments.

4.9 Strategies and Practices

The participants were asked to identify the strategies and practices that they use to work towards the creation and delivery of more accessible tests in higher education online learning environments. They provided some suggested strategies and practices that relate to the barriers and top priorities that they outlined earlier in their interviews. Some also specifically indicated supports that need to be in place for instructors who are on the front lines of assessment creation and delivery.

4.9.1 Strategies and Practices with Respect to Academic Integrity

There were several participants (ASA3, INST3, SSSD4) who indicated that a key strategy and best practice is awareness and implementation of key principles that support accessibility. These participants made specific suggestions related to the creation and delivery of accessible online assessments. In addition to considering how a question could be asked using an alternative mode in a manner that respects the academic integrity of the question, it was suggested that the question types need to be chosen with care to ensure that they are appropriate for the questions being asked. A best practice that was identified by participants (SSSD1, SSSD3, and SSSD5) was to target learning objectives as well as possible and understand the underlying aim of the questions.

The importance of linking the assessments with the learning outcomes early on in the curriculum design process was noted by several participants (INST2, SSSD1, and SSSD5). INST2 remarked:
We are trying to make people very aware that you have got to link the learning objectives to the assessment early. Not that we do not do that, but you just cannot bolt an essay on the end. We do not do that really anyway. But it is still not 100% there.

Similarly, SSSD1 said, “I do things like ‘Let us look at a question and consider the different ways we could create this question and the impact this has on the usability on the learning outcomes’”. SSSD5 noted the tangible benefits of this type of approach for a program in medicine where the test questions were mapped back to learning outcomes. Through this process, it is possible to provide targeted feedback to students about specific learning outcomes that they have mastered and those that they still need to improve. As well, direct links are made between learning objectives and the curriculum as noted in the reflection below,

A member of the staff who was doing this mapping to generate these feedback reports after the exam, and they went question by question and they tried to link a question to an objective, and they could not find it. They actually worked out that they had altered the order of when they were going to teach something. They had been teaching it in Year 1 when the assessment was, and they had shifted it to Year 2. They had forgotten to take the question out. So they were trying to map this question to a non-existent objective. It suddenly dawned on them that they were no longer teaching that in this year. So they had to take the question out of the exam paper. That was okay because they were doing the mapping before the exam paper ran. So that worked out well, but it is a nice example of the technology supporting the mapping process, and by focusing attention on the mapping process, they noticed this issue”.

ASA2 stated that, with regard to academic integrity of online tests, there are often checks and balances within academic departments, and faculty advisors will often provide input regarding tests. Four participants (INST1, SSSD1, SSSD3, and SSSD5) indicated the importance of knowing the limitations of the software to ensure that it does not jeopardize the academic integrity of the test questions. Other strategies included providing a similar test with equivalent questions for those students who had to take the test at a different time and awareness and understanding regarding how the accommodations and assistive technologies that are put
into place to support students with disabilities might impact on the academic integrity of a test (INST1, INST2, and SSSD1).

4.9.2 Strategies and Practices with Respect to Inclusive Design – Online Assessments

There were several strategies and practices that were noted by participants with respect to inclusive design that were identified as being important during the creation and delivery of more accessible tests in higher education online learning environments. A practice that was noted by two of the participants (INST2 and SSSD5) was the importance of a team-based approach to design and development that incorporates cross-unit members that are aware of accessibility issues. A strategy that was suggested was to bring in expertise from another collaborative design and development team at the design phase in order to gain the benefit of the experiences of potential pitfalls, challenges, and opportunities from other curriculum design projects (INST2).

Awareness regarding accessible and inclusive design methods to test software that is used to create and deliver tests in higher education online learning environments was noted as a best practice (SSSD1, SSSD3, and SSSD5). Another strategy was to recognize differences and commonalities in how each instructor approaches the design and development assessments depending on the context, subject matter, individual teaching styles, and other factors (SSSD1). Raising awareness regarding different question types that are most appropriate to support the design and development decisions that have been made is another strategy that was highlighted (SSSD1).

Other strategies to ensure inclusive design is considered for online assessments in higher education online learning environments were the development and use of a quality check process (ASA3) and an audit trail (SSSD5) of questions that would document how they have been
modified and the learning objectives and outcomes they are associated with, and the ability to allow for statistical analysis to support curriculum decisions (SSSD5).

For participants who had a primary role of Accessibility Specialists and Advocates, the best practices and strategies were outlined as being openness and encouragement of greater student involvement in the assessment process, adhering to accessibility principles, and development and use of more meaningful and authentic forms of assessment that are informed by student feedback (ASA1, ASA3).

Some of the participants with the primary role as an Instructor at a higher education institution (INST1, INST3) indicated their best practices included several different items. Flexibility in assignments was seen to be a key strategy as it can allow all students to have alternatives in how they can express what they have learned (e.g., allow students to submit a video instead of an essay) in a manner that is reasonable to implement and mark (i.e., will not substantially increase time pressures on instructors or other teaching staff). Another suggestion from the instructor participants was to provide students with scaffolding through suggested steps that support individual learner requirements.

4.9.3 Strategies and Practices with Respect to Mainstreaming

The participants mentioned several strategies and practices that they have observed or used with regard to mainstreaming of accessibility of tests in higher education online learning environments. Several participants indicated that awareness and understanding of current drivers in higher education institutions are a recommended strategy and best practice (ASA1, SSSD3, SSSD4); and, these participants noted a movement in higher education towards fitness for purpose drivers. They indicated the importance of customer demand drivers in terms of justifiable assessment practices. As well, they noted the importance of institutional purchasing
policies and the need for probing regarding the accessibility of assessment software to ensure that questions are answered.

It was suggested by some of the participants (SSSD1, SSSD3, SSSD5) that prioritization and planning to accommodate accessibility requests as much as possible could be a best practice that could be implemented by considering past requests and through consultation with disability services on campus (e.g., consider past requests from students regarding accessibility changes and requirements needed to take the online test successfully).

Three participants (ASA1, SSSD3, SSSD4) noted increased demands for conformance with accessibility specifications and standards (e.g., requests for availability of Voluntary Product Accessibility Template (VPAT) information. Additionally, these participants noted financial drivers such as recent cutbacks to higher education institutions in the United Kingdom. One of the participants (SSSD4) noted the importance of legislation as well.

There were participants who indicated that support for culture and ethos change was a recommended best practice and strategy (ASA1, INST2, SSSD1) with regard to mainstreaming and they made suggestions to help instructors and institutions to break out of routines and comfort zones. These participants advocated for allowing alternatives when assessing, providing more support throughout the institution and developing teams with eAssessment and accessibility expertise. As well, infrastructure was another support that was noted by several participants as being a crucial support to instructors. ASA1 suggested that support from senior management (organizational level) was very important.

Academic policies, procedures and guidelines were identified by four of the participants as being potential positive strategies that can help to ensure wider adoption of approaches to ensure that online tests are more accessible (ASA2, ASA3, INST1, SSSD5). Ensuring that the
policies are well integrated, work well together and are written in a manner that is easy to understand (INST1) was a specific strategy identified to help instructors who are responsible for creating and delivering online tests.

The importance of institutional culture and ensuring that the accessibility of online tests is supported through a collaborative group rather driven by an individual were other practices and strategies that were mentioned (ASA1, ASA2, ASA3, INST2, INST3, SSSD5). A coping strategy was identified by INST1. This person noted that there were instructors who had used the strategy of “covering up”, that when they discovered there was a problem they decided not to share or report it. This participant said,

One of their strategies was, “I promise to myself not to do that again”, and find themselves caught out for time later on the next year. But from my own viewpoint I think there were people who had some problems and never admitted it.

As new technologies become more popular, one participant (SSSD5) noted the importance of awareness and testing of new technologies (e.g., tablets) as key to remaining abreast of accessibility support mainstreaming issues.

4.9.4 Strategies and Practices with Respect to Resources

Suggestions were made regarding resources that could be supportive to making online tests more accessible. The development of formal and informal support networks, some perhaps discipline specific, was identified as a helpful strategy (ASA1, ASA2, ASA3, INST1, INST3, SSSD1, SSSD4, SSSD5). For example, several participants (ASA1, INST1) indicated that the development and support of subject discipline networks were very helpful to instructors. ASA1 stated, “there is an impetus within their subject discipline nationally to share good practice and to lift the standard within the discipline as a whole”. Resources within different institutions may be lacking, so it was suggested that instructors engage with discipline networks and services and
that they think beyond their own institution (INST1, INST3). For example, greater integration of
different levels of education and training (e.g., amongst secondary, tertiary, and further
education) was a suggestion for consideration (INST1). The development of national guidelines
and seeking external guidance from others such as accessibility organizations (ASA2) could also
assist instructors. Willingness to seek out and adopt resources that have been developed
elsewhere was an issue related to resources that was identified (INST1). As well, this instructor
pointed out that it is important to ensure that there is time, space, and opportunity set aside to
discuss these complex issues instead of simply providing data or links in an email and expecting
that instructors will have time to read it.

As well, improvements to course and policy level integration (ASA1) and opportunities
for personal meetings, chatting, and informal networks (ASA2, INST1) were mentioned as
helpful instructor supports. Other supports for instructors that were noted included the provision
of workshops, training sessions, lunch-and-learns also was identified as a strategy that can help
support instructors to create and deliver more accessible online tests (ASA3, SSSD1, SSSD4,
and SSSD5). As well, increased student-faculty dialogue (ASA2), and review of the subject
specific teaching literature to gain information about what works and what doesn't work (INST3)
were identified as other strategies.

Another positive practice was having access to accessibility specialists, advocates, IT and
pedagogical experts, and other more experienced instructors as a proactive resource during the
planning process (ASA1, ASA2, ASA3, INST1, INST2, SSSD2, and SSSD5). Three
participants (INST1, SSSD1, SSSD2) indicated that it was important for instructors to have
access to assistance from people with expertise who have both pedagogical and technical
knowledge. These participants suggested that staff development units, the development of
instructor planning skills, increased funding, and time are some additional resources that can be key factors that impact positively to support instructor success.

Several participants who focused on the importance of the development and dissemination of case studies (INST1, INST2, and SSSD5), made several suggestions to provide both examples of accessible tests and also test questions in communities of practice through various methods including the use of public virtual spaces such as wikis, blogs, and websites. It was suggested that awareness and understanding could be improved through the provision of clear exemplars (INST2, SSSD5). As noted by INST2,

We would film a scenario with actors or some staff, and then people can see the difficulties. Then we would make a podcast at the start and say, ‘We have had students who have visual impairments, they have worked in these sorts of areas in the university. Here are the sorts of things they have problems with. You might think, well how on earth could they do my course, well actually what we have done is …’ and then of course we have got loads of stuff on the website as well. But I think exemplars and some visual aids are really strong and powerful, but delivered in a supportive way.

Similarly, SSSD5 suggests

You know, if you said, “Jay Bloggs is colour blind”, well “Jolly good, what do you want me to do about it?” I think if you say, “Such and such is colour blind”, most colour blindness is red-green and the message how to, well that is a very easy example, you have to avoid red-green, but you know what I mean? Then you could start to get into possible equivalents then as well. So you put up, you know, the chart, and then you show how the same thing is expressed in text, or something like that. I think most academics would struggle to think “How would I actually change what I am doing, given a disability?” I think it needs to be done in a very concrete fashion, and you are just making them aware and saying, “This is what the software supports”. It is really two things, (a) “This is what the software supports”, and then (b) “This is what you would have to change to content”, the actual questions themselves, how they could be modified around the disabilities.

4.9.5 Strategies and Practices with Respect to Technology

The participants remarked on a number of technology-related strategies and practices to help support better accessibility of online tests in higher education learning environments. One of the main strategies and practices included ensuring that there is awareness and understanding
of the technologies and already established guidelines and standards, (ASA1, ASA2, ASA3, INST1, INST3, INST4, SSSD1, SSSD4). For example, several participants suggested that it was important that online assessment systems not rely on colour perception in order to convey information (e.g., that an answer is correct or incorrect).

In addition, the participants noted that technologies that are used for online tests are often customizable by individual students, so that learners can view and interact with the test content in a way that meets their own individual requirements (e.g., display customization, changing mouse behavior, availability of roaming profiles, etc.) (ASA2, ASA3, INST1, INST2, SSSD1, SSSD4).

Several of the participants stated that it was important to ensure that assistive technologies and devices are in place and are functioning properly for students who have disabilities (e.g., screen readers, audio renderings, control regarding font size and colour, keyboard support, keyboard alternatives, adaptive mice and screens, online calculator, etc.) (ASA2, INST1, SSSD1, SSSD4, SSSD5). A key strategy to support this work was to test the software and hardware with students who use accessibility supportive software with different web browsers (e.g., JAWS) (ASA2, INST2, SSSD1, SSSD4, SSSD5).

Participants commented on the need for a test preview or practice test so that students have the opportunity to familiarize themselves with the technical environment in which they will take the test (ASA1, INST2, SSSD1, SSSD4, SSSD5). A key strategy to support this part of the work is awareness and understanding of the design and development process itself and how technology can provide some affordances to assist with the process were mentioned by several of the participants (ASA2, ASA3, INST1, SSSD1, and SSSD5). Another suggestion was to ensure that the institutional learning management system, or assessment system, that is selected is
compatible with other systems and support students with disabilities with minimal investment of resources (e.g., templates that have been designed to be accessible) (ASA2, INST1, INST2, SSSD1).

Participants stated that it was important that technologies that are used for online tests support the creation of different types of questions, such as constructed questions, rather than focusing solely on multiple choice questions (SSSD1, SSSD3, SSSD5). In addition, it was recommended that there should be a reduction in reliance on and consideration of alternative accessibility strategies for technologies that may be less accessible or that may have identified accessibility issues (e.g., use of customized, non-standard HTML, other) (ASA3, INST3, SSSD4).

A key best practice that was identified was ensuring that the assessment system supports the use of multimedia (e.g., animations, captioned audio, images, etc.) so that students who have accessibility issues can interact with these types of elements when taking a test (INST2, SSSD1, SSSD5). The participants emphasized the importance of ensuring that multimedia content (including graphics) is as accessible as possible and properly supported, for example, through transcripts, captioning, and accessible players.

In addition to considerations regarding multimedia, participants noted the importance of ensuring that online assessments are as inclusive as possible through the separation of content and delivery (e.g., using an XML-based system to ensure that content that is developed can be shared using newer technologies) (INST1, INST3). Separating content from delivery was indicated as being important for online tests both for accessibility and to support mobile learning (INST1, SSSD4). Some of the participants (ASA3, INST3, SSSD4) stated the need to ensure that the presentation and delivery of questions adapt to the delivery requirements of individual
learners and follow basic recommended principles. For example, in the case of mathematics, it was noted by INST3 that:

There is presentational MathML and there is content MathML and it is the content MathML that allows you to evaluate, because it is understanding the mathematical structure of the equation. Whereas, some of the other systems that other people use are based on presentation onto a screen. Makes it look right, but they have not understood the mathematical structure underlying it.

The importance of this strategy was reinforced by another instructor (INST2) who noted that this separation of content and presentation allows for the reusability of content as new technologies are implemented over time.

Technical solutions were seen to be another potential support for instructors. For example, four participants (ASA3, SSSD2, SSSD3, and SSSD4) indicated that accessible authoring tools could help to better support instructors. For example, ASA3 stated:

For me that would be the most important thing, in particular tools that followed, as far as possible, the W3C Authoring Tool Accessibility Guidelines (ATAG), which I think provide a lot of very helpful advice to authoring tool creators. So these are the people, you know the software developers, who are creating the tools, whether they are software applications or functionality in a VLE, so they are web-based … assessment tools that are much more proactive and forthcoming in terms of providing accessibility advice and support”.

Participants also suggested other technical solutions as being good supports for instructors, such as improvements to software (e.g., tool tips, accessible defaults, etc.) (SSSD2, SSSD3); provision of accessible templates (ASA2); and, better access to accessibility testing tools (SSSD3).

There were several other strategies and practices that were noted with respect to technology. Several participants (ASA3, INST3, SSSD4) suggested that layout considerations and usability aspects should be considered and accessibility guidelines (e.g., web accessibility) should be consulted (ASA3, INST3, SSSD4). Three participants (SSSD1, SSSD3, SSSD5)
indicated that any technical solutions should be well tested, both internally and externally. Two participants (SSSD4 and SSSD5) remarked on the importance of vendors providing access to documentation, knowledge bases, conformance statements, self-knowledge checks, and a help system within the software itself. These two participants also stated that it was essential that the underlying systems being used for online testing need to support the proper migration of questions to retain all of the accessibility features and as well provide meta-tagging functionalities to more easily identify questions that may present accessibility challenges (SSSD4 and SSSD5).

Finally, comments were made regarding the online test timers. One of the participants (SSSD4) noted that there is sometimes a differentiation in timer affordances between ‘high-stakes’ and ‘low-stakes’ tests. For ‘high-stakes’ tests, it is important to allow the instructor to be able to set the time, and also in some cases to allow the instructor to set exceptions of additional time for individual students who are registered with the Disability Office, whereas, for ‘low-stakes’ tests there may be instances where no time limit is used. Another participant (SSSD1) noted that a strategy that is employed by some instructors is to reinvest the time gains from automated marking of some of the questions towards the development and testing of better questions.

4.10 Areas for Improvement

Participants were asked to provide input with regard to the benefits and challenges of different proposed improvements to better support the accessibility of tests in higher education online learning environments based on three approaches that I selected. The three approaches are:
1. The International Classification of Functioning, Disability and Health (ICF), which provides means to classify human functioning through (WHO, 2002), a list of body functions and structure, and a list of domains of activity and participation. In ICF, the term functioning refers to all body functions, activities and participation, while disability is similarly an umbrella term for impairments, activity limitations and participation restrictions. ICF also lists environmental factors that interact with all these components (p. 2);

2. Standardized technology components and enhanced user interface functionality (e.g., through use of IMS GLC Inc. Accessibility for Learner Information Package (ACCLIP), AccessforAll Metadata (ACCMD), ISO/IEC 24751) (Anido-Rifón, 2008; ISO, 2008);

3. Other approaches or improvements that they may be aware of or that they may have encountered.

4.10.1 International Classification of Functioning, Disability and Health (ICF)

Participants who had a primary role as Accessibility Specialists and Advocates, noted several observations regarding this type of approach to accessibility of online tests in higher education online learning environments. First, several of the participants (ASA1, ASA2) stated that this approach was similar to the U.K. University and Colleges Admissions Service (UCAS) where students indicate whether they have a physical or visual impairment, a mental health issue, dyslexia or some other disability prior to being admitted to a university or a college. For UCAS, there are nine categories and applicants may find that they may belong in more than one category. As noted by ASA1, this type of approach can have benefits and challenges:

That has positive benefits in the sense that when a student arrives at university, they have a big label on their forehead that says, “I am a whatever”, which means that the lecturers immediately know, “Okay in my class I have got a whatever student so I need to be thinking about this, I need to be thinking about that.” In a sense it walks 3 steps ahead of the students and tries to remove some of the barriers before they get there. That is the positive side of it. The negative side of it is that it reinforces the view that accessibility is
about meeting the needs of this group of people, and this group of people, and this group of people and not about creating an inclusive culture for everybody so all of those people do not need to wear those labels anymore.

Additionally, ASA1 indicated that this type of approach may be a useful start to begin to think about categorization in educational systems that do not have any formalized structure to address these types of issues, but in the long run, this may not be as useful for more established systems:

I think it depends on what stage an educational system is at nationally as to whether that is a useful approach or not. I think in the U.K., we were just about at the point where those kind of boxes are becoming less useful, because people are starting to grasp that accessibility is not just about blind people and dyslexic people and people in wheelchairs. But it is also about people who have jobs; people who do not speak English fluently, people who have childcare issues, and so people are starting to realize now that accessibility goes beyond those boxes. But certainly five years ago those boxes were a very, very useful way of getting people to think around particular problems. So, I guess as a country we are probably beyond the point now where that would be useful. But certainly maybe still at a departmental level where people understand that they have to review their assessments and be more inclusive, but they do not really know what that means. Then giving them the classification system and saying right, here are 10 groups of students who have particular needs.

ASA2 felt that this type of approach is:

Totally unhelpful and I do not approve of it because it does not give you any idea of the individual’s abilities as opposed to disabilities. It does not tell you the degree, it does not tell you anything. So most lecturers do not use it, they know what their individual students, if you think that only say about 5% of the students are disabled, you tend to know who is disabled in your course, and you tend to make adaptations for them. Although the law says it has to be done in anticipation, that is actually physically not possible very often.

This viewpoint was shared by ASA3:

The benefits of a more formal description of barriers or human attributes that need to be accommodated I think would have to focus on the ability to carry out actions that are relevant to completing an assessment. So any such classification would have to be, in my view, related to whether somebody could use a mouse to drag a piece of content across a screen for example, or whether somebody could see an image, or whether somebody could hear a piece of audio, or whether somebody could read standard black text on a white background without difficulty. I think it is important for any classification system
that is used to aid in designing inclusive assessments to focus on the mismatch between somebody’s accessibility needs and the ability of a system to accommodate those.

ASA3 added:

There is a mutual responsibility between, from an accessibility perspective, there is a responsibility on somebody to have the appropriate assistive technology and know how to use it and for somebody providing content for that student to interact with, to be able to provide the content in a way that allows them to access it in their own preferred way. What is difficult, or what introduces problems is when you go down the route of a medical model of disability, which tends to assume that the accommodations that are made are related to an assistive technology or some kind of medicine or drug, or something that the learner / the disabled person can take and there is no responsibility on the content provider. I think that is where the shortcomings of a medical model are laid bare when it comes to designing electronic resources. There is an assumption that “Well I will design this resource and as long as somebody has the right assistive technology then that will be fine, and if they do not well then that is tough.” Actually there is a mutual responsibility on the content provider to make sure that the content, the assessment in this case, is flexible and adaptable enough that it can be presented and interacted with in a way that best supports the learner’s accessibility needs.

All of the four participants with a primary role as an instructor at a higher education institution indicated that they had not heard about the ICF before. INST1 indicated that, with the UCAS as an instructor, he had received a class list with a red tick beside a student’s name, but was given no information about what the student's disability was. When he asked about it, he was told that he “could not be given that information because of legislation on privacy”. This Instructor participant said that an interpretation document would be needed for instructors to understand how something like the ICF would be implemented. Another Instructor, INST4, said:

If the different ways that a question can be presented to a student are made clear to the student, then the student can make a perfectly good decision themselves. Even if they have not got a disability, some students like it one way, and some students like it another, and I do not think the fact that they have not got a disability should disallow them from selecting different ways that the question is presented. Another thing is, and this one I have a lot of sympathy with, there a people who have disabilities who do not want to declare them. They want to do the best they can, alongside other people, doing their utmost to get along without any special dispensation.
Four of the five participants (SSSD1, SSSD3, SSSD4, and SSSD5) who have a primary role as Software, Specification or Standards Developer noted that they were unfamiliar with the ICF approach. SSSD1 indicated that it could be potentially useful, “if you were looking at, ‘If I do this, how many people will this help, how worthwhile is this for us to do?’”. However, a potential drawback is that “you cannot always classify things like that, but you know you have to start somewhere”. SSSD2 identified this approach as the “medical model of disability”. For SSSD2 the “medical model does not have sufficient granularity to deal with it properly. We should stop talking about people as being disabled and start to talk about systems that disable them”. This person stated that it does not “deal with disabilities that change for example. It is all about measuring and classifying people, and it just does not work”. To this participant, there are no benefits to this type of approach and it is mainly historical, as it has been a foundation for the way that some organizations have been funded. Another participant (SSSD3) indicated that it can be problematic:

If you attempt to overcodify things and classify things, you are also not solving the problem for anybody because the labeling does not necessarily help. If I am developing software, suddenly I have got to become an expert in which things are appropriate for which person, and given that there is not huge numbers involved here it would be better if someone said from an accommodation point of view, “We have agreed we will not show this person any video, so do not show them any video”, whatever it is. That would actually be more useful for developers of software I think rather than, what is perhaps the too much information approach. I can see why people do this, this is around monitoring and measurement and it is directly related to the disability for the same reason why you may want ethnic information if you are interested in issues related to race, but I think there are only so many people who need to know that. So that is my initial reaction when I see it, but as I say, I am brand new to it.

Another participant (SSSD4) indicated:

I personally am not familiar with this, so I cannot give you too much on it. But from the point of view of a software developer, it would be very good if the accessibility community were to combine and agree and tell us what we need to do and what is the best practice thing to do and not have lots of different best practices, because that would be much easier for us to deal with. So … yeah, it sounds like a good idea to align on
something, whether this is the right thing to align on I do not know … Accessibility is one of 20 or more different things that we want to make our software do. From both a business point of view and a personal point of view we want to be good citizens and good players, but we want it to be simple and we do not want to have lots and lots of different standards that do not necessarily fit together.

SSSD5 remarked that although it sounds like a good idea, two reservations are the issue of academic equivalence and the amount of time that an academic would need to spend to build alternative test question formats. This participant said:

I would not want to go down the route assessment-wise where we are playing to the lowest common denominator, because then everything is going to end up just a textual MCQ [Multiple Choice Questions] that can be read out. So I think we need to work out how not to discriminate against people with special needs. Clearly they need to progress through their academic studies in a robust academic way. Then for the vast majority of the cohort population, we need to be using new innovative assessment techniques online, including audio, including video, including things like drag and drop. I would not want to see the accessibility put the brakes on some of the more innovative features. It is a balancing act, we need to accommodate people with special needs, but not at the expense of the entire cohort.

4.10.2 Standardized technology components and enhanced user interface functionality

Participants who had a primary role as Accessibility Specialists and Advocates, noted several observations regarding standardized technology components and enhanced user interface functionality to address accessibility of online tests in higher education online learning environments. ASA1 stated that, although it seems to be a good approach, the “worry is that the assessors then will think that accessibility has been dealt with and will not do the other half of the equation, which is to think about accessible test questions”. ASA1 indicated that:

It is the same as it is with the disability classifications I think, the technology standards and user enhancement features can move us a certain distance along the road we need to travel, as long as they are not seen as “the solution” or “the only answer”. Certainly building in accessibility features into the delivery system is, for me, one of the biggest hurdles when it comes to accessible assessments.

This participant noted the potential benefit of using this type of approach as an initial approach and went on to indicate that helping so many students is made possible through the software that
is being used. This person also stated the need to balance the changes that can be made to improve the software with a pragmatic focus on the number of students who might be helped through changes that are made. Accordingly, this participant stated:

You know you can affect so many students so easily by just making one change to a piece of software. That is definitely worth pursuing and investing in as long as it does not breed complacency like I said with regard to the actual content of the assessment. Again, it is one of those situations where pragmatism has to come into play, you know, how many features do you make available in your assessment software? The obvious ones about changing colour and font size will benefit all users. Having text read aloud, probably worth having, having alternative text on the images, probably worth having, but when you have done all of those basics, there are then other things you could build in, which will only affect 1 or 2 students out of 10,000 and then you start thinking actually is that worth it or would we be better considering a whole different type of assessment for those couple of students.

A concern that is noted by the participant in the passage above is the 'law of diminishing returns', where increased effort to address more of the needs from fewer and fewer of students with a disability may have undesirable consequences in increased costs and limited applicability to a smaller number of students. In terms of prioritization, this participant indicated:

If I had to put them in order, I would say building accessibility features into the software has the most immediate use. Having technology standards and assessment standards has some use, and probably has more potential remaining as a concept, and having the disability categories still has some use, but is having less and less use over time, in this country. I realize that other countries are in very different positions. Certainly I am working with some projects in Country X at the moment and for them they still have decades ahead of using those disability classifications to simply get the ball rolling.

This interesting observation from ASA1 suggests that building the accessibility software into the software will be most immediately beneficial to users. Technology and assessment standards are ways that this participant envisions as being helpful. Whereas, the view of the participant seems to be that the categorization approach that is represented by the WHO ICF may be more relevant to assist countries that could benefit from structure as they begin to address accessibility issues in a more coherent fashion.
For ASA2, standardization is “hugely important”, especially ensuring that students can “change the look-and-feel” of the assessment and that their assistive technologies work well with the assessment interface. For this person, the accessibility of the test depends on “the accessibility of the browser and of the interface and the way it is being coded, but it also depends on the way the content is presented”.

Similarly, for ASA3, standardization of technology components and enhanced user interface functionality also are important. This person observed:

The benefits are, if these approaches can be integrated into virtual learning environments and integrated into assessment creation software, then it does allow for much more automated behind the scenes repurposing or delivery of a resource that best suits somebody’s needs. There is less need for human-to-human negotiation, or less need for somebody to have to make manual adjustments to a computer before we start working on an assessment, or less need for an assessment tool to provide controls for somebody to change the display before they start.

According to participant ASA3, the automated repurposing or delivery of a resource has several benefits, such as more responsive repurposing or delivery of content. Reducing the amount of manual adjustments that are needed prior to beginning to work on an assessment could be another helpful approach that could result in cost savings in terms of human resources. Additionally, taking the assessment, the more you can describe the accessibility attributes of a learning resource, the more scope there is for a learner profile to include accessibility requirements, then the more chance there is for automated behind the scenes sharing of information so that the resource is delivered in a particular way that is optimized for that student. It can potentially make accessibility more efficient and it can allow for the reuse of resources in different situations. As long as this behind the scenes repurposing is going on then it helps to make the process that much more efficient.

The standardization of these types of approaches can be beneficial for instructors and students by allowing for more automated approaches to conveying information to students and also checking in with them. For instructors, some of the benefits as noted above are potential efficiencies and cost savings. However, this participant noted that there are downsides to this type of approach. Specifically:

There is a fairly, aside from lack of availability of tools that currently support this, I am aware of ATutor that supports these standards, but there does not seem to be much else
available. There is the general issue of populating these profiles in the first place. You have got an author of an eAssessment or any piece of eLearning, is faced with the task of adding all this extra metadata about it that will be useful for profiling, that might take place later. So that authoring process has to be made as efficient and made as easy as possible, so that somebody will actually add that content and not say, “I have not got time to do it, I do not know how to do it, I do not see any point in doing it.” And then the containers for this information are there but they are empty because somebody did not have time or the knowledge, or the awareness to fill them.

With a limited number of implementations, it becomes more difficulty to learn more about work that is or has been going on that would be relevant to how to incorporate these types of standards and specifications. As well, with the use of profiles, this approach could become overly bureaucratic and difficult to administer. Scalability may be an issue; as well there may be need for development of understanding and awareness of faculty and staff who enter this type of information. This participant noted that additional challenges are that:

It is obviously vital that the process of providing this information is made as easy as possible. And the same for the learner, they need to be shown the benefits of having this information. They might feel a bit uneasy about having some profile that relates to them, having some information about some kind of limitation or disability that they might be reluctant to disclose for fear of some negative consequences that may or may not happen. So there is a bit of a trust thing there. I think the big issue is making it easy as possible for people to add the content, and if you do that then you get the trust and people see the benefit of doing it.

Thus to this participant ease of use, clarification regarding the benefits that would accrue to them, security concerns and the development of trust are all key aspects.

The responses from the participants who have the primary role of instructor were mixed with regard to standardization and enhanced user interface functionality. INST1 indicated that although standards are a good thing:

How I would use them in my context as a tutor, it would be somewhat distant from me. As a developer, they are good information to be aware of. So yes, I think they are a good thing, but not to the end user academic, but to the developer to support the end user academics.
This person is suggesting that knowledge of the standards may be more directly beneficial for those who are developers rather than for those who are direct users of the system, such as end user academics. The participant indicated that intermediate services and agencies:

- can generate solutions without the demand because we can create that demand in effect, because we can see the scope of the whole problem. I do not think you can solve things just by end user requests for solutions because end users are so thinly spread that they never generate critical mass to get something attended to.

This person is suggesting that end user requests may not always be an optimal way to effect change in the types of requests for solutions, as end users may not have a full picture of the solutions that are needed. Additional observations are made regarding several benefits regarding the use of standards. According to INST1:

- A technical standard is very good because you can produce a defined structure for many different solutions to map towards. So you need an information architecture underneath to understand how different solutions might work with it. And this is where the techies and the computer science people can develop these solutions. And also, by developing these standards on a global level, even if the problem is a small fraction of the percentage, when you add it together on a global scale, it is an enormous solution.

Thus standards can provide a basic structure that can act as a common reference point for multiple solutions by providing a underlying information architecture that helps to make sense of how different solutions might work. However, these types of approaches seem to be more within the purview of work that is done by technical people. Another important benefit by engaging in standardization at an international level is providing a solution that meets the needs of communities of users but on a much larger scale than a regional or national approach may provide.

- A drawback to this type of technical approach however could be the “complexity of the solution”. This participant recommended “stepping stone projects” that would be:

  - examples that are understandable to different communities, including ones that are understandable to the student recipients, because then if they say, “Well I have received
this solution that was based on this accessibility for learner information package, and it did this for me, and it did that for me”, they can then point that out to the staff who teach them, and therefore raise attention to that in the teaching staff.

This suggests the need for more extensive and deeper collaborative work to help determine how solutions have been implemented and what the impact and end result of the solution is from the perspective of the end users.

Another potential challenge is the lack of time that instructors have to address these types of issues. As noted by INST1:

If you give these technical standards to academic staff, they are going to say, 'Oh my god, I have not got the time to understand that’ … part of the problem is that the position of academic staff is that they are at a fulcrum point and they just make snap judgments because they have to get on with it. That is the way it is with so many of them.

This suggests that a challenge to the success of this type of approach will be to find the time and to develop mechanisms to encourage more meaningful input and discussion.

To another instructor (INST2), standardization approaches and efforts to enhance user interface functionality are “nonsense”. This person felt quite strongly that:

In the European Union these guys get loads of money, and they are all meetings shots, talking shots, and then when they produce their papers and you talk to them it is like gobbledygook, you know, what does this mean? How can I do this? It is nonsense. In theory it looks fine, the papers, the stuff on the web looks fine, looks good, looks wonderful. But when you start trying to work with it, it is not wonderful.

The observations of this individual suggest that more work needs to be done to clearly demonstrate the value added of these types of technical approaches and to make solutions more transparent and easily implementable. As well, there may be a need for more opportunities to evaluate and provide feedback from the frontline regarding technical standards and specifications.

One of the Instructors (INST3) compared the ICF approach with the standardization approach and stated:
For example, with the type of blindness … called “Retinitis Pigmentosa”, you have two different forms at least within that classification, for example, people looking down a tunnel, sometimes called ‘tunnel vision’, can see perfectly well as long as the object they are looking at is in the tunnel. Whereas, [for others there is] … an all-round field, but nothing is clear in that field. So if you were simply to go by disability, and you were to put down ‘Retinitis Pigmentosa’ you would have to sub-classify that into well several different strands, so I think you would be better with the description that you gave of the second one. I think what I have taken from APIP, which was the youngster stores their preferences for how they like things to be displayed to them, I think that is the better way.

This participant outlined some of the challenges of using a classification method approach, such as the ICF, suggesting that a challenge with using this method would be ensuring that these types of systems are extensible to be able to handle very granular descriptions. The participant, when considering the standardized technical component approach, indicated a preference for this type of approach over the classification method (as represented by the WHO ICF approach).

The instructor (INST4) agreed that the standardization and enhanced user interface approach would be helpful and noted that:

We already have user profiles, we have desktops, you have your own settings on your machine. Our computers at the university, whenever you go to a different lab it will bring up your preferences, your background colour, foreground colour, and so on. So these are just extensions of that, and that sounds great, that is what computers are for.

This person (INST4) stated that disadvantages of this type of approach would be:

Users need to go to the trouble of finding out how to use. I think this is something that is missed, there are some people do not want to do that, and I do not see any way around it. Just simple things like setting up your screen colour. I mean whether you have a different screen colour at 1:00 in the morning compared to 1:00 in the afternoon.

So a drawback would be whether users would take the time to use the tools that would be made available through this type of approach and how easy the tools would be to use.

The participants who have a primary role as Software, Specification or Standards Developer also had mixed reactions to standardization and enhanced user interface functionality approaches. A software developer (SSSD1) noted that very often specifications and standards
are viewed as a “solution”, when, in fact, they may be considered a starting point. This person stated:

My biggest issue with anything like this is that very quickly people who are in charge of purchasing systems believe that these are the be all and end all, and do not understand what implications that will have on your system, for example, just going back to QTI, people saying ‘Are you compliant with QTI?’ Well there is no such thing as compliance with a specification, you have to have a standard for that. So there is a lot of misinformation and misunderstanding going around, and really we need to step back from things being compliant and look at how we can actually use these, and whether they are appropriate, and how much work needs to be done on them. They are not something you can stop at.

The view expressed by this participant suggests that it is important to question how the standards and specifications are being used and how useful they are. As well, through this observation, the participant also notes the difference between a standard and a specification. Another concern is the lack of understanding and good information to inform how standards and specifications can be used and what improvements might be needed as they are not a finished product, but rather a snapshot of understanding of a particular technical issue at a point in time. This participant pointed out that it can be helpful to understand how a specification, such as QTI, works, but that specifications and standards have their limitations. This participant also said:

If we were to use QTI then all of our really good stuff would not be there. But knowing about QTI, and knowing about the way it works, I can make sure that our structures and the way that we describe our information and support our information tries to keep to a similar enough mechanism or adds in new information that we have so that when it does get there, we can make use of that … it was highly influenced by a lot of American companies who were looking at things like CATs, and stuff like that, where they were used to multiple choice, and that was the driver. And yeah, great, that is brilliant, but let us not assumes that is the be all and end all.

So even if a system is not compliant or conformant to a specification or a standard, it can be beneficial for developers to understand them so as to ensure that during the continued development of the systems they are working on technical considerations can be integrated. This
will help to ensure that later on the system that is being developed will work with other systems that are based on the same specification or standard.

SSSD2, indicated that the main drawbacks for specifications and standards are that:

You cannot get them accepted. What matters very much is influencing vendors that produce products. What is often said of some of the bodies that produce these standards is that they are full of academics, and that academics know nothing about implementing and they write standards that you cannot implement. And there is some truth in this. What is the point of producing standards that are not used? They have to be used. I think it can happen. I think that if you produce the standard it gives you a weight of argument with a vendor, and there are also ways that in some sectors they can be made mandatory. But they miss one of the big elements is customers asking for things. The customer says ‘I need this, I want this, please produce this’.

This participant is raising an important issue regarding representation on standards and specification development groups. There needs to be a balance of representation from academe, business, government, and other sectors. As well, the standards need to be implemented and used and somehow a clearer connection needs to be made between the standards development process and the requirements of the end users. This participants also noted issues related to communication between standards bodies and communities and vendors and user communities as being a challenge:

They kind of miss that element in a way and one of the reasons they miss that element is because it is very difficult to communicate between standards bodies and communities on the ground, because of the pace, because of the level of technology. The standards people talk in terms of 24751:2008, whereas people want to talk about is this accessible to me in words that make sense in English, and there is a big gap there to actually fill, and it is quite difficult to fill. If standards work ideally, then vendors will be involved in their production and their take up and that is good, but you do not always see that happening. The idea is for vendors and user communities to be involved, but it does not happen everywhere. We need to have vendors around the table.

This person is emphasizing the importance of the relationship between those who participate in standards bodies and the people who develop and use the technologies that form the basis for the standardization and specification development work. The process itself needs to be more
directly relevant and approachable. Encouraging participation from these groups is vital to the success of this type of effort. This participant also noted the political aspects of trying to reach consensus amongst different standards development participants:

It is not the end of the story. Even if you get the vendors around the table, then you have got this conflict, they are all competing, and it gets political then. To be honest, the politics of academic organizations is easy compared to the politics of vendors. You know it is much more fierce, and my experience is that you really have to look at what people’s agendas are, what organizations’ agendas are. It can be very difficult. I find that you get groups of people where there are representatives of vendors, but they are well motivated and they really want to make it work, and they are kind of working in their organizations to make it work. You get others, who are playing their vendor agenda, and only playing their vendor agenda, and they are dangerous, and you get these two kinds of participants.

This suggests that political processes used to move this type of work forward can be quite competitive. It is important to understand where the participants of the process are coming from and what their end goals may be. As well, this participant notes that although there are some vendors that engage in the process in an open and transparent manner, there are others who are more closely engaged in their own vendor agenda. This participant expresses a positive standards development experience that involved vendors:

If you get the kind that really does believe in an accessible inclusive world, and they just happen to be working with their vendor to do that, those can really make things happen. I have seen that happen. There is a British standard in which that has happened. There are people from industry around the table, they are the right people and they believe in the vision just as much as we do.

This participant notes that there are examples where these types of processes have worked well, such as the development of a British standard. In these cases, the right people from industry have been engaged and they are part of a shared vision. When positive changes forward are being made, this participant notes that there can sometimes be roadblocks and additional challenges:

That has happened and interestingly some of the bigger vendors have got a bit worried about what we are doing and they have come around the same table to try and influence
the future of this and control the future of this because they are a bit worried. Because if you have a good standard, people say, 'Yah, this is great, we really want to do this’ then you find you actually have a level of power that you did not have before, and the vendor is a little worried about this. Hey, are people going to come along and demand that you implement this standard in my product. I cannot afford to do that, therefore, got to influence your process and stop you doing this. This is what happens. It can work if you get the right group of people together, even if they are vendors. But it can also get completely frustrated by the political games, patent games, and all that stuff, which is a shame.

So, according to this participant, when work begins on a standard or specification or when it is being developed or close to completion, vendors in the field may be concerned if they believe that their customers may request that their product implement a particular standard. This, as well as politics or a focus on patents, can cause additional challenges to those who are trying to develop standards and specifications.

According to SSSD3, there are several benefits to standardized: components and enhanced user interface functionality including:

If you can push developers to work at a higher level, which in a way is a more appropriate level to do the modeling what they are doing, because it is kind of like a model of an interaction, so if you push it to a higher level rather than thinking in terms of menus and buttons, but you program at some level where you are talking about interactions, that would be like what we did in QTI, I think that is beneficial.

This participant is suggesting that it may be beneficial to encourage developers who are engaged in these type of development processes to work at a more abstract level and that the focus should be more on the interactions that take place between the user and the system rather than specific details regarding menus and buttons to push. In addition to extending developer work to a higher level, interactions between user and interface using different devices can be supported, as noted by SSSD3:

I think there is a huge benefit to that for people who are not able to use the devices which are in the mainstream. It is almost like the accessibility equivalent of a Turing test, why should I be able to detect what device you are using to access the interaction that I designed, even on this call I have no idea what method of interaction with the keyboard
you might have; well I do because I hear you typing, but you know what I mean, it is that kind of thing. It should be possible to put people into contact with each other through technology without having to dictate and have the developers make special accommodation I think actually.

An emphasis of this participant is on software solutions that can adapt to different devices so that special accommodations may not need to be as heavily relied upon by users. As well, the devices may not necessarily be only those that are in the mainstream. The end result would be enabling people to communicate with others through technology without being reliant on others for special accommodations. This participant noted that progress to support different modes of interaction has occurred at a more basic level:

I think we have made more progress with low level initiatives, such as changes in the operating systems than we have attempting to get every single developer application to accommodate things. Take something very simple like on a Mac where you can hold down two keys and then use the scroll wheel to zoom in and out. That used to work on my keyboard, not sure it is not working right now; I have probably changed it on this one. I used to use that all the time for presentations you see, because one of the classic cases of poor accessibility, - you are in some auditorium and you have a screen which is kind of in the distance to most of the audience and so the angle is subtended at the eye of one pixel is nowhere near what it would be if they were viewing the presentation on the screen of their laptop. So you bring up something which you can read on your screen, but nobody in the audience can read. And so that accessibility tool is just brilliant because you can just hold down a couple of keys and zoom in and pan around in the same way that somebody would if they had that issue if they were bang up in front of the monitor. Of course that is not what it was designed for. So things like that, I think they are hugely beneficial, and they open up materials to people who cannot normally see them.

This participant is suggesting that the accessibility features that are built into operating systems and browsers are improving over time. An example that is provided is the built-in tools that are available when using a computer to zoom and pan through a presentation. This is an example of the 'curbcut' approach, where a tool that is useful for all users can be particularly useful for those who have a disability.

Some drawbacks to these types of approaches according to SSSD3 are:
If people are not aware of the underlying accommodation that is being made on a software subsystem or something, then they may antagonize it in some way, by presenting material in a way that is kind of useless for that kind of accommodation. Take for example, if everyone is relying on screen readers, then people may begin to forget that text is read out on the screen and not see any difference in rendering text in a way that cannot be read compared with a way that can be read for example.

This is a concrete example where awareness and understanding are crucial to ensure that the intended underlying accommodations that have been built into a technology-based system are not inadvertently subverted by end users (such as instructors) to the detriment of other end users (such as students).

As noted by SSSD4, there are benefits to the user and to the software developer:

I think that obviously if a learner is having software from lots of different people, or lots of different organizations, then if they can define their preferences, and say for example they would like a particular contrast on the screen and the software just picks that up automatically and applies it, then I can see a huge amount of user benefit there. From the software vendor point of view, one kind of vocabulary, one kind of language would be good for us to align with.

Having one vocabulary and approach could be quite useful to software developers, especially if it would allow different people and organizations to set their own preferences with regard to the display of content. This observation was also expressed by SSSD5 who said that it would be beneficial for the assessment system to be able to allow students to determine assessment backgrounds, foregrounds, and font sizes for example. This person indicated that having the ability to store the preferences rather than information about the disability would be much more useful because if you are storing information such as:

Somebody is blind, then you do not have to work out or translate what that means. If you are storing the preferences, I think it would be easier technologically because what you are saying is the preference is I do not want anything with images, so do not display any questions with images. So I think that the latter example is probably easier to handle technologically.
A disadvantage to this type of approach that was remarked upon by SSSD4 in relation to potential changes that are being proposed for ISO/IEC 24751 could be:

There probably is not enough support of this out there. I do not know. I suspect I am not the only person who does not know enough about it. So but equally, when you start saying well it is being revised, that scares me a bit because who wants to develop for a standard that is going to change? So I do not know, I perhaps need to understand this more, and I would just like to say thank you for the heads up on this.

This participant indicates that when revisions are being made to a standard or a specification it can be concerning for a developer as implementing changes can be challenging. It is important to have clear information about how the standard may change and what implications the change may have for software vendors. Additionally, this participant stated that, as a software developer, he would “welcome getting best practice from the accessibility community and being in that kind of dialogue”.

4.10.3 Other approaches and improvements

There were several other approaches and improvements that were suggested by the participants from the three different groups.

Participants who had a primary role as Accessibility Specialists and Advocates had the following ideas regarding how to improve accessibility of tests in higher education online learning environments:

- Flexibility in the marking of assessments (ASA1). As noted by ASA1:

  Instead of dyslexic students having a green sticker stuck on their assessment, which means that they automatically get an extra 10% than everybody else. I do not believe that is an appropriate adjustment, I do not believe that any blanket adjustments, in the long term, are a good idea. There should be much more subtlety and flexibility in the system, and tutors should be able to say the quality of this student’s answer and this student’s answer are broadly the same, it is just that this student has made a load of spelling mistakes. So I am going to give them the same mark because this student is dyslexic. Instead of that student automatically getting an extra 10% or 20% or whatever, he gets the mark that the tutor thinks is appropriate. It is handing a lot of power to tutors. And the more you hand power to individual tutors, the more danger
there is that prejudice or inappropriate practices might come in. But maybe I am very naïve with this, but I think you have to hand the power to the tutors and see what they do with it.

- Place the focus on the best way to assess student learning (ASA1):

  We are not going to do a hundred in exams for this module anymore, we are going to move to online testing. And you bypass the stage of asking, “What is the best way to assess this course?” And that is the bit that worries me a little is that we tend to kind of lurch from one thing to another, without really going back and reviewing and justifying. So again it comes back to this business of pragmatically justifying practice. And it comes down to the very fundamentals of learning and teaching, and it is going to take a lot of culture change.

- Be open to change and learning new ways to improve teaching and learning (ASA1):

  It is very difficult to get people to question the fundamental components of what it is they do. Some of them, I think it is only a minority, but some of them think of it as their competence and their professionalism are being called into question. And it is very difficult to get the message across that that is not the case. If someone who has been driving trucks for 30 years has to then take another kind of driving test because certain improvements have been made to the way the lorry operates, that is not criticizing the way they drive, it is simply saying, you know, your equipment has moved on, the technology and the standards have moved on, we need to make sure your skills have moved on with it. And that is kind of what we are doing with the lecturers, we are not saying they are bad lecturers, we are just saying that there is a whole new world out there, and we need you to explore it and consider all the options.

- Involve students in the design process so that they have a clearer understanding of the mechanisms needed to create assessments in higher education online learning environments (ASA1); and,

- Ensure that the technologies that are being used support accessibility so that the assessment creation processes and test delivery occur in accessible online learning environments (ASA3).

The responses from those participants who have the primary role of instructor included the following suggestions to make improvements to the accessibility of tests in higher education online learning environments:

- Use peer assessment as one way to help people understand each other’s disability needs (INST1);
• Provide opportunities (e.g., such as publishing in online journals) where practitioners can share teaching experiences using the language of their discipline to present the results of their interventions (INST1);

• Provide easily accessible case studies of people who have done similar things or who have discovered solutions to similar problems (INST1);

• Support alternative and innovative assessment methods to build and credit local expertise (INST1);

• Make use of external expertise and guidance (e.g., through groups such as JISC TechDis) (INST2); and,

• Ensure that there are alternative modes to interact with, to have online test questions read out, and to provide feedback (e.g., use of audio to read out text for dyslexic students) (INST3, INST4).

The participants who have a primary role as Software, Specification or Standards Developer also had suggestions regarding how accessibility of tests could be improved:

• Work closely with instructors and students who have disabilities to better understand their experiences (SSSD1);

• Ensure that it there is clear legal responsibility for products to support instructors and students who have disabilities (SSSD1);

• Consider mobile operating system approaches as they encourage developers to think of new ways to interact with people (SSSD3); and,

• Ensure that there is awareness regarding web accessibility standards such as WCAG 2.0 and legislative requirements (SSSD4).

4.11 Additional Comments

The participants were asked if they had any additional comments that they wanted to make with regarding to the accessibility of tests in higher education online learning environments.

For those who had a primary role as Accessibility Specialists and Advocates, the following additional comments and suggestions were made:
• Understand that moving forward with accessibility is a step-by-step process, and “taking one small step forward is still worthwhile if it is the only step you can take right now” (ASA1);

• Think about accessibility and assessments at the course design stage (ASA1);

• Consider the general principles of inclusive electronic content authoring (ASA3);

• Consider context specific constraints with regard to accessibility to avoid potential conflicts between accessibility and the preservation of academic integrity (ASA3); and,

• Acknowledge that assessment accessibility may be slightly more challenging and less straightforward than general content accessibility (ASA3).

For those who had the primary role of Instructor the following additional comments were made regarding accessibility of tests in higher education online learning environments:

• There is a need for more research and awareness (INST2);

• Consideration needs to be given to specifications that have been developed (e.g., QTI) (INST3);

• Put education before technology (INST3);

• Make sure you have got steps in there to scaffold student learning (INST3);

• Work formatively before you start thinking summatively (INST3);

• Do not expect the computer to do everything in testing, - it is merely a tool that can do part of the job (INST3);

• Provide students with lots of opportunities to practice (INST3);

• Recognize that assessments in higher education are very personal and that sharing may occur more readily at the lower levels (first and second year) and perhaps not so readily at the upper levels (INST3);

• When using tests across national borders, understand that materials may need to be re-engineered to fit learning outcomes (INST3); and,

• Assessments and online assessment systems have the potential to provide a level playing field, and to allow students with disabilities to compete on an equal footing with other students (INST3).
Participants with the primary role as Software, Specification or Standards Developer made the following additional comments:

- It is important to consider the accessibility of the user interface and to ensure that students can access information such as results and progress data (SSSD1);

- Assessments need to allow everyone a fair chance to participate to allow opportunities to transcend or surpass goals and to support human development, “we will be richer if we do and poorer if we do not” (SSSD2);

- Do not underestimate the power of metadata to assist and support accessibility of online tests (SSSD3); and,

- Provide opportunities for developers to learn more about accessibility issues as “most developers want to do the right thing” (SSSD4).

### 4.12 Summary of Major Findings

The major findings provided by the participants is provided in this section and includes participant views of accessibility, the barriers and top priorities with respect to accessibility of online tests in higher education online learning environments, strategies and practices, and areas for improvement.

#### 4.12.1 Participant views of Accessibility

All of the participants indicated that accessibility was either important or very important to them. During the semi-structured interview participants were asked what accessibility means to them. An analysis of the responses indicated that the concepts expressed by the participants clustered into three main topics including,

1. What accessibility means - Broadening access to as many people as possible (ASA1, ASA2, INST2, INST3, SSSD1, SSSD2, SSSD3, SSSD5);

2. What accessibility involves - Enabling and enhancing access to as many individual learners as possible who form a target audience (ASA3, INST1, SSSD3, SSSD5); and,
3. Accessibility in relation to assessment - Assessment as a judgment of ability including limitations of assessment and issues of reasonableness, pragmatism, fairness, validity and reliability (ASA1, SSSD2, SSSD4).

A concept map of participant views regarding accessibility based on their responses is provided below in Figure 5.

![Concept map of participant views regarding accessibility](image)

**Figure 5: Concept map of participant views regarding accessibility**

4.12.2 Barriers and Top Priorities

The participants identified the barriers and top priorities they had experience with regarding accessibility of online tests in HE online learning environments. Below is a table of the barriers and top priorities that were identified by the different participants. The symbols indicate the number of times that an issue was counted in the responses from each participant using text analysis. Barriers are identified using an asterisk (*) and top priorities are identified using a plus symbol (+).
Table 4: Summary of barriers and top priorities

<table>
<thead>
<tr>
<th>Participant Code</th>
<th>Barriers (*) and Top Priorities (+)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Academic Integrity</td>
</tr>
<tr>
<td>Accessibility Specialists and Advocates</td>
<td></td>
</tr>
<tr>
<td>ASA1</td>
<td>*</td>
</tr>
<tr>
<td>ASA2</td>
<td>****</td>
</tr>
<tr>
<td>ASA3</td>
<td>+++</td>
</tr>
<tr>
<td>Instructors</td>
<td></td>
</tr>
<tr>
<td>INST1</td>
<td>*</td>
</tr>
<tr>
<td>INST2</td>
<td>**</td>
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<tr>
<td>INST3</td>
<td>+++</td>
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<tr>
<td>INST4</td>
<td></td>
</tr>
<tr>
<td>Software, Specification and Standards Developers</td>
<td></td>
</tr>
<tr>
<td>SSSD1</td>
<td>*****</td>
</tr>
<tr>
<td>SSSD2</td>
<td>**</td>
</tr>
<tr>
<td>SSSD3</td>
<td>*****</td>
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<tr>
<td>SSSD4</td>
<td></td>
</tr>
<tr>
<td>SSSD5</td>
<td>****</td>
</tr>
</tbody>
</table>

The top barriers and top priorities identified in Table 4 have been ranked ordered by number of participants who mentioned the item and then by number of times the item was mentioned, and the resulting rank ordering is provided in Table 5 below. For all 3 groups technical issues and approaches were the top identified barrier and the top identified priority.
Table 5: Rank ordering comparison of barriers and top priorities by participant group

<table>
<thead>
<tr>
<th>Barriers</th>
<th>Top Priorities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Accessibility Specialists and Advocates (N=3)</strong></td>
<td><strong>Accessibility Specialists and Advocates (N=3)</strong></td>
</tr>
<tr>
<td>1. Technical Issues and Approaches (N=3, 9t)</td>
<td>1. Technical Issues and Approaches (N=3, 6t)</td>
</tr>
<tr>
<td>2. Inclusive Design (N=3, 4t)</td>
<td>2. Academic Integrity (N=2, 7t)</td>
</tr>
<tr>
<td>3. Academic Integrity (N=2, 5t)</td>
<td>3. Mainstreaming Issues (N=1, 3t)</td>
</tr>
<tr>
<td>4. Mainstreaming Issues (N=2, 4t)</td>
<td>4. Inclusive Design (N=1, 1t)</td>
</tr>
<tr>
<td>5. Resources (N=2, 3t)</td>
<td></td>
</tr>
<tr>
<td><strong>Instructors (N=4)</strong></td>
<td><strong>Instructors (N=4)</strong></td>
</tr>
<tr>
<td>1. Technical Issues and Approaches (N=4, 12t)</td>
<td>1. Technical Issues and Approaches (N=3, 10t)</td>
</tr>
<tr>
<td>2. Mainstreaming Issues (N=4, 12t)</td>
<td>2. Academic Integrity (N=3, 5t)</td>
</tr>
<tr>
<td>3. Resources (N=4, 4t)</td>
<td>3. Resources (N=3, 3t)</td>
</tr>
<tr>
<td>4. Inclusive Design (N=3, 13t)</td>
<td>4. Inclusive Design (N=2, 2t)</td>
</tr>
<tr>
<td>5. Academic Integrity (N=3, 5t)</td>
<td>5. Mainstreaming (N=1, 2t)</td>
</tr>
<tr>
<td><strong>Software, Specification and Standards Developers (N=5)</strong></td>
<td><strong>Software, Specification and Standards Developers (N=5)</strong></td>
</tr>
<tr>
<td>1. Technical Issues and Approaches (N=5, 14t)</td>
<td>1. Technical Issues and Approaches (N=5, 15t)</td>
</tr>
<tr>
<td>2. Inclusive Design (N=4, 12t)</td>
<td>2. Resources (N=2, 3t)</td>
</tr>
<tr>
<td>3. Mainstreaming Issues (N=4, 9t)</td>
<td>3. Mainstreaming Issues (N=2, 2t)</td>
</tr>
<tr>
<td>4. Academic Integrity (N=3, 13t)</td>
<td>4. Inclusive Design (N=1, 1t)</td>
</tr>
<tr>
<td>5. Resources (N=3, 5t)</td>
<td></td>
</tr>
</tbody>
</table>

Those who had the role of instructor were the only participants to rank mainstreaming as being tied with technical issues as a critical barrier. The next most frequently cited barrier for the instructor group was resources. Inclusive design ranked fourth both as a barrier and as a priority for instructor participants. Three of the participants from the instructor group mentioned inclusive design the most times (13 times) as a barrier compared to the other topics. Academic integrity was listed last by instructors as being a barrier and it was the second most frequently mentioned priority for the instructor and the accessibility specialists and advocate participants.

Both accessibility specialists and advocates and the software, specification and standards developers indicated inclusive design as the second most frequently mentioned barrier and the fourth top priority. Academic integrity and mainstreaming issues were the third and fourth most frequently cited barriers by accessibility specialists and advocates and the fourth and third by the
software, specification and standards developers. Mainstreaming issues were the third top priority for participants in both of these groups. Resources were the fifth most frequently mentioned barrier by participants in these groups, and the second most frequently mentioned top priority for the software, specification and standards developers.

4.12.3 Strategies and Practices

The participants indicated that they use a number of different strategies and practices to try to overcome identified barriers and to move forward with top priorities for accessibility of tests in higher education online learning environments. The strategies and practices that were identified by participants were focused on academic integrity, inclusive design and delivery, mainstreaming, resources, and technology.

With respect to academic integrity, instructors and software, specification and standards developers noted the importance of greater awareness and understanding of how accommodations requested and assistive technologies can impact on the academic integrity of a test. As well, another strategy was to understand the limitations of the software being used so that it doesn't negatively impact on academic integrity for online tests. Strategies and practices that were mentioned with regard to inclusive design and delivery included awareness and understanding of the design and development process, linking assessments with learning outcomes, team-based approaches that incorporate and leverage awareness of accessibility issues, and quality check processes and audit trails.

There were several suggestions made regarding mainstreaming and resources. Accessibility specialists and advocates, several instructors, and one of the software, specification and standards developers noted the importance of institutional culture and the role that academic policies, procedures and guidelines can play in supporting the accessibility of online tests. Participants from all three groups noted the importance of participation in formal and informal
support networks (including discipline-specific groups). Proactive involvement of individuals with accessibility, IT and pedagogical expertise during the planning process was another strategy that was mentioned by participants in all three groups. Workshops, training sessions, lunch-and-learns were mentioned as a strategy by one accessibility specialist and advocate and three software, specification and standards developers.

Participants from all groups mentioned strategies and practices that were technology-related. Awareness and understanding of already established guidelines and standards was one of the strategies mentioned by 8 participants across all three groups. The importance of using customizable technologies to support learners (e.g., display preferences, ability to change mouse behavior, roaming profiles, etc.) was another strategy that was indicated by half of the participants. Ensuring that the assistive technologies and are in place and functioning properly, that software and hardware are tested with students using different web browsers, and the provision of test preview or practice opportunities were mentioned by five of the 12 participants across all three groups. Technical compatibility with other higher education IT systems and supports was mentioned by four (or one-third) of the participants across all three groups. One of the instructors and two of the software, specification and standards developers stated that provision of and support for accessible multimedia (captioning, etc.) was a strategy that they would recommend.

The participants also identified their best strategies and practices. Some of the best practices and strategies included awareness and implementation of key principles that support accessibility, support for culture and ethos change, the development and dissemination of case studies, and awareness and understanding of current drivers in higher education institutions.
4.12.4 Areas for Improvement

Participants were asked to provide input regarding the benefits and challenges of different proposed improvements that could be implemented to support improved accessibility of tests in higher education online learning environments including

1. The International Classification of Functioning, Disability and Health (ICF);
2. Standardized technology components and enhanced user interface functionality; and,
3. Other approaches or improvements they may be aware of or that they may have encountered.

The participants reflected on the benefits and challenges of the different approaches and as well noted other approaches and improvements.

A small number of the participants (only four out of 12) indicated that they were aware of the International Classification of Functioning, Disability and Health (ICF) approach. Several of the participants remarked on the similarity of this approach to the University and Colleges Admissions Service (UCAS) approach to documenting the disabilities of learners during the application process. Some of the benefits of the ICF approach that were observed by participants included the provision of more structured methods and processes that may be useful where such structures do not exist and also to assist with the organization of supports for learners. Some of the challenges included the emphasis on labelling individuals, the alignment with a medical model approach, insufficient granularity of the approach, and problems related to academic equivalence.

A total of eleven of the 12 participants noted benefits and nine of the 12 indicated challenges with approaches that focus on standardized technology components and enhanced user interface functionality. Some of the benefits that were mentioned were the potential for automated repurposing and delivery of diverse content in a manner that matches the needs of
individual learners, stronger protection of personal privacy (i.e., storage of learner preferences rather than storage of information about learner's disabilities), and economies of scale. Some of the challenges included the lack of availability of tools that currently support these types of approaches, comfort level of learners to have personal display preferences stored, lack of end user awareness, complexity of solutions, difficulties in encouraging meaningful involvement from various groups, problematic with communication, and insufficient support within the marketplace.
Chapter 5: Discussion and Interpretation of Findings

5.1. Research Purpose

In order to gain better understanding of issues related to the creation and delivery of tests in higher education online learning environments, this study focused on the perspectives and practices of U.K. higher education expert practitioners. The research study results indicate that U.K. expert practitioners share some common experiences and have developed some interesting approaches. The results revealed interesting differences that may have been influenced by the unique and contextual factors that are specific to the U.K. situation. In this discussion chapter, I will focus on the analysis of the responses by U.K. expert practitioners to the research questions that framed the study. In addition, the limitations of the study, ideas for future research and researcher reflections are provided.

5.2. The Research Questions – Responses Gathered

During this study, the data collection was guided by the following research questions:

1. What are the issues and barriers encountered regarding accessibility of tests in higher education online learning environments as noted by U.K. expert practitioners?

2. What are current strategies and practices used by U.K. expert practitioners to support accessibility of tests within higher education online learning environments?

3. How can accessibility of tests within higher education online learning environments be improved?

A total of 12 expert practitioners provided responses both to a survey that included quantitative and qualitative questions, and also to semi-structured interview questions. In the next three subsections a discussion of the responses to the research questions is provided.
5.2.1 Question 1: What are the issues and barriers regarding accessibility of tests in higher education online learning environments as noted by U.K. expert practitioners?

All of the 12 participants indicated that technical barriers and issues are most commonly encountered and that they are a top priority with regard to accessibility of tests in higher education online learning environments. Although seven of the 12 participants felt very comfortable in creating online tests and gathering data from online tests, only two out of the 12 participants strongly agreed that the technology they were using to create and deliver online tests was working well. There were several main issues identified as technology-related barriers by the participants, including lack of understanding, limited technical awareness, and standardization challenges. Further analysis of the qualitative and quantitative data indicated that barriers and problems are being encountered with the technology mainly at the point of use by both instructors and students and at the design and standardization stages by those who develop the software, specification, and standards.

At a very practical level, the technology itself can be a barrier for those with accessibility issues who are relying on it to complete a test. The participants observed that students may encounter technology issues such as no keyboard accessibility and lack of alternative input options. As well, instructors may be using tools that do not support their own requirements and needs, and that have limited options in terms of accessible tools that can support their work. Just under half of the participants (five out of 12) indicated that they had experience with migration of questions from one IT system to another and all five participants stated that they had experienced technical issues with migration that impacted on the accessibility of tests. Some of these issues included problems with question formatting, limited support for adaptive questioning and accessible multimedia, and discipline-specific limitations (e.g., support for mathematics presentation and delivery). Problems with inconsistent implementation of
specifications and standards seemed to arise or be more noticeable when there is a transition from one LMS or assessment system to another or when tests or test items are shared across or within higher education institutions. Technical issues, such as computers crashing, web browser incompatibilities, network issues were other problems that were mentioned by participants. These identified barriers also were reflected in the literature (Abreu-Ellis, Ellis & Hayes, 2009; Ashton, Beevers & Thomas, 2008; Ball, 2009; Dunn, 2003; Enjelvin, 2009; Bennett et al., 1999; Clariana & Wallace, 2002 both cited in Sim, Holifield & Brown, 2004; Sloan, Stratford & Gregor cited in Badge, Dawson, Cann & Scott, 2008; Seale & Cooper, 2010; Sloan & Walker, 2009 cited in Draffan, Wald, Newman, Skuse & Phethean, 2010).

Additional insights provided by the participants in their responses to questions regarding the migration of online tests from one IT system to another help to the impact of the barrier on higher education institutions and to explain why some of these barriers may exist. A barrier that was observed is the resource intensive costs for universities to correct issues that introduced during the migration process because current IT systems that do not function as well as they should. Personnel and time are required to fix technical issues that result when tests and test questions are migrated from one IT system to another because two systems may not be compatible (even though they indicate that they are compliant to the same specification).

The migration issues could be a manifested symptom of a deeper underlying concern that was discovered, namely, that software, standards and specifications developers may not be as comfortable in their understanding of the legal definition of disability and in their knowledge of the legislative requirements that relate to accessibility, as noted in Figures 2, 3, and 4. Another barrier that was revealed during this study was the fact that software, specification and standards
developers may not be aware of accessibility toolsets that can be used to verify and improve their approaches and coding.

As well, those who are developing the software, specifications, and standards may have limited understanding of instructor experiences and requirements for accessible testing. An underlying reason for the lack of understanding that was remarked upon by the participants was that software, specification and standards developers may have limited or no contact with end users of their products. Their main contacts may be with administrators at higher education institutions and they may not interact with instructors and students who their software, making it difficult to understand how their software is actually being used in the real world. In the words of one software developer, "a challenge as a software developer who is not an expert in accessibility is that it is hard to know what it is that is wanted and what is important and what is not important". As a consequence, this leads to costly product development decisions. Time and resource constraints also may limit end user testing. These barriers make it difficult for software, specification and standards developers to integrate accessibility design considerations into the online test software and related specifications and standards.

Another issue related to technology is limitations of the higher education context on the use of technology to support the creation and delivery of online tests. One of the participants stated that there are timeframe limitations for higher education upgrades to enterprise-wide systems. In higher education contexts, large numbers of users rely on the system to be operational for entire semesters or academic years. This means that there are limited windows of opportunity to complete upgrades to an enterprise-wide systems that are used to support the creation and delivery of accessible online tests.
The literature indicates that there seems to be interest within some higher education institutions to explore how to increase personalization and customization of online tests so that the delivery will reflect learner preferences (Ashton, Beevers & Thomas, 2008; EdExcel, 2006; JISC, 2007; Middlemas, 2010; Orr & Hammig, 2009). There also seems to be interest in supporting standardized formatting of tests and test questions (Anido-Rifon, 2009; IMS GLC Inc., 2009, ISO/IEC 24751, Bacon, 2012; Seale & Cooper, 2010). However, the participants said that there seem to be few technical implementations of the standards and specifications. At the time of this study, one participant indicated that he knew of only one learning management system from Canada (i.e., ATutor), which had implemented accessibility specifications and standards. As well, the participant responses suggest that competing priorities may mean that accessibility considerations lose out to assessment priorities. So for example, there are secure browsers that are used for online testing that may not meet current standard requirements and specification recommendations to support accessibility features, such as being able to view text at different sizes. It can be challenging for developers to incorporate specifications and standards effectively when there are few or limited examples of technical implementations, small product development teams, and when there are competing priorities between ensuring assessment priorities are being met and trying to support accessibility functionalities.

Beyond technical issues and barriers, the other barriers and issues that were indicated as priorities seemed to differ by group and there was a noticeable split between the Instructor participants and the other two groups. For the Instructor participants mainstreaming issues tied with the technical issues as the top barrier and the next most frequently cited barrier was resources. Given the situation within U.K. higher education at the time of the study, it is not surprising that mainstreaming and resources were the next two top issues/barriers identified by
the Instructor participants. The instructors in many U.K. higher education institutions were being asked to consider, create and innovate regarding more accessible and inclusive assessment approaches. The literature indicates that further pressures at the time of the study within U.K. higher education institutions were intense fiscal and accountability pressures that have greatly impacted on resources (Jamieson, 2012; Waterfield & West, 2010). As well the literature review indicated that part of the impetus with regard to mainstreaming accessibility of tests in higher education online learning environments may be rooted in the legislative changes that have impacted all aspects of U.K. society (May & Bridger, 2010).

A closer review of the findings suggested that some of the accessibility issues experienced by instructors may be further explained when both pedagogical and other factors that impact on higher education institutional contexts are considered. Although the participants mentioned accommodations and alternative forms of assessment using various mediums, there did not seem to be any mention of support for modifications of test questions. Concerns also were expressed about focusing solely on the use of multiple choice questions for online assessments. Several participants noted the importance of other types of questions for use on online assessments and confirmed the lack of accessibility of some of these other types of questions. Participants stated that lack of time and instructor overwhelm were issues that impacted negatively on the use of accessible online tests, this particular finding was also mentioned in the literature (Dunn, 2003).

There seemed to be inconsistent reports from participants regarding the levels and types of supports that are provided across higher education institutions in the U.K., with some indicating that instructors and students are well supported, and others remarking that there seemed to be little or no support provided to instructors and students. Although there were
pockets of understanding regarding legislation related to accessibility, the participants observed that there were some inconsistencies in the interpretation and application of the legislation at different institutions. Another concern was the lack of specialized support staff, particularly those who had both technical and educational knowledge; this was an issue that was noted in the literature as well (Dunn, 2003). Problems were noted specifically with the plethora of policies and the lack of integration amongst all of the different institutional policies that instructors must consult and follow. As well, a participant remarked on the limitations of policies in terms of understanding how disabilities may manifest themselves when students are taking an online test.

Inclusive design was denoted as a barrier for instructors, but it was not a top priority among instructors. At an individual instructor level, one participant emphasized that instructors may perceive an imbalance between the proportion of students who have a disability and the amount of time required to ensure their materials are accessible. This participant suggested that instructors and staff may not understand how inclusive design principles and procedures can help to address the academic needs and requirements of learners. A participant stated that another barrier is lack of integration of accessible inclusive curriculum development as part of established university course development processes. Several participants noted that accessibility did not seem to be integrated as part of the curriculum design at an institutional level.

Although Instructor participants indicated that mainstreaming and resources were among the top barriers, both Accessibility Specialists and Advocates and Software, Specification and Standards Developers remarked that inclusive design was the second most commonly encountered barrier. Further analysis of the responses of the Accessibility Specialists and Advocates indicates some relationships between the barrier of technology, the second most
commonly identified barrier of inclusive design and their third, - academic integrity. Accessibility Specialists and Advocates disclosed that current approaches to accessibility do not seem to be well integrated into design processes, but are often viewed as "bolt on" or as an added burden to instructors (ASA1, ASA2).

If the curriculum is indeed the balance of four commonplaces including the learner, the teacher, the milieu, the subject matter (Schwab, 1973), then one of the challenges brought to light is how to integrate accessibility into the balance that must be maintained. As each individual learner requires accommodations that are specific to their own requirements there can be a tension if an overall approach is taken to meet the learning needs of one individual at the expense of others (ASA2). An example provided by a participant was a test designed to meet the needs of a student with a vision disability who required alternative text for images, and a student with dyslexia who forgets to turn off the alternative text and is provided with "verbosity they do not want" (ASA2). This has implications for certification of software products as well, as something that is certified as meeting the requirements of an established group of users who have a disability may not meet the requirements and needs of other groups of learners who may have different types of disabilities. This has deeper implications for those who develop these types of technologies, as it suggests that more modular approaches that are capable of supporting adaptive delivery of a variety of learning resources could be more useful to meet the teaching and learning requirements of a broader number of users.

Concerns about what happens when technology tools do not work properly were expressed by the Accessibility Specialists and Advocates who explained that the technology needs to work well so that it supports understanding of the test content and basic functionality of the test. The Accessibility Specialists and Advocates (ASA1, ASA2, ASA3) noted the purpose
of the test is not to determine whether a learner is "a good mouse user", if they can be "quick enough to get the answer in" or if they can "use drop down boxes accurately enough", but rather to assess whether or not learners can demonstrate their knowledge, skills, and capabilities with regard to the subject material in a coherent and appropriate manner. This concern also was present in the literature (Ball, 2006; Thomas & Milligan, 2003 both cited in Draffan, Wald, Newman, Skuse & Phethean, 2010). At the same time, it was noted that some students with disabilities may need to develop their skills to make use of the accessibility affordances provided by some of the technologies they use. It was suggested by one of the participants that students with a specific type of disability may find specific topics more difficult than others. These findings were reflected in the literature review of the U.K. legislation, and as well in the accessibility and testing literature more generally (Richardson, Taeko & Wydell; Sloan, Stratford & Gregor both cited in Badge, Dawson, Cann & Scott, 2008).

Another problem that is introduced when technology is being used to create and deliver a test is the potential for the academic integrity of the test to be compromised. The example that was provided by several of the participants from the Accessibility Specialists and Advocates and the Software, Specification and Standards Developers groups was the use of alternative text for an image that might provide the answer to a question to the student taking the test (ASA2, ASA3, SSSD2, SSSD3, SSSD5). Other concerns related to academic integrity and accessibility were the use of accommodations, difficulties with the creation of alternative questions and challenges with creating equivalent questions that are accessible. One suggested barrier that was mentioned by a participant was the need to separate the purpose of the question from the way that the question was being asked. These concerns also were noted in the literature (Ashton,
The issue of equivalency also seemed to prompt discussions regarding fairness, validity, and reliability. Several participants expressed concerns regarding the perception of the importance of fairness, validity, and reliability and the tensions regarding assertions of requirements for large enough sample sizes to support statistical analysis procedures. It has been suggested that the number of students in a classroom who identify as having a disability can be a fairly low percentage of the overall class, making it more difficult to perform more commonly used statistical procedures. Another participant (SSSD3) noted that providing an equal service regardless of the accessibility requirements is quite different from treating all learners exactly the same in a statistical distribution regardless of how learners interacted with the test. This person also pointed out the tensions between the commonly accepted ways of grading and completing statistical calculations and the individual accessibility requirements of students. Finally, it was mentioned that students with disabilities may have technical dependencies and hidden disabilities that impact negatively on their performance and that there is a lack of student support networks.

5.2.2 Question 2: Best practices and strategies used by U.K. expert practitioners to support accessibility of tests within higher education online learning environments

The study participants provided their current strategies and practices to support the accessibility of tests within higher education online learning environments. Each of the participants was asked to identify their best practice and strategy to support the creation and use of more accessible tests in higher education online learning environments.

For participants who had the primary role of Accessibility Specialists and Advocates, the best practice and strategy that was identified was being open to and encouraging greater student
involvement in the assessment process. As noted in the literature, accessibility considerations are "often implemented as reactive measures to identified students rather than as proactive measures" (Sloan & Walker, 2008, p. 4). According to the participants, the development of alternative test items is a complex process that could benefit from a more inclusive design approach that incorporates feedback and input from students. Additionally, the participants confirmed the importance of developing and using more proactive, meaningful, and authentic forms of assessment through innovative approaches as evidenced through projects such as Roehampton University's equivalent assessment project where students can submit their assignments using a format that best demonstrates their understanding, knowledge and skills (Middlemas, 2010; Watefield & West, 2010).

Openness to being flexible to different forms and ways of assessing students was a common theme that was shared by participants who had the primary role of instructor. Participants in this group stated that their best practices and strategies were to allow for assignment flexibility and to provide plenty of optional steps and scaffolding to support learners. To the participants with the primary role of instructor, a key critical success factor was to engage in formal and informal subject discipline networks and to think beyond the institution.

Participants who had the primary role of Software, Specification or Standards Developer presented their some of their best practices and strategies as being: increased awareness of accessible and inclusive design methods, awareness and availability of software testing tools, and well-documented and disseminated procedures to incorporate the needs of users. The prioritization and planning to better accommodate accessibility requests was made possible through more effective and broader consultation with stakeholders including learners, instructors, disability services, and others.
The participants observed that support for consultation processes was further enhanced through better understanding of the target learning objectives and understanding the underlying aims of the test questions. The participants remarked on the importance of separating the purpose of the question from the ways it could be asked. Clarity regarding the competence standards underlying or underpinning the testing for qualifications also was listed as a top priority in the U.K. *Accessibility in e-Assessment Guidelines Final Report*. Thus, the participant responses regarding the 'anticipatory' and clarity of purpose strategies promoted by U.K. legislation and guidelines seemed to reflect what was found during the literature review (Ball, 2009; EdExcel, 2006).

A key strategy that was identified was the provision of support for the creation of different types of questions instead of focusing solely on multiple choice questions. It was suggested that questions could be asked in different ways to align with targeted learning objectives and outcomes. Having variations of different questions could be helpful to assess students who may have diverse accessibility requirements. Understanding the underlying aims of the question would help to support determining varied forms for the questions. These suggested strategies also were indicated in the literature (Ashton, Beevers & Thomas, 2008; Ball, 2009; Middlemas, 2010). However, the modification of test questions and involvement of students in testing the modified questions, although highlighted in a U.S. research article (Roach et al., 2010), was not something that had been experienced by any of the study participants, and did not seem to be a common practice for U.K. higher education institution online tests.

As well, software, specification, and standards developers stated that a key strategy was to develop a thorough understanding of the affordances of the technologies being used. Those involved in specifications and standards work also noted the importance of consultation with and
involvement of stakeholders in the development process. The specifications and standards
developers also observed the importance of ensuring technical solutions that are standardized are
well established and thoroughly tested. Although these items were mentioned in the literature
JISC 2007; Ellis & Hayes, 2009; Ball, 2009; Enjelvin, 2009; Roach et al., 2010, Seale & Cooper,
2010; Waterfield & West, 2008), another key strategy that did not seem to be mentioned was the
suggestion by specification and standards developers to develop broader and deeper
understanding of the applicability of the specific scopes of relevant accessibility specifications
and standards with higher education stakeholders.

All participants were asked to provide suggestions regarding specific supports that could
be helpful to support the creation and delivery of more accessible tests in higher education online
learning environments. Some top strategies that were recommended were to provide clear
exemplars to instructors of accessible tests and test items, support culture change and improve
communication. Several participants felt that case studies could be used to develop accessible
test questions and to model best practice.

Participants suggested that there needed to be better integration between the different
levels of education (e.g., secondary, tertiary and further education). SCHOLAR is an innovative
e-learning program that helps to build student skills to ease the transition between secondary and
post-secondary school work (Beevers & John, n.d.). Based on many years of research in
computer assisted learning in Mathematics at the university level, this e-courseware is used to
support accessible e-assessments (Beevers & John, n.d.). As well, participants remarked on the
importance of having the time, space, and opportunities to discuss information related to
accessible online tests, rather than just having the information provided in an email. They
stressed the use of strategies such as workshops, training sessions, and lunch-and-learns as a way to support learning about these issues. The participants also suggested that involvement in communities of practice around these issues as another helpful strategy. These suggestions also were mentioned in the literature (Abreu-Ellis, Ellis & Hayes, 2009; Ashton, Beevers & Thomas, 2008; Barnard-Brak et al., 2009; Lombardi & Murray, 2011; Madaus & Shaw, 2004; Matthews, 2009; Murray, Lombardi, Wren & Keys, 2009; Orr & Hammig, 2009; Scott, 1991).

There were several other strategies that were mentioned by participants but were not evident in the literature. For example, coping strategies that were being adopted by instructors where problems were not shared or reported, were mentioned by a participant. Having opportunities for increased student-faculty dialogue and awareness regarding subject specific teaching literature were additional strategies that were noted by participants. The availability of accessibility, IT, and pedagogical experts during the planning process was another strategy that was perceived as being helpful by participants. The use of national guidelines and willingness to seek out and use and adapt guidelines developed elsewhere also were mentioned as strategies.

Acknowledging that instructors will approach test development in a manner that blends specific contexts, subject matter considerations, and their own teaching styles, another suggested strategy was to develop and use the expertise of collaborative team-based approaches that leverage team member expertise. This finding was consistent with the literature review regarding the legislation, where it was indicated that accessibility is an institution-wide priority in which all staff are expected to participate (Dunn, 2003; Ferl/TechDis 2003; May & Bridger, 2010).

As well, participants stated the importance of having quality check processes along with audit trails that could assist instructors and other staff in ensuring that online test questions are accessible and align with learning objectives and outcomes. One strategy that was identified to
make assessments that are supported by technology as inclusive as possible was to ensure that content and delivery are separate. Participants stressed that it is essential that instructors know the limitations of the software so that using accessibility affordances do not impact on the academic integrity of the questions that are on the online test. This last point was observed in the literature (Ashton, Beevers & Thomas, 2008).

At an institutional level, other suggestions were to develop infrastructure through support from senior management and to provide support for institutional capacity building. It was suggested that stakeholders within higher education institutions need to refer to supports that are provided beyond the institution, and to explore and implement technical solutions that directly address accessibility issues. There were strategies that were present in the literature (Dunn, 2003; Ferl/TechDis 2003; May & Bridger, 2010).

Understanding current drivers within higher education was identified as another strategy. Some current drivers that were identified included justifiable assessment practice, the development of legislation, probing the actual accessibility of software products (e.g., through Voluntary Product Accessibility Templates (VPATs) and other means), and recognizing the impact of funding reductions. The development of better integrated policies, guidelines, and procedures for instructors and the use of institutional purchasing policies were other strategies that were mentioned.

With regard to the use of technology, participants stated several strategies that also were mentioned in the literature. They indicated that technologies that are used should be customizable by individual students. The participants emphasized the importance of testing to ensure that assistive devices and technologies are functioning properly and also the provision of a test preview or practice test to ensure that students have ample time and opportunity to
familiarize themselves with the technology that will be used for online tests (Ashton, Beevers & Thomas, 2008; Dunn, 2003; EdExcel, 2006; JISC, 2007; Middlemas, 2010; Orr & Hammig, 2009).

Other technology strategies that did not seem to be prevalent in the literature included ensuring that the assessment system being used is compatible with the other higher education systems (e.g., student information systems, etc.), the importance of accessible templates that can be used by instructors to support more accessible test questions, and reduced reliance on technologies that are less accessible (e.g., such as customizable HTML). The value of testing tools was another strategy that was mentioned by participants. Several participants focused on strategies that could be used to ensure that migration of test questions and tests retain all accessibility features, such as the availability of metatagging and the use of vendor documentation, knowledge bases, and other resources.

There were several strategies that were mentioned in the literature and were confirmed by participants. Participants highlighted the importance of ensuring that assessment systems support accessible multimedia and that the multimedia content is as accessible as possible and properly supported (e.g., through the use of accessible players, captioning, transcripts) (Abreu-Ellis, Ellis & Hayes, 2009; Ball, 2009; Enjelvin, 2009; Waterfield & West, 2008). The importance of accessible authoring tools was a strategy identified as being helpful for instructors who create online tests (Sloan & Walker, 2009 cited in Draffan, Wald, Newman, Skuse & Phethean, 2010). As well, participants stated that having a timer that supports exceptions for individual students who require more time is an important feature that can be used to support the individual required accommodations of students (Maurice & Lissel, 2006). A participant also suggested the reinvestment of time gains from the automation of test creation and delivery to prepare better questions as a strategy that can be employed by instructors.
5.2.3 Question 3: How can Accessibility of Tests within Higher Education Online Learning Environments be improved?

The participants were asked to provide input regarding the benefits and drawbacks of different proposed improvements aimed at supporting the accessibility of tests in higher education online learning environments including:

1. The International Classification of Functioning, Disability and Health (ICF);
2. Standardized technology components and enhanced user interface functionality; and,
3. Other approaches or improvements they may be aware of or may have encountered.

Four of the 12 participants (2 Accessibility Specialists and Advocates, 1 Instructor, and 1 Software, Specification and Standards Developer) indicated that they had heard of the International Classification of Function, Disability and Health (ICF). The Accessibility Specialists and Advocates and the Software, Specification and Standards Developer identified this approach as being most closely akin to the 'Medical' model of disability that was outlined in the literature review (Amundson, 2000; Marks, 1999; Pfeiffer, 2001 all cited in Dubois & Trani, 2009) as this approach seems to promote the classification of disabilities.

Concerns and challenges with this approach were that it may be overly focused on labeling learners and puts the focus on disabilities. As well, concerns were raised about the practicality and technical implementability of this type of approach, as it would require descriptions of each type of disability and as disabilities are experienced quite differently by individuals this approach may have limited applicability in terms of designing a system to meet individual presentation requirements. Additionally, depending on how this approach is implemented, if information specific to an individual's disability is stored, then privacy issues also may come into play.
Several of the participants found that this method reminded them of UCAS, the U.K. Universities and Colleges Admission Service - as both systems seemed to involve the classification of learners. The UCAS approach also was mentioned in the literature review (Matthews, 2009). Two of the participants indicated that this type of approach could be useful in regions where there are limited to no supports in place for people with disabilities as it provides a starting framework from which to develop services. However, a caution from one of the participants was that this type of approach can quickly become overly bureaucratic and over time can be responsible for the development of structures that may not be as inclined to support the exploration of new and innovative approaches.

Eleven of the 12 participants had heard of some kind of specification or standardization initiatives with respect to online tests or accessibility. This type of approach was identified as being associated with the social approach to disability that was noted during the literature review (Barton, 1993; Hahn, 1986; Oliver 1996 all cited in Dubois & Trani, 2009). Some of the positives that were associated with this type of approach by participants were consistency in ways and means to allow students can change the look-and-feel of the assessment and allowing for more automated ways to repurpose the delivery of tests to meet individual learners' presentation requirements. There were two participants who indicated that having the system store learner preferences rather than the learner's disabilities is a preferred way to provide customization and personalization of online tests.

The participants also associated many challenges with approaches that focus on standardization. According to the participants, relying solely on this type of approach may make end users complacent. Two of the participants indicated that there are limited tools in the marketplace that employ standardized approaches to online testing in higher education learning
environments. Learners may still be reluctant to share their preferences so that this data can be stored and used to manage their learning activities. Higher education instructors may not see the point of adding extra metadata that may be required for this to work. Learners may still be reluctant to share and store their preferences.

Additionally, there may be disconnects between end users requirements and system affordances. One of the participants indicated disillusionment with the specification and standards development processes and outcomes. This participant could not identify any positive outcomes from the process and could not see how it applied and assisted at the user level. Another participant indicated that from his experience standards and specifications are not always fully and consistently implemented. For example, in some IT systems there may be additional formatting and coding that made migration of test questions and preservation of accessibility accommodations challenging.

One participant who had been involved in the development of one of the specifications shared insights that explained why specifications and standards sometimes fall short of expectations. This person noted that at times those involved in the standards process may have more of a research focus and emphasized the importance of specifications and standards as being the distilled wisdom of current practice. This person also reflected on how much was learned during previous specification and standard development processes about the importance of better testing tools to determine whether or not systems actually meet requirements outlined in specifications and standards. Other difficulties that were identified by participants regarding this type of approach were that there are often inadequate discussion opportunities and no training provided. Another complexity that was identified was that it is sometimes challenging to encourage meaningful involvement of different groups for the development of standards and
specifications. Lack of communication and insufficient support within the marketplace also were viewed to be obstacles to be overcome with this type of approach.

The participants from each of the three groups provided additional input and comments regarding improving accessibility of tests in higher education online learning environments. The Accessibility Specialists and Advocates provided suggestions that were mainly focused on general principles of inclusive design such as providing flexibility in marking of assessments and focusing on the best way to assess student learning. They also indicated the importance of involving students in the design process to mitigate contextual constraints. They noted the need to address potential conflicts between accessibility and the preservation of academic integrity.

Instructor participants tended to focus on the need for more research. One of the participants suggested that peer assessment could be used to help students understand the subject matter and each other's learning and accessibility needs. The Instructor participants also suggested that alternative modes could help to allow students to have better access to online test questions. They emphasized the importance of ensuring that education is placed before technology and ensuring that scaffolding is in place to support student learning.

Another important approach identified by Instructors was to work with the students formatively prior to assessing summatively by providing students with ample opportunity to practice. It was suggested that more opportunities, such as academic publishing, could be a powerful avenue to promote the sharing of teaching experience grounded in discipline specific language. The provision of case studies could help to build and develop local expertise. External expertise and guidance could be sought as well. Another comment was regarding the need to carefully review and adapt tests that may be used across national borders; and, using the
technology to provide a level playing field so that students with disabilities can compete on an equal footing.

Those with the primary role of Software, Specification or Standards Developer stressed the importance of working closely with instructors and students to better understand their experiences. An interesting aspect that was mentioned by one of the participants in this group was the refreshing and innovative approaches that are being developed as a result of mobile operating systems and applications that require developers to develop new ways for learners to interact. Raising awareness of legislative and standards and specifications was another approach that was indicated by this group. Another comment was improvements that are being made to the accessibility of user interfaces and the importance of related information such as results and progress data through learning analytics approaches to further drive these types of improvements. Metadata was again emphasized as another important way to support accessibility of online tests. Finally, participants in this group commented on the importance of providing a fair chance for everyone to participate and also providing opportunities for developers to learn more about accessibility issues.

### 5.2.4 Participants' Perspectives regarding Accessibility

In this section, the perspectives of the participants with regard to accessibility will be examined and discussed. It has been suggested that the "Jain wisdom of Anekant or Many-Sidedness is a complex idea, which avers that truth has multiple facets, and depends on the position of the seeker and their assumptions and world-views, explicit or implicit" (Henriksson, 2012, p. 135). An individual's understanding of a topic can frame their experience and understanding. It can impact on expectations and inform action. Taken together, many viewpoints from differing perspectives can begin to provide a sense of accessibility, - how it is
perceived and understood and how it can shape the actions of those who are concerned with the creation and use of accessible tests in higher education online learning environments.

In order to better understand how the participants view the concept of accessibility, they were each asked to rate the importance of accessibility on the survey and to express their views about what accessibility means to them during the semi-structured interviews. All of the participants indicated that accessibility is either important or very important to them. During the semi-structured interviews, their conceptions of accessibility were revealed to be multi-dimensional. Participants from all three groups viewed accessibility as a broadening of access and inclusion. To the participants, accessibility seemed to mean being available to all users (ASA1), and another participant noted that all students should be able to work with the materials and connect with other students (INST2) among other things. It also was viewed as involving the removal of barriers to allow for full participation and inclusion (ASA2, SSSD1, SSSD2, and SSSD3).

Technology was viewed as a way to allow for everyone to see, read, and interact with materials (INST3). Where technology is concerned, there was a distinction made between accessibility and usability (SSSD5). Accessibility was viewed as a doorway that allows individual learners to access the learning materials and systems using technology. Usability, on the other hand, was viewed to be how easy it is to use the technology once you have crossed the threshold and have access to it (SSSD5). Accessibility was said to extend beyond software to include all aspects of learning as noted by one of the participants (ASA2).

Participants also expressed the idea that accessibility means meeting the requirements of individual learners who form a target audience. This viewpoint is reflective of more recent pedagogical practice related to instructional classroom strategies such as differentiated
instruction (Tomlinson, 2003, 2001; Hume, 2008; Strickland, 2007; and others). As well, several participants asserted that technology affordances can be used to support personalization and customization to the requirements of the individual in a way that meets broader learning goals. Software is viewed as something that is malleable that can be adapted and supplemented with assistive technologies to "maximize the number of different students who can operate the [eAssessment] system under their own means" (SSSD5). It is the ability of each individual to "use an electronic resource for its intended purpose regardless of any disability or situational impairment they may have" (ASA3).

A thread that runs through participant concepts of accessibility through to practice during the creation and delivery of tests in high education online learning environments is the relationships between judgment processes with respect to assessing learning and the concept of pragmatism or reasonableness. The participants from each of the three groups have a particular focus with respect to pragmatism or reasonableness providing a more multi-dimensional perspective. As noted by ASA1, "accessibility has to go hand in hand with this concept of reasonableness or pragmatism". This accessibility specialist and advocate (ASA1) said, "it comes back to this business of pragmatically justifying practice", - the need to step back and ask if this is the right way to assess whether a student has grasped the main concepts within a course. The issue of pragmatism is a thread that is continued by an instructor (INST2) when this person discusses experiences with providing equivalent questions to a learner who may have a disability. This participant stated, "I am pragmatic, if I have not got a complete equivalent, I will do the next best". SSSD5 commented, "it is one of those situations where pragmatism has to come into play, you know, how many features do you make available in your assessment software?" This participant discusses his experiences as a developer in trying to find a balance
between the inclusion of features such as the ability to change the presentation of the online test (e.g., the ability to change font sizes) that could be useful for a large number of learners versus the inclusion of additional features that may meet the needs of only a few students.

The participants seemed to focus on key considerations including validity, reliability and fairness; the limitations of tests; and, requirements for reasonableness or pragmatism. Through further discussion during the semi-structured interviews it was noted that validity, reliability and fairness seem to be cornerstones of tests in general and required of online tests in particular. However, an ongoing challenge is to develop more robust mechanisms to aggregate test data across institutions to allow for the required numbers to perform what are considered to be more commonly applied statistical tests of validity and reliability and also equally importantly to consider new and innovative statistical methods that can be used with smaller population samples.

Another interesting aspect regarding the participants' views of accessibility is the discomfort expressed regarding the judgment of learners. Participant SSSD2 noted that particularly in higher education contexts there is a hierarchical and sometimes condescending approach taken by instructors. This person much preferred an approach where everyone is encouraged to develop "all of their potentials, and to be critical"; and furthermore, this participant noted, it is essential that instructors acknowledge when an individual student can do something but the assessment has fallen short and "has not measured it". This view of assessment requires that instructors know their students and have a sense of what they can do. It harkens back to the Latin origin of the word assessment, *assidere*, which literally means to "sit beside" or "sit by" (C. Boyd, personal communication, March 3, 2008), where the assessment is a time of personal connection between the learner and the instructor.
5.3. Study Limitations

This study is focused on the perspectives and practices of U.K. expert practitioners, and could have benefited from a broader sampling of expert practitioners from more diverse academic backgrounds and from other countries. As well, the focus was limited to Instructors, Accessibility Specialists and Advocates, and Software, Specification and Standards Developers. It could have benefited from the inclusion of the voices of others, such as students, administrators, policy makers, to provide a more rounded perspective of the issues.

The timing of the study was another limitation as it occurred during a time of extreme fiscal restraint and a climate of uncertainty within U.K. higher education. This meant that some of the study participants were focused on pressing matters regarding funding, service rationalization, and resource issues. As well, due to the U.K. context at the time of the study, it was challenging to identify and encourage participation in the study. Thus, this study could benefit from multiple replications to enhance the generalizability of the results to the broader population.

The technologies that were used were additional limitations to the study. Although Skype was quite useful, not all participants could use the technology equally due to bandwidth constraints. For some audio and visual were possible, and for others only audio was possible. Although the audio interviews focused more on "rhythm, feeling and ambience" (Henriksson & Friesen, 2012, p. 5) and interviews with both audio and visual were further enriched, there is additional information that could have been gained from in person interviews. A further limitation was discovered when two of the participants asked to respond to the survey using Word instead of Survey Monkey. The surveys that were completed using Word provided far richer data as Survey Monkey provided more restrictive options for participants to input data.
An additional issue is the fact that several of the participants indicated that they were part of more than one grouping. For example, ASA3 and INST2 indicated that they were both Accessibility Specialists and Advocates and had experience as instructors. To reflect their perceived primary roles for the purposes of the study, ASA3 decided to provide input from the perspective of an Accessibility Specialist and Advocate, whereas INST2 decided to provide input from experiences as an Instructor.

Finally, I acknowledge that, although I have tried to remain open and minimize researcher bias, my perspectives and experiences have influenced the findings of this study. Specifically researcher bias may have been introduced during the researcher interpretation of the WHO International Classification of Function, Disability and Health (ICF) approach and discussions of several of the standards in instances where I had to describe the approaches when participants were unfamiliar with them.

5.4. Future Research

Future research could help encourage further developments in the area of accessibility of tests in higher education online learning environments. Further development of a validated tool that is based on the ExCEL validated survey tool (Lombardi & Murray, 2011, pp. 53 – 54) could be helpful in order to gather information regarding willingness to accommodate students with disabilities and to adopt Universal Design principles for the creation and use of more accessible tests in higher education online learning environments. As well, further research regarding the development and use of more advanced statistical procedures that are finely tuned to the requirements of smaller samples within classrooms and also ways to aggregate small samples across classrooms to support more commonly used statistical methods could help inform design and development of more accessible tests in higher education online learning environments.
Additionally, the use of MOOCs could provide new frontiers in terms of gaining a critical mass of learners with disabilities to meet sampling requirements for analyses of validity and reliability. Mechanisms and processes that support the sharing of learning outcomes and curriculum supported activities of instructors within and amongst higher education institutions could help to support further development of modified and equivalent question inventories and databases.

Research could focus on additional topics such as the relationships that exist between world views (medical, social, capability and IT systems) – how these interact and manifest themselves in practice. Another possible topic of study would be ways to encourage a safe atmosphere / environment to encourage increased reflection and self-awareness in students; encouraging discussion of dimensions of difference and power.

As well, a potential area of study is the impact of legislation on practice, for example, anticipatory duty and good practice; and, push versus pull regulations (NCD, 2006 cited in Neville, 2008, p. 109).

More research could be done with respect to standards and specifications, for example, how standards and specifications have been implemented within technologies that are used to create and deliver accessible online tests. Future research also could focus on the quality of e-assessments, for example to develop quality indicators that could be used for certification or for other quality activities such as quality assurance and management.

Further research could be done to explore assistive technology uptake and usage, attitudes to and awareness of browser capabilities; learning analytic approaches, best practice or evidence-based practice through case studies, effective outreach to policy makers and the legal sector inclusion in policy, standards and legislation, and better ways to provide accessibility support and advice to end users.
5.5. **Researcher Reflections**

In this study, I investigated the accessibility of tests in higher education online learning environments. There were four intertwined components of this study: accessibility, assessment, technology, and the higher education context. With regard to accessibility, it was noted in the literature review that current perspectives regarding inclusive design may ascribe to the 'medical', 'social', or 'capability' models. The work of e-Learning assessments has been influenced by pioneers such as the American architect Ronald Mace, who has emphasized the importance of the 'curbcut' approach. This is a powerful example of how simple changes can make a big difference in the lives of many.

However, at this point, one of the key findings of this study seems to be a need for more ideas around processes that will support the creation and use of tests in higher education online learning environments. How do we decide what 'curbcuts' are needed and where they should be placed? The U.K. experience indicates that the approaches that have recently gained traction within higher education online learning environments are founded on collaborative team-based efforts that include the viewpoints, feedback and guidance of professionals from diverse backgrounds. At higher education institutions, such as the U.K. Open University, teams of individuals plan, implement, and evaluate course designs, including important components such as the technologies used and accessibility considerations. In the U.K., collaborative networks of instructors, technology professionals, assessment experts, and others work together on a variety of projects to further student learning on many fronts including accessibility.

When I consider the team-based approaches that seem evident in many of the U.K. projects and returning to the field of architecture and the design of the built environment, more recent frameworks, such as those that inform the work of urban planners, could suggest a
possible way to move forward with accessibility issues. Urban planners continue to develop Communicative Planning Theory (CPT), which is based on the work of John Rawls and other liberal democracy scholars (Harper & Stein cited in Sager, 2009, p. 3), but has been further refined by Sager through consideration of the Habermas’s theory of communicative action (2009, p. 3). Communicative Planning Theory is focused on "empowering the citizenry" (Sager, 2009, p. 3). Sager discusses technology assessment as a process of participative planning and acknowledges that occasionally compromises must be made (2009, p. 1). Sager suggests the use of 'constructive technology assessment' procedures (Schot, 2001; Schot & Rip both cited in Sager, 2009, p. 18), which when extended to the field of educational technology could involve end users in the technology assessment process. The values and ideas of the end users are "negotiated and renegotiated" throughout the process (Sager, 2009, p. 18). The approach being proposed by Sager is based on Communicative Action theory (Habermas cited in Sager, 2009, 3), which not only includes the values of transparency and public availability of information but also has been characterized as (Sager, 2009, 3)

- Respectful, open, participatory, inclusive;
- Supportive of interpersonal discursive approaches, where the intent is not to focus on or to favour one group;
- Promoting genuine deliberation and civic discourse;
- Truth-seeking and fair; and,
- Empowering.

Founding accessibility decisions on more open and consultative processes, such as Communicative Planning Theory and Communicative Action theory, could provide a helpful way forward for the accessibility of tests in higher education online learning environments.
Team-based approaches that bring together instructor, learners, accessibility experts, technology support, librarians, administrators, and others could encourage and promote more open dialogue and action.

It appears that assessment as a process is a concept that itself is shifting. Within higher education, the assessment of learners has been defined as (Maki, 2010, p. 3):

a systemic and systematic process of examining student work against our standards of judgment [that] enables us to determine the fit between what we expect our students to be able to demonstrate or represent and what they actually do demonstrate or represent at points along their educational careers.

However, the term 'assessment of learning' is perhaps now considered to be linked to the 1st generation assessments first described by Bennett in 1998. It focuses on what Fink would describe as "auditive" assessment rather than "educative assessment" (2003, pp. 13–15). More recent views of assessment have been expressed as 'assessment for learning' and 'assessment as learning', where the focus of the assessment is to promote learning, or the assessment actually is the learning activity. These may be considered as being closer to what Bennett has termed 2nd or 3rd generation assessments.

An interesting development in the realm of testing that supports these newer forms of assessment is the creation of concept inventories where both the questions and the answers have been extensively researched and distractors are based on commonly held misconceptions that have been documented through research (Rawle, 2013). Tests that are constructed using concept inventories can provide insight regarding student thinking patterns, barriers to learning, and misconceptions (Rawle, 2013).

Applying these ideas regarding the use of concept inventories to support assessment to the accessibility of tests in higher education online learning environments, similar to concept inventories, banks of alternative or modified questions that are designed to be of equivalent
semantic value and weight could be used to provide individual learners with additional opportunities to demonstrate their knowledge, understanding, and skills. Although alternate modified test items include modifications that reduce the difficulty of items and other potential factors such as cognitive load (alternate modified) (Roach et al., 2010, p. 65), alternate equivalent questions can be constructed to include modifications that do not change the target constructs or reduce the depth of knowledge required to answer the question. These types of test items could be constructed by instructors themselves, who are subject experts and understand most intimately the true equivalence of question items within specific domains. They can be added to question banks, shared amongst instructors at the same institution or across institutions.

The anonymized response data (and sometimes relevant contextual data) may be shared in order to determine the efficacy, validity, and equivalency of questions. As well, more structured approaches may be taken such as the development of questions that are focused on conceptually complex tasks (Shafrir & Kenett, 2010, p. 586 – 587). In addition, the field of intelligent tutoring system research provides some insight regarding different factors that can impact on learning such as motivation, emotion, and cognitive scaffolding; and, provides some suggestions regarding structured approaches, theory, and best practices with regard to stepped integration of questions within adaptive IT systems that support assessment (e.g., Boyer et al., 2008, pp. 239 – 249; Parvez & Blank, 2008, pp. 291 – 301). As well, providing educational and training opportunities that integrate accessibility (NCSU, 2013) is an important strategy that holds much promise.

One of the key findings of this study was that technology continues to be a barrier and a top priority. It does not always function as it should. According to Seale & Cooper (2010), accessibility refers to "the ability of the learning environment to adjust to the needs of all
learners" (p. 1107), and is determined by the learning environment's ability to flexibly match learner preferences and requirements (e.g., control, access, supports, presentation). This means that, within online learning environments, individual learners and instructors should be able to interact with the technologies they are using in ways that best meet their requirements. The technologies employed should accommodate different methods of input and alternative ways of providing student responses and instructor feedback.

Approaches such as the International Classification of Function, Disability and Health (ICF) can be useful in regions where there are limited or no supports services in place for those with disabilities, but care must be taken to ensure that the resulting system does not become a bureaucracy more intent on self-sustainment rather than on serving the needs of learners and instructors. The responses from the participants suggest that approaches such as the ICF are viewed as being most akin to the 'medical' model, as information about the individual is recorded, stored and used to determine the services needed by that particular person.

Standardization and specifications also can provide some consistency in approach, but they are not a panacea. Standards and specifications may be viewed as a starting point to support or assist the matching between presentation requirements of learners and assessment delivery. These types of approaches have the potential to better support and ensure accessibility of tests and test questions that are migrated amongst different IT systems. As well, the use of metadata can be used to support more robust matching between individual requirements and the IT systems that are being used for assessment. Metadata can be used to flag potential accessibility issues, question difficulty levels, and topics. As well, they can be used to support the use of taxonomies within assessments.
Interestingly standardization and specification approaches seem to be characterized as being closer to the 'social' model of disability, as in cases such as ISO/IEC 24751, the focus is on bridging the gap between the mismatch of individual learning requirements and the learning resources available. Specifications, such as QTI, could benefit from enhanced cooperation amongst software vendors and developers and from more rigorous and extensive testing tools. Approaches in the U.K. such as the FREMA (Framework for Reference Model for Assessment) can help to provide a common vocabulary regarding basic terminology, thus supporting shared understanding that can form the basis for more meaningful interactions amongst instructors, technology staff, administrators, librarians, and others.

The adoption of accessibility guidelines has been estimated at about 10% across the Internet over a 10 year period (Harper & Chen, 2012). Some reasons why web developers do not implement these guidelines include "lack of time, lack of training, lack of managerial support, lack of client support, inadequate software tools, and confusing accessibility guidelines" (Lazar, Dudley-Spronaugle & Greenidge, 2004 cited in Harper & Chen, 2012). Developers may simply not see the benefits of incorporating these types of guidelines especially if there is limited or no demand. Additionally, an interesting finding of this study is that there may be a lack of understanding of legislative requirements. As suggested by one of the participants (SSSD3) (and also confirmed in the literature c.f. Harper & Chen, 2012), a more robust approach may be to incorporate existing guidelines into technical specifications. As well, this participant (SSSD3) suggested that technical developments on the mobile front may help as designers and developers need to consider how to ensure content is going to be accessible across different types of devices.

The use of technology within higher education institutions in the U.K. to support online tests and other forms of assessment seems to be quite prevalent. However, the context within
which technology is being integrated within these higher education institutions is continually changing. Higher education institutions in the U.K. and elsewhere are coming under increased pressures to provide evidence of learning. In the U.K., the legislative framework and guidelines have emphasized the importance of anticipatory action, a focus that emphasizes the role of the institution and the leadership within higher education institutions to ensure that the accessibility requirements of learners and instructors are being met. As well, the importance of academic integrity is something to be protected as any action to promote and encourage the use of more accessible formats and should not contravene the intended purpose(s) of the assessment.

Legislation and regulations have played an important role in the transition of commonly held conceptions regarding accessibility. For example, as noted by ASA3, within higher education institutions one must:

… identify the academic competency that you are trying to assess, and try and abstract that from any other demand on sensory or physical ability or even cognitive ability that is not directly related to the intellectual attainments of this knowledge.

This separation between the purpose and all other considerations of the test question is a key characteristic of the U.K. experience.

Changes within U.K. higher education are occurring within the broader context of economic constraints and accountability requirements. The danger is that technology will be viewed as an attractive and comparatively 'easy' way to assess large numbers of learners as efficiently as possible. To counteract this view, the U.K. experience has proven that it is essential to consider how assessment can be used to inform learning, and how more meaningful authentic forms of assessment have the potential to encourage better outcomes for learners and for Higher Education institutions.
References


Appendix A: Invitation to Participate as a Research Participant

April xx, 2011

Dear Professor/Researcher,

The U.K. is a recognized leader in the field of accessibility of online testing, and you have been recommended to me as an expert practitioner in this field. I am an M.A. candidate in the Curriculum Studies and Teacher Development Program at the Ontario Institute for Studies in Education (OISE), University of Toronto. I invite you to participate in my dissertation research, “Accessibility of Tests in Online Learning Environments in Higher Education: Perspectives and Practices of U.K. Expert Practitioners”.

I would like to work with you to explore issues related to the accessibility of online tests in higher education online learning environments through a short 20-minute pre-interview survey (either online using Survey Monkey or via email depending on your preference) and a semi-structured interview (approximately 1 hour), which will be conducted via technology that is mutually agreeable to both of us (e.g., telephone, Skype, etc.). You are welcome to review the interview transcript (if you wish to do so), and I request that you agree to respond to possible questions for clarification by email after the interview, during the data analysis phase if needed. Additionally, during the pre-interview survey, I will request that you provide up to 3 exemplars of accessible tests that have been used in a higher education online learning environment and your comments related to the accessibility aspects that you believe might be most relevant to research on this topic.

You are under no obligation to participate in this project, and have the right to withdraw from the project at any time without negative consequences. You do not need to answer all of the questions. If you decide to withdraw from the project, all information collected from you will be removed from the data and destroyed. Please note that this research is not an evaluation of your performance, and there are no consequences from the information that could affect your professional status.

All the information obtained during this study will be kept private and confidential. Individual participants will be assigned a unique identifier code, and all information about participants will be identified only by this code. Those who opt not to participate in the study will not be able to be identified by their peers, and none of their survey or interview results will be collected. All data will be kept in a secure cabinet and/or in password-protected electronic files. The only people who will have access privileges to the data will be the Principal Investigator and her research supervisor. The data may, however, be used in professional endeavours (e.g., publications, conference presentations, etc.). In such cases, confidentiality and anonymity will be ensured by the use of unique identifier codes and anonymization of any other identifying details. After a period of five years, all notes will be shredded and destroyed, and all electronic files will be deleted. At the end of the study, I will write a dissertation based on these data.
Should you have any questions about your rights as a participant in this project, please contact the University of Toronto Ethics Review Office at ethics.review@utoronto.ca or 416-946-3273. Should you have any questions about this research study, you are welcome to email me at simone.laughton@utoronto.ca. Dr. Doug McDougall, whose contact information also is included below, is supervising this research. If you decide to participate, please indicate your agreement by reply email. I will then contact you with details regarding the pre-interview survey and to determine a date and time for an interview that is convenient for you and that minimally disrupts your busy schedule.

I sincerely hope that you will consider taking the time to share your expertise and look forward to hearing from you in the near future.

Best wishes,

Simone Laughton
B.Sc., M.I.St., M.A. Candidate
Curriculum Studies and Teacher Development Program
Department of Curriculum, Teaching & Learning
Ontario Institute for Studies in Education, University of Toronto
simone.laughton@utoronto.ca

Doug McDougall, Ed.D.
Chair, Department of Curriculum, Teaching & Learning
OISE/University of Toronto
252 Bloor Street, 11th floor
Toronto, ON M5S 1V6
doug.mcdougall@utoronto.ca
Appendix B: Online Consent form to Participate as a Research Participant

1. Online Consent form to Participate as a Research Participant

Curriculum Studies and Teacher Development Program
Department of Curriculum, Teaching & Learning
Ontario Institute for Studies in Education, University of Toronto
252 Bloor Street West, Toronto, Ontario M5S 1V6 Canada

If you have any questions regarding this research study, please do not hesitate to contact:
Principal Investigator: Simone Laughton, simone.laughton@utoronto.ca
OR
Project Supervisor: Dr. Doug McDougall, OISE/UT, doug.mcdougall@utoronto.ca

If you have questions about your rights as a research participant, please contact the Ethics Review Office at 416-946-3273 or email ethics.review@utoronto.ca.

I agree to participate in the M.A. research being conducted by Simone Laughton in connection with her M.A. dissertation, “Accessibility of Tests in Online Learning Environments in Higher Education: Perspectives and Practices of U.K. Expert Practitioners”. I have been apprised of the purpose of the study and the research methods that will be employed.

When you click on "I agree" you will proceed to the survey.

I agree     I do not agree
Appendix C: Demographic and Background Survey

1. UNIQUE ID# (Please enter the number provided to you in a confirmation email): _____

2. What role(s) do you have in the higher education institution where you teach? (Please check all that apply.)
   a. Instructor
   b. Administration (e.g., Departmental Chair)
   c. Governance
   d. Liaison with institutional technical support
   e. Librarian
   f. Other, please specify: _________________________
   g. Not applicable

3. Approximately how long have you been teaching at a higher education institution?
   a. 0-3 years
   b. 4-5 years
   c. 6-10 years
   d. 11-20 years
   e. More than 20 years
   f. Not applicable

4. Approximately how long have you been researching accessibility issues as they relate to online tests?
   a. 0-3 years
   b. 4-5 years
   c. 6-10 years
   d. 11-20 years
   e. More than 20 years
   f. Not applicable

5. What is your primary educational background in terms of discipline (please check all that apply):
   a. Sciences
   b. Social Sciences
   c. Humanities
   d. Other, please specify: ____________________________

6. What purposes have you used online testing for? (Please check all that apply):
   a. formative
   b. summative
   c. diagnostic
   d. self
   e. peer
   f. continuous
   g. Other, please specify: ____________________________
   h. Not applicable
7. What types of online testing systems have you used to deliver online tests? (Please refer to the definitions below and check all that apply):

**Learning Management System** – “Assessment which takes place within an overarching digital environment in which the candidate learns and interacts with other learners as well as sitting assessments; virtual learning environments such as WebCT and Blackboard.”

**Assessment Management System** – “Assessment which takes place within a discrete digital environment dedicated to the delivery of assessments; systems such as TOIA and Questionmark.”

**Component based system** - “Assessment which takes place within a digital environment constructed from separate segmented elements often connected by web services; exemplified by the linking of specialised assessment systems such as AiM, STACK, ASSIS, APIS and ASAP using the Remote Question Protocol.”

- Learning management system (e.g., WebCT, Blackboard, ATutor, Moodle)
- Assessment management (e.g., TOIA, Questionmark)
- Component based system (e.g., AiM, STACK, ASSIS, APIS, ASAP)
- Other, please specify: ________________________________.
- Don’t know

8. Compared to other colleagues at your institution, how comfortable are you with creating a test in an online learning environment?  
(Where 1 = very uncomfortable and 6 = very comfortable)

   1  2  3  4  5  6

9. Compared to other colleagues at your institution, how comfortable are you with gathering data from a test in an online learning environment?  
(Where 1 = very uncomfortable and 6 = very comfortable)

   1  2  3  4  5  6

10. Have you ever migrated test questions from one online learning environment to another where both indicated that they are compliant to the same level of technical specification and/or standard?

   Yes       No       Unsure

11. If you answered yes to the question above, what has been your experience with the migration of test questions from one online learning environment to another where both indicated that they are compliant to the same level of technical specification and/or standard?
12. Have you ever used a publisher’s test cartridge in an online learning environment in order to gather assessment data from students?
   Yes           No           Unsure

13. If you answered yes to the question above, what has been your experience with using publisher test cartridges?

14. Accessibility has been defined as, "the ability of the learning environment to adjust to the needs of all learners" (Seale & Cooper, 2010, p. 1107)

   How important is accessibility to you with regard to the creation of tests and gathering of e-assessment data from tests within an online learning environment?
   (Where 1 = very unimportant and 6 = very important)

   1   2   3   4   5   6

   Please indicate your agreement regarding the following items as they relate to ensuring that tests in higher education online learning environments are accessible. ** NOTE: These items are adapted from the ExCEL survey instrument and are used with permission (Lombardi & Murray, 2011). (Where 1 = "strongly disagree" to 6 = "strongly agree")

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<thead>
<tr>
<th>Item</th>
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<td>16. I am willing to allow students with documented disabilities to use technology (e.g., laptop, calculator, spell checker) to complete tests in online learning environments even when such technologies are not permitted for use by students without disabilities</td>
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<td>17. I make individual accommodations for students who have disclosed their disability to me</td>
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<td>18. I am aware of assistive technology that students with disabilities can use to help them to complete a test within an online learning environment</td>
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<td>19. Providing testing accommodations (such as extended test time) in online learning environments to students with documented disabilities is unfair to students without</td>
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<td>20. I am willing to spend extra time (i.e., in addition to normal</td>
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<td>office hours) helping any student prepare for a test that will be</td>
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<td>21. I am willing to spend extra time (i.e., in addition to typical</td>
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<td>office hours) meeting with students with documented disabilities</td>
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<td>to prepare for an upcoming test in an online learning environment</td>
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<td>22. I ensure that the tests delivered in an online learning</td>
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<td>environment are aligned with the learning objectives for the course</td>
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<td>23. I am confident in my understanding of the legal definition of</td>
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<td>disability</td>
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<td>25. I am confident in my understanding of the Special Educational</td>
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<td>26. Currently, I do not have sufficient knowledge to make</td>
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<td>adequate accommodations for students with disabilities taking tests</td>
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<td>in online learning environments in my course(s)</td>
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<td>27. The technology that I currently use to support the delivery of</td>
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<td>28. I would like to have additional flexibility to provide</td>
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<td>equivalent content in alternative formats so that my test is more</td>
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<td>29. I receive adequate support from campus resources to make</td>
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<td>30. Students with documented disabilities who request support from campus services receive adequate support to be able to complete tests in an online learning environment</td>
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31. Please provide up to 3 exemplars of accessible tests that have been used in a higher education online learning environment and provide your comments related to the accessibility aspects that you believe might be most relevant to research on this topic.

Additional comments or experiences you may have regarding accessibility of tests in higher education online learning environments also may be provided below.

THANK YOU FOR YOUR PARTICIPATION!
Appendix D: Semi-Structured Interview Questions

UNIQUE ID#: __________

A. INSTRUCTOR INTERVIEW QUESTIONS:

GENERAL:

1. Have you, your colleagues, or your students ever encountered any barriers or issues in terms of accessibility of tests in higher education online learning environments? If yes, then please provide examples.
   a. Have you encountered issues at the institutional level, for example with institutional policies, guidelines or procedures or lack thereof?
   b. Have you encountered technical issues, for example browser incompatibility issues with the test as it is delivered in the online learning environment used at your institution?
   c. Have you encountered resource issues, for example a lack of time, expertise, or people to help with development, implementation, and evaluation?
   d. Have you or your colleagues ever encountered a situation where you had to develop an equivalent or alternative assessment question (e.g., an assistive technology in an online test conflicts with the test objectives or intended learning outcomes of the test)? How have you handled this type of situation?
   e. What other barriers or issues have you encountered?

2. What does the term “accessibility” mean to you?

3. Please describe any prior training or other instruction you may have had regarding accessibility issues as they relate to tests within online learning environments. In your estimation how has this training or instruction impacted on your development and delivery of tests within higher education online learning environments?

4. As someone who develops or uses technology to deliver tests in higher education learning environments, what are your top priorities in terms of accessibility?

STRATEGIES AND PRACTICES:

5. What are some of the strategies and practices that you use or are aware of to ensure that the tests developed or used in online learning environments are accessible? (Draffan et al., 2010)

Institutional Support:
   a. Do you ever consult or review your own institution’s policies, guidelines procedures, checklists, planners or those externally developed by other institutions or organizations? If yes, then which ones do you consult? Are these helpful, and if so how?
b. Does your institution provide support for enhanced communication between test makers, test takers, academic faculty developers, instructional technology designers, technical support people, and others? Please describe any initiatives or mechanisms that are in place.

c. Do the networked computers at your institution allow for customized settings and provide access to productivity tools to support student access to testing in the online learning environment at your institution?

d. Do you have access to support to help with the provision of accommodations to students who take tests at your institution?

e. Please describe any other institutional support initiatives at your institution specifically targeted toward accessible testing within the online learning environment used at your organization.

**Academic Support:**

f. Do you have access to academic support to help with the development and alignment of intended learning outcomes or learning objectives with respect to the tests you use in higher education online learning environments?

g. Do you have access to academic support to help with the development of equivalent test questions for students who require alternative assessments? What type of help is provided?

h. Please describe any other academic supports at your institution specifically targeted toward accessible testing within the online learning environment(s) used at your organization.

**Online Learning Environment Functionality:**

i. Do you provide students with access to information about the types of questions that will be asked and examples of how students might navigate the types of questions you will be using?

j. Do you have the ability or have you ever allowed students to have control over test timing features (e.g., time limits or expiration)?

k. Does the online learning environment that you use for testing allow students to control the font size when tests are displayed?

l. Does the online learning environment that you use for testing allow students to view questions and associated content in alternative formats?

m. Does the online learning environment that you use for testing allow students to control the colour contrast levels when tests are displayed?
n. Within the online learning environment that you use for testing is navigation easy and can all navigation be completed using keyboard alone?

o. Does the online learning environment that you use allow for the description of multimedia elements that form part of assessment questions?

p. Are there any other assistive technology functionalities afforded by the online learning environment you currently use for testing?

Other Practices and Strategies:
6. Do you share test questions with other instructors? Have you ever tried to migrate test questions from one system to another? Have you ever tried to use a test cartridge from a colleague or a publisher? (Probing question - What have been / Describe your experiences with respect to sharing tests that you have created or gathered assessment data from within an online learning environment? In your experience, how have accessibility issues been addressed in these types of situations? Have you encountered any problems related to accessibility?)

7. In your opinion what kind of supports are most beneficial for higher education instructors to help to address accessibility issues with respect to tests in online learning environments?

8. What would you say are 4 or 5 “Best Practices” or "Best Strategies” that you employ in the design and delivery of tests in the online learning environment that you use?

IMPROVEMENTS:

9. Given your previous experiences with accessibility of tests in higher education online learning environments, what are improvements that could be made in order to ensure that all students have an opportunity to demonstrate their knowledge and skills?

a. It has been recommended that the International Classification of Functioning, Disability and Health (ICF) could be a useful tool to support students with disabilities (Jones, 2011). In your view, what might be some of the benefits and drawbacks of this approach with respect to supporting accessibility of tests in online learning environments?

b. Other approaches suggest that standardized technology components and enhanced user interface functionality could be helpful for students with accessibility issues (e.g., IMS GLC Inc. Accessibility for Learner Information Package (ACCLIP), AccessforAll Metadata (ACCMD), ISO/IEC 24751) (Anido-Rifón, 2008). What might be the benefits and drawbacks of these types of approaches?

c. Are there other approaches or improvements that you are aware of that have been suggested to assist with accessible tests in online learning environments? What might be the benefits and drawbacks of these approaches?

10. Do you have anything else that you would like to share or bring forward regarding accessibility of tests in higher education online learning environments?
Appendix E: Abbreviations, Terms and Definitions

E.1 Abbreviations

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<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>IEC</td>
<td>International Electrotechnical Commission</td>
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<td>IMS</td>
<td>IMS Global Learning Consortium, Inc.</td>
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<td>ISO</td>
<td>International Organization for</td>
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<td></td>
<td>Standardization</td>
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<tr>
<td>IT</td>
<td>Information Technology</td>
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<td>ITLET</td>
<td>Information Technology for Learning,</td>
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<td></td>
<td>Education, and Training</td>
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<td>OLE</td>
<td>online learning environment</td>
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<td>QTI</td>
<td>Question Test Interoperability</td>
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E.2 Terms and Definitions

accessibility

usability (2.26) of a product, service, environment or facility by individuals (2.20) with the widest range of capabilities

NOTE 1 Although “accessibility” typically addresses users who have a disability, the concept is not limited to disability issues.

NOTE 2 Adapted from ISO/TS 16071:2003, 3.2.


higher education assessment

systemic and systematic process of examining student work against our standards of judgment [that] enables us to determine the fit between what we expect our students to be able to demonstrate or represent and what they actually do demonstrate or represent at points along their educational careers

Source: Maki, 2010, p. 3.

test item modification

changes made in the content, format and/or administration procedures of a test in order to accommodate test takers who are unable to take the unmodified test under standard test conditions

**accommodation (for a test or a test item)**
customization to an individual learner’s needs that is procedural in nature

NOTE 1  Examples of accommodation include increased time, quiet segregated location, screen reader or text enhancement software, voice-over, alt-text, a reader for exams, captioned or described video, etc.


**test item alternate modified**
changes are made to the actual anatomy of the test item according to the documented needs of a specific group of students

NOTE 1  Alternate modified questions include modifications that are structural and may be under the control of test developers through pilot testing with the target audience (Roach et al., 2010, p. 62, 63).

NOTE 2  Some examples of alternate modified changes to questions include (Roach et al., 2010, p. 65, 77)
- Language simplification (e.g., item stem, response options or initial passage);
- Additional visual and graphic support;
- Reading supports, such as bolding of key terms related to vocabulary and comprehension;
- Elimination of the least plausible distractor for a multiple choice question (based on Rodriguez’s meta-analytic work on optimal answer options for multiple choice questions (2005 cited in Roach et al., 2010, p. 65); and,
- Increasing white space for response options.

**usability**
extent to which a product can be used by specified users to achieve specified goals, with effectiveness, efficiency and satisfaction, in a specified context of use