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## Accessibility of Thai university websites: Awareness, barriers and drivers for accessible practice

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Edith Cowan University

Accessibility of Thai University Websites: Awareness, Barriers and  
Drivers for Accessible Practice

**This thesis is presented for the  
Doctor of Information Technology (DIT)**

By

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## Abstract

Governments and organizations have to respond to a range of legislative and policy initiatives intended to promote equal opportunity for all. The Thai government has passed a number of laws which aim to protect its citizens from discrimination and from breaches of their human rights by government departments and agencies. The Persons with Disabilities Education Act B.E. 2551 (2008) and the Thailand Information and Communication Technology (ICT) Policy Framework (2011-2020) required government agencies to delivery equal education and access to online information for all Thais. Most Thai universities receive government subsidies, and therefore have an obligation to contribute to national prosperity so that all Thais can benefit from their activities, or as the Ministry of Information and Communication Technology and The National Electronics and Computer Technology Centre (2011, p. 23) states *“The creation of content, database, online content which promotes lifelong learning, the development of school websites and other digital content should follow the web accessibility standard”*. Given the Thai government’s commitment to lifelong learning and the creation of accessible materials, this thesis sought to investigate to what level Thai universities were implementing web accessibility in their websites and e-learning materials.

A mixed method approach was employed in order to explore the level of accessibility awareness, barriers to web accessibility implementation and possible drivers for accessibility uptake which might exist within Thai universities. Quantitative data derived from automated and manual web evaluations was gathered based on WCAG 2.0 guideline in order to determine the actual levels of accessible design apparent in Thai university websites. Fifty representative universities were selected from the top ranked Thai universities and a number webpages were tested from within each of the university websites. In addition, online surveys were conducted with three stakeholder groups within the Thai university sector, namely lecturers, web staff and senior managers. These surveys were design to set the context for quantitative website assessment findings and provide evidence as to these stakeholders understanding of web accessibility as a concept. Finally, follow-up interviews were conducted

after the web assessments and surveys were analysed so as to reduce ambiguity and increase understanding, creating a very clear picture of the standing of web accessibility in Thailand's universities.

The findings of the data analysis indicate that Thai universities have low levels of web accessibility implementation in their websites and e-learning materials, even though web accessibility requirements had been embedded in Thai laws and policies for over a decade. In terms of web evaluation, the university webpages had accessibility problems across all aspects of WCAG 2.0's POUR principles, with not a single tested webpage passing even the lowest level of WCAG 2.0 compliance. The survey and interview data revealed very low levels of awareness of web accessibility amongst Thai university staff members as well as lack of knowledge regarding students with disabilities and their specialised technology needs.

Whilst Thai university staff were generally supportive of the concept of web accessibility and supporting students with special needs, this was accompanied by some less supportive views, including students with disabilities being taught only in specialised educational facilities or only where there were sufficient numbers of such students to make the investment in accessibility worthwhile. A number of universities in this study featured university admission requirements which could be classed as a discriminatory and not aligned with the requirements of the Thai government. In fact, this thesis revealed an almost total lack of awareness within the Thai university sector of Thai government policy regarding web accessibility and equality in education.

This thesis proposed a Smart Thailand : Accessible Learning model and an associated implementation framework which together might lead to an environment in which Thai universities would be more willing and able to implement the tenets of web accessibility and provide an equitable learning experience for all Thai citizens, especially those with disabilities.

The declaration page  
is not included in this version of the thesis

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## DEDICATION

This study was inspired by people with disabilities who are denied access to basic information. Discrimination arises not as a result of impairment in a person's ability, but rather, as a consequence of lack of understanding of web accessibility and accessibility knowledge. Generally, people with disabilities face barriers when accessing information on websites. My hope is that this study will encourage improvement in the level of accessibility of online resources published by education institutions, especially in Thailand, allowing students with disabilities to fully participate in their studies on the same basis as other students.

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The development of information and communication technology (ICT) has affected all parts of society including education, where teaching and learning processes have been changed through the use of ICT applications and the advent of e-learning (Sife, Lwoga, & Sanga, 2007). Essentially, we have seen a coming together of education and technology (Soyoz, 2010). Glenn and Agostino (2008) argue that technology impacts on education in five ways: influencing teaching methodologies, increasing the use of online courses, fostering corporate institution partnerships, encouraging staffs of university using new technology and, stimulating the move toward globalized education. E-learning relies on the effective delivery of learning and training activities, and events such as webinars, blogs and forums accessible via the internet (Hussin, Bunyarit, & Hussein, 2009). Online learning may offer many advantages for organizations such as cost saving, access to the latest information and, less intimidation than a face-to-face classroom (Pearson, 2010). Online learning also offers students the opportunity to access content away from a physical location at a time and place that is suitable to them (Layton, 2009). This is of particular advantage to students who have to work to meet financial commitments and may not be able to attend regularly scheduled on campus lectures and tutorials. The provision of university resources, including e-learning allows students with disabilities to study and access learning facilities from home in a more comfortable and customised environment (Shah, 2011). Consequently, e-learning gives benefits to a wide variety of educational stakeholders. However, Marcelle (2011) noted that the format and provision method of online materials may create obstacles for students with disabilities. For example, hearing-impaired students may face problems with media containing audio only online resources within a university's website. Additionally, in traditional face to face delivery the teacher is able to identify and deal with problems that students' may be having with their understanding of course materials. In the online environment teachers may have little opportunity to observe when a student is having difficulty with learning resources as would the IT staff have difficulty observing accessibility issues related to the university's various online tools. Ease of access to clearly written web pages is therefore essential in the design and delivery of effective university websites, learning resources and online teaching.

This research seeks to investigate the accessibility of online materials in Thai universities including efforts made by each university in making their online resources available to the widest possible audience, including users with disabilities. Accessibility refers broadly as being “able to be reached, entered, or used by people who have a disability” (The Oxford dictionary, n.d., para. 4). Web-based distance education has increased educational opportunities for higher education students however this mode of delivery can pose significant challenges for students with disabilities who rely on assistive technology (AT) to utilize web content, especially in the presence of poor web design (Blackhurst & Morse, 1996; Wong, Cohen, & Tan, 2011). Web accessibility is the practice of making websites accessible to people who require more than just traditional web browsers to access the internet. The World Wide Web Consortium (W3C) emphasises that the Web Content Accessibility Guidelines (WCAG) include recommendations for creating accessible web content for all people, including people with disabilities. The WCAG guidelines outline how people with disabilities use the web and how the different components of web development interact, such as content, users and assistive technology. If one component does not work properly with the others, a number of problems will arise for users, especially users with disabilities. For example, a common problem for people with hearing impairment is access to multimedia formats (video and audio) without captions. Whilst the term ‘accessibility’ is broad and has numerous interpretations, in terms of this thesis it is primarily aligned to that of the WCAG and how people with disabilities interact with the Web. It is recognised by the researcher that WCAG conformance does not necessarily mean access for all, as every user’s need is different, however in terms of this work, the WCAG do provide for site testability and levels of conformance to be recorded. The WCAG is aligned to ISO/IEC 40500: Information Technology, and Section 508 Amendment to the Rehabilitation Act 1973 (World Wide Web Consortium, 2008d). The course content and the technologies used to deliver it must not create an obstacle for learners with a disability, as they should be able to have the same (or as similar as possible) learning experience by accessing online university environments (J. Seale & Cooper, 2010). Building on the work of Seale and Cooper, this research aims to investigate the current state of accessibility of Thai university websites and the factors that might influence either drive those accessibility outcomes or prevent them in the first place.

## 1.1 BACKGROUND TO STUDY

A survey by the Universities and Colleges Information Systems Association (2010) found institutions benefit through investment in new technologies that improve access to learning for off-campus and part-time students. Moreover, the improved access results in delivery of course materials and services that better meet student expectations (Browne, Hewitt, Jenkins, & Walker, 2008). The Higher Education Funding Council for England (HEFCE) online learning strategy argues that learners expect to be able to access institutional contexts and services from their own devices, regardless of location. Consequently, there is both an opportunity and a need for institutions to meet user's specific computing requirements (Palmer, 2009). Osborn, Stevens, & Wheeler (2009) contend that a university's web forum is an alternative community for students to make contact with other students allowing them to share their study experiences. Student expectations of university ICT are divided into four areas; social life, teaching, learning and structure and administration (Littlejohn, Margaryan, & Vojt, 2010). Therefore, universities need to use their online technology resources effectively in order to meet student expectations across this wide range of service areas, as this thesis sought to achieve in the Thai university context.

According to Hadley (2011) mature age, socio economic standing and disability influence student outcomes in a college environment. Specifically, students with disabilities may require additional services from the university to support them through assistive technology, web accessibility and accessible learning technology in the classroom. Marcelle (2011, p. 47) states *"Depending on the type of disability a student may have, many aspects of an online course can present a challenge"*. Therefore design of online materials must also take into account the differing types of disabilities students may have. There are two methods for improving the quality of web-based information; through the use of accessibility technology and through adopting good practices in interface design that ensure materials are accessible and useful for all stakeholders in an online environment (Brophy & Craven, 2007; Park, 2012). Online learning environments can benefit from the use of Universal Design for Learning (UDL) as described by the Centre for Applied and Special Technologies (CAST) which is an organization tasked with providing better education experiences for all, especially students with disabilities. UDL principles allow course

and web designers to meet the individual needs of potential users by providing multiple methods of presenting material and providing students with multiple ways of engaging with and responding to online content. Specifically, UDL relates to online learning problems including provision for individualized approach, the use of multiple contexts within a given approach and pedagogical framework (Granić & Ćukušić, 2007). For example, individualized approach refers to different user characteristics such as physical or cognitive abilities, background and interests and the impact these have on the design of effective e-learning environments. As a result, online course designers need to be aware of the influence different types of disabilities can have on a student's learning experience, be they physical, mental, social or cultural. Aspects of these requirements helped frame some of the survey and interview questions posed to Thai university staff as to their awareness of such issues in terms of supporting students with disabilities.

People with disabilities require assistive technology (AT) to use computers and access the internet, with each assistive technology being designed for specific types of disability (World Wide Web Consortium, 2012d). For example, individuals with vision impairment use screen readers such as JAWS or NVDA to access websites, including their content and navigation systems. In response to the needs of people with disabilities, assistive technology has been developed to help people with disabilities interact with the Web and the recommendations found in the WCAG reflect how websites can be best developed so as to allow assistive technologies to work more effectively. Web accessibility involves a wide range of hardware and software tools that can be offered to students with disabilities who may otherwise be excluded from engaging in the learning process (Richardson, 2011). The Web Content Accessibility Guidelines (WCAG) is a set of guidelines used for developing accessible web content for people with disabilities (World Wide Web Consortium, 2008c). The WCAG guidelines present best practices and methods for achieving web accessibility. For example, success criterion 1.1.1 of WCAG 2.0 guidelines indicates that *"All non-text content that is presented to the user has a text alternative that serves the equivalent purpose"* (World Wide Web Consortium, n.d.-a). If web developers provide alternative text properly it will help users with vision impairment read non-text content, such as accurately describing the content of a digital image. WCAG 2.0 has been adopted by a number of countries around the world as the standard by which nations deliver their online materials and services to their citizenry. As an example of accessibility policy at an

international level, all Indian government web sites have to be developed under the Government Process Reengineering (GPR) Policy which complies with WCAG 2.0 Level AA, to ensure equal access for everybody (Praveen, 2011). Likewise, the Australian government have endorsed WCAG 2.0 and published the web accessibility National Transition Strategy (NTS) in 2010 (Australian Government Information Management Office, 2010b), with the intention that all federal (and eventually state) government online resources were to be accessible to WCAG 2.0 AA by 2015. These are just two examples of national level adoption of accessibility principles, whilst other nations like the United States tackle the issue of accessibility from a procurement approach as part of their Section 508 requirements. Article 9 of the Convention on the Rights of persons with Disability (United Nations, 2008) aims:

To enable persons with disabilities to live independently and participate fully in all aspects of life, States Parties shall take appropriate measures to ensure to persons with disabilities access, on an equal basis with others, to the physical environment, to transportation, to information and communications, including information and communications technologies and systems (p. 9).

With the above as a guiding principle, all state parties are required to provide accessible information and communication systems for all persons, including those with disabilities. However, discrimination of people with disability, either intentional or unintentional, is a real problem faced in many nations by many people (European Commission, 2012). For example, people with disabilities account for almost one in six citizens of the EU (80 million people), but they are typically less financially independent and have less opportunities to enjoy goods and services such as education, healthcare and technology than other citizens. In addition, only one third of EU public sector and government websites are fully accessible (European Commission, 2012). In Brazil, only 19% of Brazilian web developers were aware of web accessibility, with a lack of training in that country identified as barrier for developing web accessibility (Freire, Russo, & Fortes, 2008). Looking at the Thai government, as of the mid 2000's only 1% of its websites passed any level of accessibility compliance (Mitsamarn, Gestubtim, & Junnatas, 2007), which at the time was WCAG 1.0.

In order to foster the adoption of online learning across all levels of Thai education, the Thai Commission on Higher Education (CHE) developed the Thailand Cyber University's Project (TCU) in order to provide equal education for all (Saekow & Samson, 2011b) students enrolled in universities participating in the TCU project. As of 2012 the TCU had over 300,000 course registrations and nearly 20 study programs in their sites, with over 150,000 students and 43 universities and organizations participating in TCU activities (TCU, 2012). At the same time, the Thai Web Content Accessibility Guideline (TWCAG) 2008 is based on a modified version of WCAG 2.0 and provides guidelines for Thai government agencies and commercial organizations in terms of increasing their level of website accessibility. Through its development of the TWCAG materials, the TCU, the National Education Act of 1999 and the National ICT Policy Framework (2011-2020) the Thai government has committed significant social, financial and policy resources to the development of accessible government and higher education. This research will investigate the higher education aspects of this commitment through the lens of Thai universities and their awareness of and commitment to web accessibility.

## **1.2 SIGNIFICANCE OF THE RESEARCH**

Join Information Systems Committee is cited in Annex (2008) and states that using appropriate technology leads to significant development of learning and teaching and this also improves student satisfaction, retention and achievement. This research project concerns web accessibility in Thai universities and whether Thai universities are meeting the various policy and educational frameworks expected of them by the Thai government. The research is premised on three overarching issues: (1) a lack of accessibility compliance and awareness in educational institutions, (2) web accessibility resources available in the Thai language and (3) the gaps between Thai government policies and their implementation at the university level. It is argued that these issues with particular reference to Thailand underpin the importance of defining web accessibility in Thai universities as an exemplar for the wider levels of web accessibility across the university sector in Thailand.



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### 1.2.1 A LACK OF ACCESSIBILITY COMPLIANCE AND AWARENESS IN EDUCATIONAL INSTITUTIONS

According to the report “Web Accessibility Policy Making: An International Perspective” (Centre for Internet Society & Global Initiative for Inclusive Information and Communication Technologies, 2012), Japan, the Philippines, Korea and Thailand are mentioned as examples of countries demonstrating best practices in addressing web accessibility from the Asia Pacific region. In particular, the CIS report indicated that Japan does not have legislation covering accessibility but provides some reference to web accessibility in terms of industrial standards, the latest version of which, the Japanese Industrial Standard (JIS), is compliant with WCAG 2.0. South Korea has instituted legislation that offers a comprehensive range of web accessibility policies, and in order to monitor the evolving accessibility situation in Korea, the South Korean government conducts annual surveys (Centre for Internet Society & Global Initiative for Inclusive Information and Communication Technologies, 2012; Hong, Katerattanakul, & Lee, 2007a). Also within the Asia Pacific region, the Philippine Web Accessibility Group (PWAG) has begun developing an official set of ‘Philippine Web Accessibility Design Recommendations’ which respond to the country’s needs rather than adopting WCAG style guidelines (Centre for Internet Society & Global Initiative for Inclusive Information and Communication Technologies, 2012; Kuzma, Yen, & Oestreicher, 2009).

It should be noted that the U.S. Section 508 and the Web Content Accessibility Guidelines (WCAG) guidelines are popular accessibility guidelines against which developers can test their sites. Section 508 applies to electronic and information technology procured by the United States federal government, whilst WCAG is recognised internationally and is often the standard by which governments set their own accessibility standards. WCAG 2.0 has become an ISO (International Standards Organization) standard, and many countries have adopted WCAG 2.0 as their legal or policy standard for web accessibility, such the European Union, Australia and Thailand (Rogers, 2015). Looking outside of the Asian region, there were over 6.1 million students in the United States (U.S.) taking at least one online course in 2010 (Allen & Seaman, 2011) and U.S. higher education institutions realise that e-learning is an essential part of their strategy for student retention and growth. The National Centre for Education Statistics is cited in Keeler and Horney (2007) maintained that 13 per cent of the online student population in the U.S. are students with some type of disability or special need and that there is a lack of awareness of their

specialised requirements or the need to accommodate their accessibility circumstances. A more recent piece of research shows that only 4.5 per cent of Spain's university web sites and the pages they contain can be defined as having no errors in terms of automated assessment, though only 0.9 per cent of web page passed any level of WACG 1.0 compliance (Fernández, Roig, & Soler, 2010). Similarly dismal results were reported for university homepages in Turkey in terms of WCAG 2.0, with (Kurt, 2011) highlighting the relatively poor levels of accessibility in educational institutions across the world.

According to Kane, Shulman, Shockley and Ladner (2007) universities in Asia present with the most accessibility errors with 5.93 errors per page followed by North America (4.81), Europe (4.45) and Oceania (3.28). The lack of support services for students with disabilities, inadequate campus facilities and poorly adapted academic materials for accessibility needs are the primary barriers for students with disabilities within the higher education system in Indonesia, where less than 4% of students with disability have access to educational services (Steff & Mudzakir, 2010). Interestingly, Cheausuwantavee (2014, p. 1) noted that *“problems and ineffective law enforcement on educational provisions for persons with disabilities in Thailand exist similarly to previous studies in other developed and developing countries”*. Kuakiatwong (2012) also found that a selection of pages from within the Thailand Cyber University (TCU) web pages failed to meet WCAG 2.0 standards in 2010. It should be noted that the TCU, which is developed by the Ministry of Education, aims to:

- assist all the higher education institutes to deliver distance learning via the internet
- ensure that all online courses are of a high quality and meet government standards
- promote the sharing of teaching resources and human resources (Office of the Commission on Higher Education, 2004a, para. 2).

The TCU is the biggest e-learning provider in Thailand, with 834 online courses in 17 programs and almost 200,000 Thai students enrolled in the courses in 2015 (Office of the Commission on Higher Education, 2004b, para. 4). Given that the TCU is expected to serve as the benchmark of university access and accessibility, these kinds of results, though not generalisable, provide some indications that accessibility can be elusive even to those institutions whose sole responsibility is the delivery of online services in support of learning.

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### 1.2.2 THE ACCESSIBILITY IN THAI LANGUAGE RESOURCES

There is some cause for concern as to the apparent lack of accessible e-learning courses available in Thai universities, with issues such as a lack of policy, regulation and human resources being identified by Saekow & Samson (2011a). Ineffectiveness of law enforcement and prejudice toward students with disabilities, tied to little or no improvement of educational provisions and facilities for students with disabilities in Thailand are seen by some authors as being a failure of policy, or of a failure to enforce policy (Cheausuwantavee & Cheausuwantavee, 2012). While there are numerous Assistive technologies (AT) available on the market for use by people with disabilities, most applications do not natively support the Thai language (Poobrasert, Sabayjai, & Mitsamarn, 2011; Punyabukkana, Chirathivat, Chanma, Maekwongtrakarn, & Suchato, 2007). For example, Dragon NaturallySpeaking, a popular tool for accessibility users, is not available in the Thai language. The unique characteristics of Thai languages such as the Thai alphabet, grammars and tones are obstacles for developing Thai speech recognition (Wutiwiwatchai & Furui, 2007). As will be discussed in more detail later in the thesis, issues surrounding the availability of accessibility resources in the Thai language are significant. For example, Section 508 and WCAG 2.0 are available in English only, as are most web accessibility evaluation tools, including those recommended by the W3C (World Wide Web Consortium, 2012a). Examination of these issues in greater depth will help provide some context as to the findings of this research and the role that language based resources play in accessibility compliance and awareness.

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### 1.2.3 THE GAP IN THAI GOVERNMENT POLICIES

As stated above, many countries have adopted web accessibility in their legislation and policies, so that schools and universities are required to ensure accessibility in their websites. Thailand has passed the legislative and policy framework according to article 27 of the Convention on the Rights of Persons with Disabilities (CRPD) such as The Constitution of the Kingdom of Thailand B.E. 2550 (2007), The Promotion and Development of Quality of life of Persons with Disabilities Act B.E. 2550 (2007) and, the National Education Act B.E. 2542 (1999) in order to encourage equal education for all Thai people. For example, the Persons with Disabilities Empowerment Act B.E. 2550 (2007) aims, amongst other things to:

Section 20 Persons with disabilities have the rights to access and utilize public facilities including welfare services and other supports from the government as follows:

(2) Education in accordance with the National Act on Education or National Plan on Education, which is provided appropriately in specific educational institutes or general educational institutes or alternative education or non-formal education, and where the agencies involved shall be responsible for providing facilities, media, services and any other assistance for persons with disabilities (Thailand Ministry of Social Development and Human Security, 2005, p. 9).

Moreover, Thailand's ICT Policy Framework (2011-2020) encourages the reduction of obstacles in accessing online service, has as one of its objectives that:

Provide electronic government services through various access channels and ensure that these services meet the needs of people in their daily life. This in order to facilitate people's access to information and social services and increase their participation in public administration and services. In any case, appropriate ICT standards should be used, for instance, standards for web accessibility that allow the PWD and elderly to access the government information and services on an equitable basis (Ministry of Information and Communication Technology & The National Electronics and Computer Technology Centre, 2011, p. 21).

The Ministry of Information and Communication Technology (ICT) of Thailand has promoted the use of ICT in order to improve the standard of living through national policies "*however, no systematic planning on how to increase the web accessibility and deployment of appropriate assistive technology for the disabled, the poor, and the senior citizen in all the previous government supported strategic planning efforts*" (Punyabukkana, Thanawastien, & Jirachiefpattana, 2008, p. 1). These three documents are critical in highlighting the fact that Thailand as a nation has made a commitment to accessible online services, people with disabilities and the social inclusion of these people into all areas of Thai society, including higher education. The Thai Web Content Accessibility Guidelines (TWCAG) were developed by the ICT Ministry in order to assist web developers improve the accessibility of websites, and moreover, TWCAG is a national guideline which is based on WCAG 2.0 (Office of the Ministry of Information and Communication Technology, 2010). The Electronic Government Agency (EGA) is a Thai government agency which aims to promote e-government development in Thailand. The EGA has determined the

Thai government website standard as following TWAG 2010 since 2012 (Electronic Government Agency, 2012). Most Thai universities are government organisations (Office of the Higher Education Commission 2008) and therefore the university websites would in theory be required to conform to TWAG guidelines as they are extant government agencies. This thesis sought to test these commitments at the service provider level, in this case, through the Thai university system and their web presence.

### 1.3 STATEMENT OF RESEARCH QUESTIONS

The purpose of this research was to explore the relationship between web accessibility of Thai university websites and the attitudes and awareness of staff within those institutions as to the digital needs of students with disabilities. This research was guided by the following primary research question and its supporting questions.

***Primary Research Question: Is Web Accessibility Conformance inherent in Thai university websites?***

According to Thailand Ministry of Foreign Affairs (2011), the Persons with Disabilities Education Act B.E. 2551 (2008) aims for *“persons with disabilities to be able to access education services and other resources at all levels and to improve the Thai educational system to enhance their quality of life and independent living through empowerment”* (para.2). The *Thailand Information and Communication Technology Policy Framework 2011-2020*, the 6<sup>th</sup> strategy of the plan details ‘*Smart Learning*’ which provides learning and training opportunities in a fully online environment so that Thais have equal rights of access to information and services. Ideally, the positive outcome of these laws and policies would support inclusive education and promote accessibility for everyone, not just for people with disabilities. However, Rotatori, Bakken, Burkhardt, Obiakor, and Sharma (2014, p. 690) claimed that:

In Thailand, individuals with disabilities were likely perceived as ‘not able’ and therefore unimportant... In some cases, adults with intellectual disabilities were locked or chained at home to prevent self-injury or harm to others, or were treated in psychiatric hospitals as they were viewed as having mental illnesses.

It seems negative attitudes toward people with disabilities appear to be influenced by Thai cultural attitudes. According to the Thailand National Statistical Office (2012), there were approximately 1.5 million people with disabilities in Thailand (2.2 per cent of the total population) and there were 1,4774,096 people with disabilities who are aged over five year olds, participating in education in 2012. The majority of Thai people with disability were educated to less than primary school level and were defined as not attending school almost 80% of the time, whilst only 1% achieved a bachelor's level degree or higher. Cheausuwantavee (2014) also outlined that a lack of accommodation is still the case for students with disabilities in Thai universities, and the even the government sponsored TCU project, providing e-learning (with over 800 online courses) for Thai students failed to meet the WCAG guidelines at Level A (Kuakiatwong, 2012).

Research by Boondao, Komlayut, and Punnakan (2009) shows that there are five key drivers operating in online courses in Thailand namely, clear policy and planning, adequate financial support, the readiness of team members, building the infrastructure and the evaluation and follow-up procedures. These issues helped inform the primary research question in terms of looking at the Thai university websites and their commonly used components, such as the homepage, contacts page, the library as well the selections of online learning materials.

Whilst the focus of the primary research question is on the actual accessibility compliance of Thai university websites, which can be ascertained using automated and manual techniques, to help place those results in context, a number of supporting questions were developed.

***Supporting Question #1: What level of awareness is there for web accessibility in Thai universities?***

The term web accessibility can mean a number of different things depending upon the audience, their technical experience and their understanding of disability and assistive technologies. In terms of this research, this first supporting question was primarily explored using WCAG 2.0 guidelines as a reference point, in the belief that whilst some of the Thai participants in the study might not have heard the term web accessibility, they might have had some familiarity with WCAG 2.0 as a concept given its notoriety (Sohaib, Hussain, Ismaili, & Bukhari, 2012). Thailand has formulated several policies dealing with web accessibility based on a modified version of WCAG 2.0

(Lund, Lazar, & Wulf, 2011) called the TWAG. Research shows that 42 per cent of WCAG 1.0 training projects and related activities were implemented in the first year of the National Social Equality in ICT master plan Thailand (Punyabukkana, Thanawastien, & Komolsuradej, 2009), however, there was limited existing literature which addresses the adoption of WCAG 2.0 in Thailand, a gap this thesis sought in part to address. To this end the first supporting question focuses on the levels of awareness of WCAG 2.0 in Thai educational institutions focussing on the responses of university stakeholders such as senior managers, lecturers and web administrators. Since the WCAG 2.0 is stated as an essential part of “*Smart Learning*” in the ICT Thailand framework (2011-2020), this question examines whether this 'essential' element is actually being addressed by those responsible for implementing the framework.

***Supporting Question #2: What are the barriers to web accessibility in Thai universities?***

The second supporting question explores the difficulty in applying WCAG 2.0 and other tenets of web accessibility in the Thai university sector. This question examines to what extent WCAG2.0 is at significant risk of not being fully implemented in Thai universities and the reasons for it not being fully implemented. Research indicated that a lack of training and awareness on the part of people working with this technology could be key factors limiting its effective implementation, and thus informed the types of data collected against this supporting question.

There are three different stakeholder groups who play important roles in making web accessibility a possibility in Thai universities, namely, students, instructors and educational institutions (Wagner, Hassanein, & Head, 2008). This research aims to explore the issues associated with the instructors and educational institution stakeholder sets. Abou-Zahra and Henry (2010) maintain that there are three obstacles to improving web accessibility, including limitations on accessing the Internet, lack of language support in the protocols, formats and applications, and lack of policy and implementation of web accessibility standards. Inadequate ICT in developing countries can also be an issue. Most Thai universities use a leased line with 2 Mbps to offer online services, however a national survey conducted by the National Statistical Office reported that the use of computers and the internet in Thailand is rather low, the ratio of computers to schools was four to one in addition, the ratio of computers to students was one to 61 (National Electronics and Computer Technology Center, National Science and Technology

Development Agency, & Technology, 2011). This means staff and students may be limited by a lack of equipment for accessibility implementation, even though Thai educational institutions supposedly provide high speed internet services within their organization.

Successfully migrating websites from WCAG 1.0 to WCAG 2.0 depends on the personal experience of developers (World Wide Web Consortium, 2009), and a lack of knowledge and awareness can be a significant barrier to accessibility uptake and implementation. These and other possible barriers were explored via surveys and interviews with Thai university staff and their awareness of both web accessibility as a concept and WCAG 2.0 as a specific entity.

***Supporting Question #3: What drivers exist for web accessibility within Thai universities?***

The final supporting question aimed to discover what, if any, drivers existed to advance the adoption of WCAG principles and web accessibility practice in Thai universities. According to the Preamble of the Convention on the Rights of Persons with Disabilities states that *“the importance of accessibility to the physical, social, economic and cultural environment, to health and education and to information and communication, in enabling persons with disabilities to fully enjoy all human rights and fundamental freedoms”* (para. 1). Thailand’s ICT Policy Framework also clarified that:

Encourage the creation and application of innovation and digital content for learning at all levels, including informal education...The creation of content, database, online content which promotes lifelong learning, the development of school websites and other digital content should follow the web accessibility standard (p. 23).

These statements would seem to indicate that the national and international level there are indeed reasons for the adoption of accessibility practice in Thailand, and thus this supporting question sought to identify if these or other drivers were prevalent in Thai universities. One of those drivers to be explored was that of the social benefit of web accessibility, expressed via the concept of corporate social responsibility (CSR) . Corporate social responsibility has shifted from ideology to reality, and organizations are required to determine their roles in society and the ethical standards of their policies (Bhattacharya & Sen, 2004; Lindgreen & Swaen, 2010). Baker, cited in Frank



(2008) contends that the stakeholder theory of corporate social responsibility is broadly a set of social responsibilities for business and stakeholders such as consumers, government and organizations to follow. Companies are committed to operate CSR not only not only to favour stakeholder attitudes and advance support but also improve corporate image, make strong stakeholder–company relationships, and develop stakeholders’ advocacy. However stakeholders can have a low awareness of companies’ CSR activities, such as staff adhering to university policy, or universities adhering to government policies, clearly raising the issue for improved communication between organisations and stake holders (Du, Bhattacharya, & Sen, 2010). Organizations have to not only design and deliver the information in their web sites in terms of usability and accessibility for users but also raise awareness across and within organizations of the importance of accessibility issues.

#### 1.4 STRUCTURE OF THE THESIS

This research study is divided into the following seven chapters:

**Chapter 1** justifies the significance of the research topic by demonstrating the potential benefit of online learning and web accessibility for all students in Thai universities, including students with disabilities, by outlining the issues that appear to exist with Thai e-learning and general online resources. This chapter posits that Thai language and government policies are likely to be significant factors in the implementation and adoption of web accessibility in Thai universities.

**Chapter 2** surveys the literature regarding the research problem and identifies three key issues relevant to web accessibility in Thai universities, namely web accessibility, online learning and, and the Thai learning environment. Literature regard web accessibility standards, the history and features of e-learning, international policies on accessibility and the Thai policy environment are all examined in detail.

**Chapter 3** provides a description of the theoretical underpinnings of mixed method approach employed in this research study. The data collection involved three tools: web evaluation, staff surveys and staff interview. The chapter discusses how these methods and techniques were applied and the technical tools used alongside them.

**Chapter 4** analyses the data derived from the web evaluation. The errors found on the university webpages across the POUR principles of WCAG 2.0 guideline were used to elucidate the significance of the levels of accessibility of Thai university websites.

**Chapter 5** analyses the data derived from the Thai university staff surveys and follow-up interviews. The analysis refers to the research questions and the responses of the participants. The impact of Thai accessibility laws and policies, the attitude of participants towards students with disabilities and web accessibility were also included in the interview questions and analysis.

**Chapter 6** discusses and summarises the research investigation. Key findings are discussed in detail, especially those centred on the lack of accessibility knowledge, policy issues and mixed attitudes of Thai university staff towards accessibility and disability.

**Chapter 7** provides two proposed models for Thai universities to achieve website accessibility compliance namely, the Smart Thailand : Accessible Learning model for web accessibility adoption in Thai universities and its associated Implementation Framework.

## 1.5 ACRONYMS FREQUENTLY USED

Assoc. Prof.: Associate Professor

Asst. Prof.: Assistant Professor

AT: Assistive Technology

ATAG: Authoring Tool Accessibility Guidelines

B.E.: Buddhist Era

CSR: Corporate Social Responsibility

CSS: Cascading Style Sheets

E-learning: Electronic learning

EQA: External Quality Assurance

Exp. Yrs: Experience Years

EU: European Union

HTML: Hyper Text Markup Language

ICT: Information and Communication Technology

IQA: Internal Quality Assurance

LMS: Learning Management System

MS: Microsoft

OHEC: Office of the Higher Education Commission

ONESQA: Office for National Education Standards and Quality Assessment

QA: Quality Assurance

PDF: Portable Document Format

TCU: Thai Cyber University

UAAG: User Agent Accessibility Guidelines

U.K.: United Kingdom

UN: United Nations

UNESCO: United Nations Educational Scientific and Cultural Organisation

U.S.: United States of America

WAI: Web Accessibility Initiative

WCAG: Web Content Accessibility Guidelines

WWW: World Wide Web

W3C: World Wide Web Consortium

YRS: years

## 2 REVIEW OF THE LITERATURE

The literature available in the field of web accessibility is both broad and varied. This review will examine the broader contexts of web accessibility, e-learning principles and methods and accessibility policy and law. Some discussion of discussion of web standards and testing methodologies will be explored, as will people with special needs and assistive technologies. Finally, a review of literature examining the learning environments in Thailand and current accessibility practice in Thai universities will be presented.

### 2.1 WEB ACCESSIBILITY

This initial section of the literature review will examine issues around accessibility policy, standards, technologies, testing methods and perceived challenges to international adoption of web accessibility goals.

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#### 2.1.1 THE INTERNATIONAL ACCESSIBILITY POLICY

According to Article 25 of the Universal Declaration of Human Rights, a person has "*the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control*" (United Nations, 1948 , para.3), and therefore it is a requirement for all signatories of the Declaration to implement activities and programs to ensure that there is no discrimination against people with disabilities. The Global Initiative for Inclusive Information and Communication Technologies (G3ict) (2013, p. 6) indicate that the principle of equal access is significant in the many articles of the UN Convention on the Rights of Persons with Disabilities (CRPD) such as Article 21 (Access to Information), Article 24 (Inclusive Education) and, Article 29 (Voting Procedures via electronic kiosks) as The Global Initiative for Inclusive Information and Communication Technologies (2013, Figure 2-1) shows below.

Application Areas	CRPD Article	Accessibility Dispositions with Implications for ICTs	Reasonable Accommodation	Promoting Assistive Technologies
Non- discrimination	5		Y	
E-Government	9.2.a	Y		
Media and Internet	9.1,	Y		
Television	30.1.b	Y		
Private Sector Services	9.2.b	Y		
Liberty and Security	14		Y	
Living Independently	19			Y
Education	24	Y	Y	Y
Employment	27	Y	Y	
Political Rights	21, 29	Y		Y
Emergency Services	9.1.b, 11	Y		
Culture and Leisure	30.5.c	Y		
Personal Mobility	20			Y
Rehabilitation	2			Y

Figure 2-1 : Researcher's summary of the CRPD specifics of accessibility

The G3ict (2013, Figure 2-2) demonstrated that the mix of responsibilities vary among stakeholders contributing to the development of ICT accessibility across a range of activities and that policy addressing ICT accessibility would be specific rather than generic. In the context of this thesis, it is interesting to note that governments are seen as primarily (80%) responsible for driving the accessibility of educational ICT.

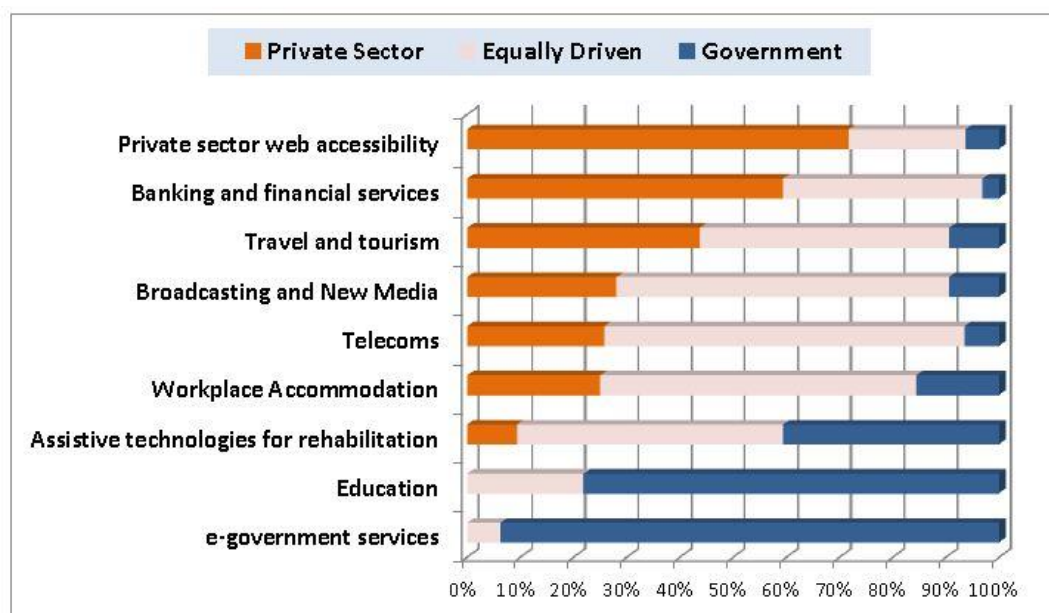
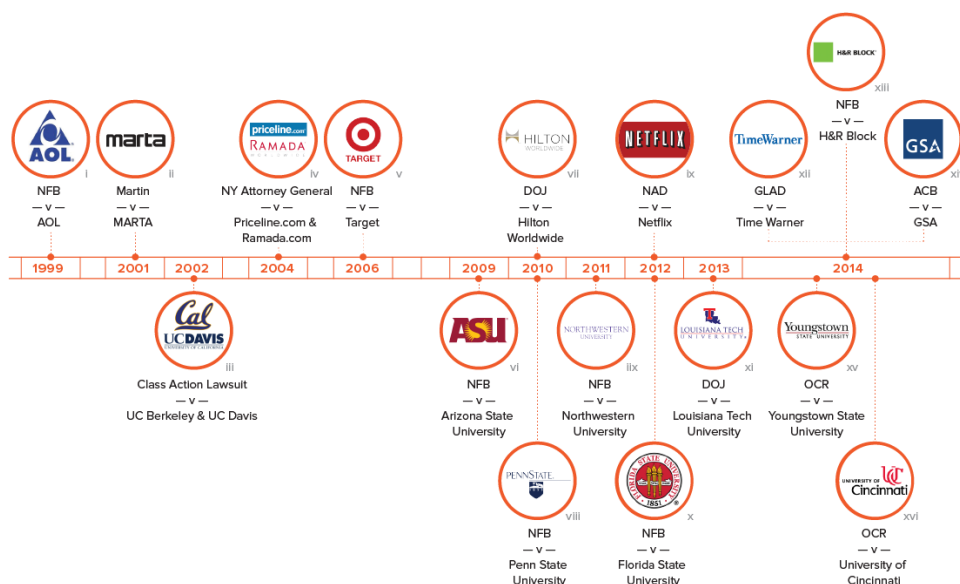


Figure 2-2: The mix of responsibilities for developing ICT Accessibility

Internationally, the impact of accessibility and its uptake has taken shape in a number of forms such as legislation, policies and frameworks (Centre for Internet Society & Global Initiative for Inclusive Information and Communication Technologies, 2012). In Australia, the case study of Bruce Maguire who sued the Sydney Organising Committee of the Olympic Games (SOCOG) over inaccessibility on its website provoked Australian organisations to pay closer attention to the importance of accessibility of their web pages (Australian Human Rights Commission, n.d.). SOCOG was fined and reprimanded and an outcome which put web accessibility on the map as an issue for corporate and government bodies. It could be argued that the SOCOG ruling went some way to the requirement that all government bodies in Australia must provide accessible web content to ensure people with disability cannot be refused services (Ellis, 2012). In June 2010, the Australian Government introduced the Web Accessibility National Transition Strategy (NTS) which outlined a strategy and plan for implementation of the Web Content Accessibility Guidelines (WCAG 2.0) Level A by 31 December 2012 and Level AA by 31 December 2014 across all government websites (Australian Government Information Management Office, 2010b). In fact, Australia has generic legislation in terms of the *Disability Discrimination Act 1992* (DDA) which covers all divisions of Australian's organisations (Stancliffe, 2012). Accessibility of all Australian websites is also governed by the Australian Human Rights Commission and the latest version of their *Advisory Notes, Version 4.0* was published in October 2010 (Australian Human Rights Commission, 2010a). The *Advisory Notes* reinforce the *NTS*, but also advise all non-government website holders of the requirement to ensure compliance to WCAG 2.0. New non-government websites must adhere to WCAG 2.0 (level AA), and existing website owners had until December 31, 2013 to comply with this same level (Australian Human Rights Commission, 2010c).

The United States has changed accessibility rules since the *Americans with Disabilities Act* (ADA) was declared in 1990, which has affected requirements for the development of federal websites. The ADA also guarantees equal opportunity for individuals with disabilities in public accommodations, employment, transportation, state and local government services, and telecommunications (United States : Department of Labor, n.d.). Title I of the ADA deals with the same employment opportunities of people with disabilities, for example, the ADA requires "*employers with fifteen (15) or more employees to provide qualified individuals with disabilities an equal opportunity to benefit from the full range of employment-related opportunities available to others*" (United States Department of Justice,

2009, para. 2). However, there are differences in the details regarding employment rights for people with disabilities for each state. For example, *“the California Fair Employment and Housing Act (FEHA) prohibits discrimination against any person with a physical or mental disability by employers with five (5) or more employees”* (Disability Rights California, 2010, para. 60). This means if a business, which is located in California state, has 5 employees or more, it is then a business that has to comply with the FEHA, although nationally the ADA identifies a business with 15 employees as needing to meet such requirements. As far as the ADA and other laws are concerned, all of them aim to protect and provide employees with equal opportunity to participate in employment. The United States : Bureau of labor statistics (2013, p. 2) reported that American workers with a disability who were employed in federal, state or local government was at 15% compared to workers with no disabilities at 14% in 2013, though a majority of people with disabilities who were employed were not in management or senior roles. Moreover, workers who had higher levels of education were more likely to be employed than those with less education. Clearly, providing equality of employment, education and accessing information on websites can make life better for Americans with disabilities. Subsequently the United States (U.S.) signed the protocol of the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) on 30 July 2009 (Kovacs Burns & Gordon, 2010). The notable act for accessibility of information and communication technology (ICT) content in the U.S. is the Section 508 standards in the *Rehabilitation Act 1973* (United States Department of Commerce, 2011). The Section 508 standards refer to all information technology (IT) products and activities in federal departments and agencies as having to meet accessibility standards for all users. Additionally businesses that supply IT goods and services for government have to comply with the act, requiring most large organisations in the U.S. to incorporate the recommendations of the Section 508 standards into their products if they wish to do business with government agencies. This requires that web accessibility issues must also be addressed by websites in the U.S. The number of lawsuits and settlements related to web accessibility grew in the United States as shown in Figure 2-3 (AudioEye Inc., n.d. , Figure 2-3).



**Figure 2-3: The lawsuits and settlements related to web accessibility in the United States**

Under the Section 508 (1194.22) requirements: Web-based Intranet and Internet Information and Applications, “The criteria for web-based technology and information are based on access guidelines developed by the Web Accessibility Initiative of the World Wide Web Consortium” (United States General Services Administration, n.d. , para 5). There is a relationship between the Section 508 standards and the Web Content Accessibility Guidelines (WCAG) 1.0 as outlined in Table 2-1 (United States Access Board, 2000 , Table 2-1). However, IBM (n.d.) pointed out that the WCAG guidelines are merely recommendation however, the Section 508 is a law that requires all U.S. federal government agencies to ensure that their websites meet the Section 508 requirements.

**Table 2-1: The relationship between the Section 508 and the WCAG 1.0**

Section 1194.22 Paragraph	WCAG 1.0 Checkpoint
(a)	1.1
(b)	1.4
(c)	2.1
(d)	6.1
(e)	1.2
(f)	9.1
(g)	5.1
(h)	5.2
(i)	12.1
(j)	7.1
(k)	11.4



Among Asian countries, the Hong Kong government provides a number of laws and policies which support web accessibility and the WCAG 2.0 guidelines. The Hong Kong government also provides a Web Accessibility Handbook in order to assist web developers and others to develop accessible web content for people with disabilities (Hong Kong the Government Chief Information Officer, 2012). The handbook is based on WCAG 2.0 and provides web accessibility definitions, accessibility guidelines, and techniques with illustrated examples. Likewise, the Korean government enacted the *Digital Divide Act* and implemented the *Master Plan for Closing the Digital Divide (2001-2005)* which is based on a social determinants approach to support the development of online information in Korea (Kock & Gale, 2009). With respect the ICT master plan, the Korean government developed web accessibility evaluation tools and Korean Web Content Accessibility Guidelines 2.1 which is based on WCAG 2.0 (Hyun, Moon, & Hong, 2008; Telecommunications Technology Association, n.d.).

The above represent some of the more notable web accessibility work being undertaken at the international level, from Australia, the U.S. and through Asia, where laws and policies have been developed to promote greater accessibility of online information. A lack of legislative and regulatory frameworks for accessibility, training and limited knowledge is barriers in developing web accessibility in Greece when considered against many other European countries that do have policies in place (Basdekis, Klironomos, Metaxas, & Stephanidis, 2010). Centre for Internet Society and Global Initiative for Inclusive Information and Communication Technologies (2012, p. 55) reported that Portugal had both a weak policy framework and a limited scope of accessibility responsibility, whilst the United States, Korea, Germany, and Italy had both highly comprehensive and legally enforceable web accessibility regimes (Centre for Internet Society and Global Initiative for Inclusive Information and Communication Technologies, 2012, Figure 2-4).

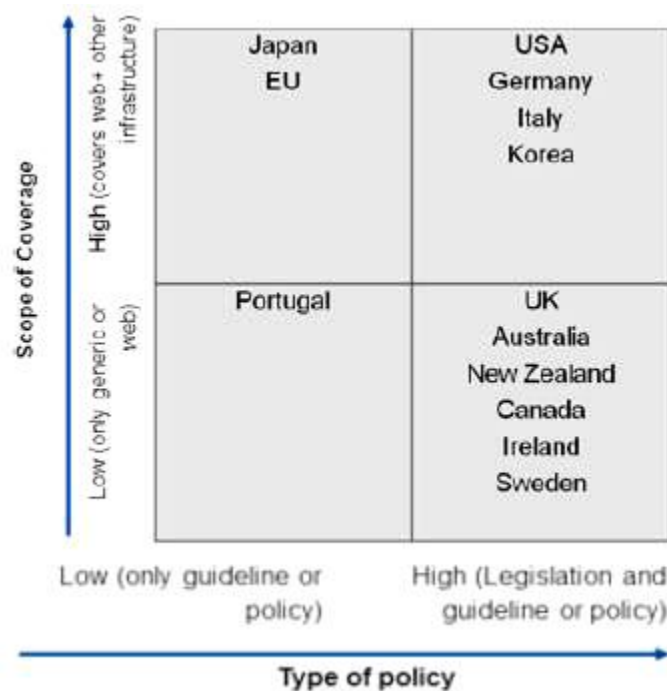


Figure 2-4 : The international accessibility policy in thirteen countries

In particular, many countries adopted the WCAG guidelines as a bench mark for determining web accessibility requirements for websites managed within their national borders (Centre for Internet Society & Global Initiative for Inclusive Information and Communication Technologies, 2012, Table 2-2). However, there are countries which have not adopted the WCAG guidelines, such as Cambodia and China. The Handicap International France (2008, p. 21) reported that *“there is no specific law or standard in Cambodia concerning accessibility, several existing draft versions are mentioning it more or less deeply”* even though the Cambodian National Assembly decided to ratify the United Nations Convention on the Rights of Persons with Disabilities (UNCRPD) in 2012 (United Nations, 2012). Walle (n.d.) also acknowledges that there are challenges in education for people with disabilities in Cambodia, such as a lack of policy. Clearly, Cambodia has issues with accessibility and therefore it is not surprising why Cambodia has not yet adopted and implemented WCAG guidelines and any other standards, though in part this may be due to WCAG resources not being available in the Khmer language. A similar situation appears in China, where Sloan and Horton (2014) noted that the Chinese government modified the *Law on Protection of Disabled People* in 2008, however there was no evidence found of a national standard for web accessibility in early 2013, although the Chinese government provided Standard GB/T 29799-2013: Guidelines for Web Content Accessibility in December 2013 (Zheng, 2013). It is more likely that many governments have promoted campaigning for web

accessibility through the WCAG guidelines, as shown in Table 2-2. This table summarises the content of the Centre for Internet & Society's *Global Initiative for Inclusive Information and Communications Technology* (2012) report, which indicates that whilst a number of countries have developed mature accessibility policy and legislative frameworks, WCAG 1.0 still seems to play a primary role seven years after it was replaced with WCAG 2.0.

**Table 2-2 : Summary of adoption of WCAG in government policy across 14 countries and the EU**

Countries	Compliance with WCAG
Australia	Australian government departments and agencies are required to adopt the WCAG.
Canada	The CLF standards are aligned with the WCAG. They emphasise adapting to Priority 1 and 2 of WCAG 1.0 (double A conformance level).
Germany	The BITV has two priorities and 14 standards, all of which are based on the WCAG 1.0 Guidelines.
Ireland	The document <i>New Connections - A Strategy to realize the potential of the Information Society</i> recommended the adoption of WAI Level II Guidelines. The Code of Practice also directs public bodies to aim at achieving "Double-A level conformance with the Web Accessibility Initiative's (WAI) Web Content Accessibility Guidelines". The National Disability Authority has published national guidelines on accessibility of IT products and services. In the specific case of web accessibility, they essentially adopted or incorporated W3C WCAG 1.0 without substantive changes. The guidelines, based on WCAG 1.0, were provided to help make websites easy to understand and use.
Italy	Compliant with WCAG 1.0.
Japan	Not wholly compliant, but some guidelines have been borrowed from the WCAG.
South Korea	South Korea's national standard of web accessibility guidelines is based on the reference guidelines: Section 508 .H1194.22, WCAG 1.0 & WCAG 2.0 Draft Version.
New Zealand	The New Zealand Government Web Standards are fully based on WCAG (version not specified).
Philippines	The NCDA and NCC-CICT has begun formulating an official set of Philippine Web Accessibility Design Recommendations. In terms of compliance with WCAG, the final standards are expected to be only partially compliant.
Portugal	The Portuguese law does not mention the WCAG explicitly but there is broad reference to the general guidelines of the WCAG in the resolution.
Sweden	The Guidelines draw heavily from WCAG 1.0, and are almost completely compliant with them (only three guidelines are not included).
Thailand	The Th-WCAG is partially compliant with WCAG 1.0.
United Kingdom	Not wholly compliant, however the BS 8878:2010 refers to the WCAG.
United States	Not wholly compliant, certain basic components of the WCAG are not covered by section 508.
European Union	The plan fully complies with the WCAG 1.0 Guidelines but has not yet been implemented.

Centre for Internet Society and Global Initiative for Inclusive Information and Communication Technologies (2012, p. 56) also pointed out that:

Countries whose local languages are alphabet based or that use English as the official medium may leverage the WCAG for their accessibility policy. Additional accessibility

measures should, however, be considered to accommodate regional languages.

Depending upon the penetration of ICT in the country, policy makers can assess the

need to adopt a modified version of the WCAG, as have Thailand and the Philippines.

The last sentence of this quote is concerning in that the number of countries currently making the investment in effort necessary to create a regional version of the WCAG is extremely small. As the later chapters of this thesis will reveal, even having a direct translation of the WCAG 2.0 guidelines is not sufficient in itself to drive accessibility uptake without a range of supporting materials to provide context.

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### 2.1.2 W3C STANDARD

This section of the literature review examines the general concepts of web accessibility and the standards and guidelines that have evolved to address the issue. The World Wide Web Consortium (W3C) provides the Web Accessibility Initiative (WAI), accessibility guidelines and other techniques to help developers produce websites for people with disabilities (World Wide Web Consortium, 2008a). The Web Content Accessibility Guidelines (WCAG) addresses how accessible web content is designed and delivered, and has seen two versions, WCAG 1.0 and WCAG 2.0. WCAG 1.0 introduced fourteen principles with sixty-five checkpoints, with each checkpoint having three priorities regarding how to determine the level of accessibility on a webpage (1, 2 and 3) (L. Moreno, Martinez, & Ruiz-Mezcua, 2008). Whilst WCAG 1.0 represented a good first attempt at addressing the issues of equitable access to online materials for all web users, it did have a number of issues, including technology reliance and difficulties with checkpoint testability (Aizpurua, Arrue, Vigo, & Abascal, 2011; Hend, 2012; Ribera et al., 2009a; Rømen & Svanæs, 2012). Subsequently WCAG 1.0 was replaced with WCAG 2.0 in 2008, with the new version focussing on the perceivable, operable, understandable and robust principles (POUR principles), with WCAG 2.0 not relying on specific technologies and user agents as did WCAG 1.0 (Aizpurua et al., 2011; Caldwell, Cooper, Reid, & Vanderheiden, 2008; Hend, 2012; Ribera et al., 2009a; Rømen & Svanæs, 2012). The 'Perceivable' principle within WCAG 2.0 means that items of web content that are perceived by the user (media, controls and visual formatting), whilst 'Operable' refers to the user interface elements and navigation components which should be designed in a way that work properly with assistive technologies, and in particular, keyboard devices. 'Understandable' refers to the design of the website, so that the content, the location of the user and error

identification/prevention are always apparent to all categories of users. Finally, the ‘Robust’ principle ensures that web content and the ability to interact with said content does not fall into the WCAG 1.0 trap of becoming technology dependent, and is rather, technology agnostic. As Gaigg’s (2008) Figure 2-5 illustrates, each of the WCAG 2.0 principles have a number of guidelines, which in turn have a number of testable success criteria, with compliance at each level being dependent on the compliance of the level below. In other words, in order for a site to meet all Level AA success criteria, all success criteria for Level A must first be met. In a majority of the documents examined in this literature review and through the entire thesis, Level AA appears to be the standard to which most governments and organisations wish to be held, as the stringent requirements of Level AAA are considered by most to be a ‘bridge too far’.

Principles	Guidelines	Level A	Level AA	Level AAA
1. Perceivable	1.1 Text Alternatives	1.1.1		
	1.2 Time-based Media	1.2.1–1.2.3	1.2.4–1.2.5	1.2.6–1.2.9
	1.3 Adaptable	1.3.1–1.3.3		
	1.4 Distinguishable	1.4.1–1.4.2	1.4.3–1.4.5	1.4.6–1.4.9
2. Operable	2.1 Keyboard Accessible	2.1.1–2.1.2		2.1.3
	2.2 Enough Time	2.2.1–2.2.2		2.2.3–2.2.5
	2.3 Seizures	2.3.1		2.3.2
	2.4 Navigable	2.4.1–2.4.4	2.4.5–2.4.7	2.4.8–2.4.10
3. Understandable	3.1 Readable	3.1.1	3.1.2	3.1.3–3.1.6
	3.2 Predictable	3.2.1–3.2.2	3.2.3–3.2.4	3.2.5
	3.3 Input Assistance	3.3.1–3.3.2	3.3.3–3.3.4	3.3.5–3.3.6
4. Robust	4.1 Compatible	4.1.1–4.1.2		

Figure 2-5: The four POUR principles of the WCAG 2.0 guidelines

The Authoring Tool Accessibility Guidelines (ATAG) are design in some ways to be a compliment to WCAG 2.0, in that ATAG aims to identify how authoring tools should further allow web developers to create accessible content in websites with regard to WCAG standards. Authoring tools that are ATAG compliant should allow users with disabilities to actually use the authoring environment, whilst at the same time automatically adding accessibility components to the content being created in the system (Li, Yen, Lu, & Lin, 2012; World Wide Web Consortium, 2005a). The Authoring Tool Accessibility Guidelines (ATAG) 2.0 are divided into two parts: *Part A: Make the authoring tool user interface accessible* and *Part B: Support the production of accessible content* (World Wide Web

Consortium, 2015). There is a strong relationship in POUR principles between WCAG 2.0 and ATAG 2.0. For example, the ATAG 2.0 (Part A) shows:

*Principle A.1: Authoring tool user interfaces must follow applicable accessibility guidelines*

*Principle A.2: Editing views must be perceivable*

*Principle A.3: Editing views must be operable*

*Principle A.4: Editing views must be understandable* (World Wide Web Consortium, 2015, para. 2).

As stated above, three out of four principles of WCAG 2.0: *Perceivable*, *Operable*, *Understandable* are applied in ATAG 2.0. However, some researchers claimed that authoring tools such as Adobe InDesign and MS Word are insufficient to produce accessible sites and content, with for example, MS Word not warning developers if there is inadequate contrast ratios between text and background, ignoring cases where there is no alternative text for a picture (Darvishy, Hutter, Horvath, & Dorigo, 2010a). Of course, as the environments themselves are continually developed (such as MS Office and the various Adobe suite of products) and ATAG 2.0 eventually becomes the new recognised yardstick for author tools accessibility, the accessibility outcomes of such tools should continue to show improvement. The User Agent Accessibility Guidelines (UAAG) promotes the development of accessible user agents (such as web browsers), with UAAG 2.0 being in a working draft which is based on the five principles of perceivable, operable, understandable, programmatic access, and specifications and conventions for websites to be accessible to all users (James, Kelly, & Jaeanne, 2011), with HTML5 being an example of a user agent technology which encourages some UAAG 2.0 features (Gonzalez-Garc, Moreno, & Martnez, 2014; L. Moreno, Martínez, Iglesias, & Gonzalez, 2011). For example, HTML5 presents a new embedded media player controls for the developer to create a command button for users to control media on websites by using keyboard shortcuts (Baker, 2014; Riley-Huff, 2012). When viewed holistically, various standards and guidelines are designed to promote the continual development of accessible tools and interfaces so as to aid content providers in achieving accessibility, if not by default, then at least with assistance.

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### 2.1.3 ACCESSIBILITY TECHNOLOGIES

Assistive technology helps people with disabilities to live independently, perform tasks, play a part in community activities, and improve employment prospects (Kaye, Yeager, & Reed, 2008). Screen readers provide an interface

for presenting information in synthesised speech or in Braille, and secondly, whilst screen magnifiers present enlarged portions of screen content for users who have partial visual impairment. Most operating systems and mobile devices now have a number of accessibility features built-in, including screen readers, magnifiers, sticky keys and high contrast settings. There are a number of free and open source software applications for screen readers which run on Mac OS and Linux systems (Pal, Pradhan, Shah, & Babu, 2011). In terms of screen readers, amongst the most popular (outside of the commercial Jaws product) is NonVisual Desktop Access (NVDA) which runs on Windows. A survey by WebAIM (2014 , para. 2) shows that the most frequently used of primary screen readers is JAWS (50%), followed by NVDA (18.6%) and VoiceOver (10.3%) (WebAIM, 2014, Figure 2-6). Even though many operating systems such as Microsoft Windows, Apple's OS X, and Linux offer built-in accessibility features, many users prefer to use specialised screen readers (for example, JAWS, NVDA, SuperNova and Windows-Eye) and magnification software (such as MAGic and ZoomText) rather than the built-in applications (Ramakrishnan, Mahmud, Borodin, Islam, & Ahmed, 2009).

<b>Screen Reader</b>	<b># of Respondents</b>	<b>% of Respondents</b>
JAWS	721	50.0%
Window-Eyes	97	6.7%
VoiceOver	149	10.3%
NVDA	268	18.6%
System Access or System Access To Go	111	7.7%
ZoomText	19	1.3%
ChromeVox	6	0.4%
Other	70	4.9%

Figure 2-6: Screen reader usage

Blackboard Learn v9.1 provides a learning management system (LMS) that includes collaborate assistive technology, virtual classrooms and accessible multimedia controls (Blackboard Inc., 2012). Blackboard Learn also measures accessibility levels by using two standards: WCAG and Section 508, to ensure Blackboard meets the needs of the wide range of students with disabilities. However, as with most of these tools, whilst they may come

with accessibility features built into the program, that does not stop developers and educators from using them in inaccessible ways.

The World Wide Web Consortium (2005b, Figure 2-7) explains the interaction between content developers and content consumers (or users) as:

Web developers usually use authoring tools and evaluation tools to create Web content.

People ('users') use Web browsers, media players, assistive technologies, or other 'user agents' to get and interact with the content.

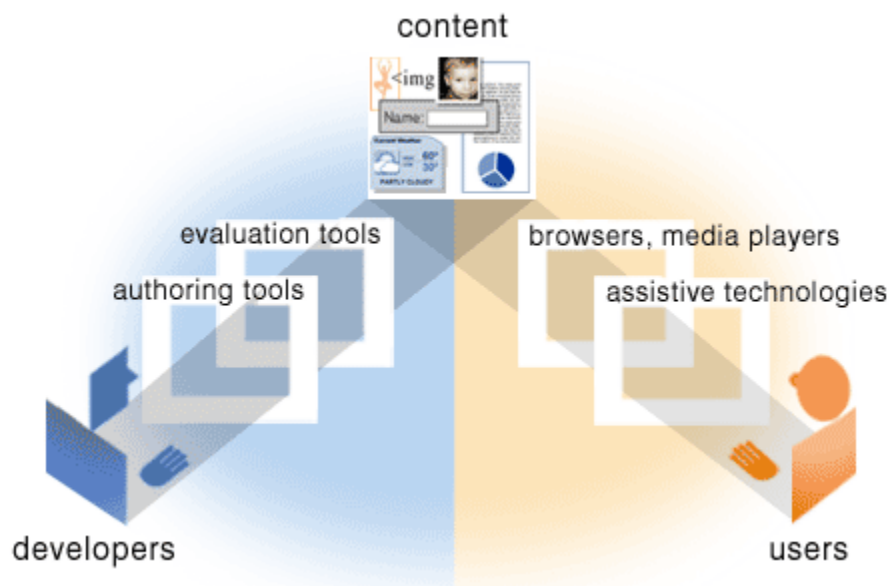


Figure 2-7 : Components of Web Accessibility

As Figure 2-7 illustrates an alignment should exist between web developers and the tools and methods they use to create websites and site content with the tools that users routinely use to interact to with those sites and content. The authoring tools should be WCAG aware so that sites and content are implemented in a manner that will allow different users with different disabilities to access that content with the particularly assistive technology they utilised. Assistive technologies need to be able to interact with user agents such as web browsers and media players, and ideally the developers should be aware of the real world functionality of assistive technologies and what elements of the accessibility guidelines apply to which types of assistive technologies. Evaluation tools



should be able to test authored content against a number of standards, included valid HTML, CSS and obviously, WCAG 2.0. Essentially, accessibility is never an individual activity, as it requires corporate and government level buy in to ensure that developers use appropriate tools and techniques in order to support the requirements of the broadest possible base of end users.

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#### 2.1.4 ACCESSIBILITY TESTING AND EVALUATION

There are a number of methods to evaluate the level of accessibility of websites that lead to different results. Hassanzadeh and Navidi's (2010) Figure 2-8 shows a general diagram for evaluating web accessibility by classification of method into two groups: user experiences testing and technical testing.

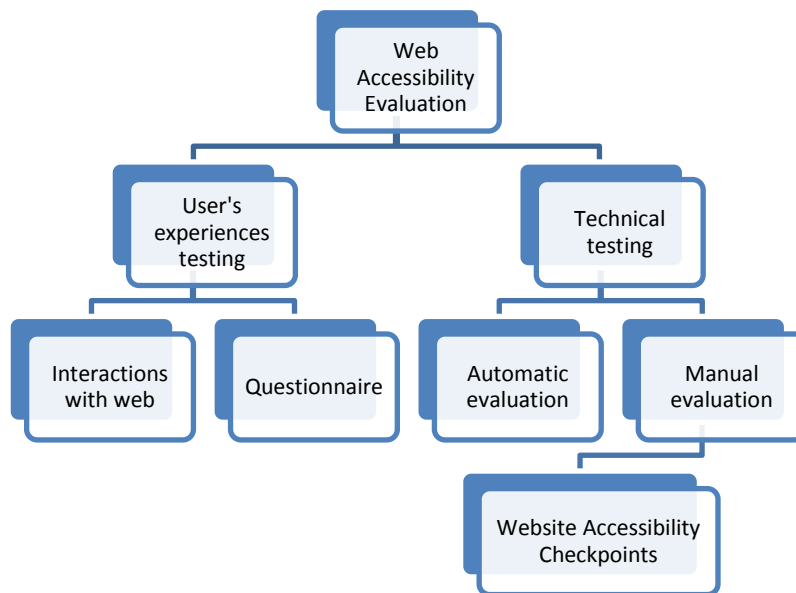


Figure 2-8: Accessibility evaluation

Ideally, any tools used for web accessibility evaluation should aim to identify the accessibility level of a website against an accepted set of guidelines. Testing tools and methods can each have their own advantages and disadvantages thus, most researchers agree that the evaluation should not rely on specific or single tool/method but rather the integration between human and software testing (Salomoni, Mirri, Muratori, & Battistelli, 2012; Vigo, Brown, & Conway, 2013).

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#### 2.1.4.1 AUTOMATED TESTING

According to McLellan (2011), automated testing tools are excellent to identify missing elements used in the context of accessibility, as such tools can test entire sites in relatively short periods of time. Automated tools are particularly strong at picking up technical issues, such as missing ALT tags on images, validation of HTML documents, incorrect use of structure (ie headings) and colour contrast issues (on text). Automated tools, whilst useful for large scale site diagnostics, are not definite in terms of their ability to identify all issues of web accessibility and usability, and are known to report both false positive and false negatives. A false positive is where an issue is report as a violation of guidelines, but in fact is not, such as a lack of ALT attributes being reported in what might be a purely decorative image. Conversely, a false negative is an accessibility issue which does exist, but is not identified, such as tools not picking up 'read more' style link descriptions. Effective analysis of sites via automated tools requires developers to use a number of such tools whilst also understanding the strengths and weakness of those tools across the POUR principles (Babu, 2011; Molinero, 2004; Vigo et al., 2013). Some of the tools available at the time of this research included WAVE by WebAim (a page at a time visual reporting tool), SortSite by Poweremapper Software, Deque's cloud based accessibility checking solutions and Acrobat XI Pro by Adobe (for documents rather than websites) (World Wide Web Consortium, 2014c). Web browser plugins and extensions are alternative tools for checking website accessibility, with a variety of such tools being available across a number of operating systems (McHale, 2011). For example, the Web Accessibility Toolbar (WAT) is a free application and compatible which plugs into Microsoft's Internet Explorer and allows both users and developers to load and test websites for WCAG 2.0 compliance, check colour contrast on images, switch off style sheets and check page structures (Jun, Faulkner, Atkinson, & Novak, 2012). In terms of web accessibility evaluation tools, there are many free web-based evaluations tools, such as TAW and AChecker, along with WAVE (Web Accessibility Evaluation Tool) which evaluates cognitive web accessibility by entering website addresses, uploading files and checking HTML code, it provides recommendations on how to fix errors but it tests web content rather than offers complex technical reports (WebAIM, 2012). Third party application providers such as IBM, Microsoft and Adobe are also supporting their products by offering test tools to ensure developers build accessible documents. For example, Adobe XI Pro software provides accessibility checking tools for addressing accessibility issues on the

webpage and also including the feature for developing and testing accessible PDF files (Adobe Systems Incorporated, 2011). Perhaps the most notable differences between ‘free’ accessibility checking tools and those defined as being commercial is that the free tools typically only check one page at a time, whilst paid for solutions offer site wide assessments, detailed reports and management consoles. The temptation for web developers and site owners is to rely exclusively on such tools and not include manual and user testing techniques, which provide far greater human usability indicators for a websites accessibility, but at the cost of the speed and convenience afforded by automated tools (Benjamin, 2010; Cooper, Sloan, Kelly, & Lewthwaite, 2012; Schiavone & Paternò, 2015).

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#### 2.1.4.2 MANUAL EVALUATION

According to de Souza & Mont'Alvão (2012), the accessibility level of requires human inspection for a more effective evaluation beyond what automated tools can deliver. The World Wide Web Consortium (2008e) states that:

Users of this methodology are assumed to have solid understanding of how to evaluate web content using WCAG 2.0, accessible web design, assistive technologies, and of how people with different disabilities use the Web. This includes an understanding of web technologies; accessibility barriers that people with disabilities experience; assistive technologies and adaptive approaches that people with disabilities use; and evaluation techniques, tools, and methods to identify barriers for people with disabilities. In particular, it is assumed that users of this methodology are deeply familiar with all the resources listed in Background Reading (para. 6).

This statement goes some way to highlighting the why some developers may wish to use automated tools for web accessibility testing, as manual techniques imply a requirement for significant levels of knowledge and expertise in web technologies, accessibility guidelines and the manner by which people with disabilities access the web. The World Wide Web Consortium (2007 , para. 1) also outlined in the “*Requirements for WCAG 2.0 Checklists and Techniques*” that there is a reliable human testing method if the method can be evaluated by human inspection and it is believed that at least 80% of human auditors would agree on the finding. Therefore, evaluating web

accessibility can occur by human judgment as long as there is some level of agreement as to the expertise of those judges. There are two categories for manual accessibility evaluation, namely user and expert testing.

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#### 2.1.4.3 EXPERT TESTING

According to the World Wide Web Consortium (2002) *“Comprehensive and effective evaluations require evaluators with an understanding of Web technologies, evaluation tools, barriers that people with disabilities experience, assistive technologies and approaches that people with disabilities use, and accessibility guidelines and techniques”* (para. 2). Law & McKay noted that (2007) traditional evaluation for accessibility focuses on user-centered based guidelines, however some evidence argues that it is necessary to include developers and programmers in the accessibility evaluation process because programmers are essentially the people who develop code for websites. If they lack understanding of accessibility concepts, they will not assess and rectify issues at the point of development (Law, Jacko, & Edwards, 2005; Law & McKay, 2007). Yesilada, Brajnik & Harper (2009) found that the quality of accessibility evaluation depends on the actual number of people who are considered ‘experts’, and furthermore, expert evaluation provides significantly greater benefit than non-expert evaluation, such as spending less time conducting an evaluation, and being more productive, confident and reliable. However, the problem of manual evaluation is that it is costly, a website contains many webpages so it is difficult to check in great detail all pages, especially large websites (Yesilada et al., 2009). A paper titled “Testability and validity of WCAG 2.0: the expertise effect” shows that experts can incorrectly identify 26% of a sites issues as errors, present 20% of issues as false positives and identify 32% of actual problems in evaluating websites, an result that the researchers attribute to a lack of training web accessibility concepts (Brajnik, Yesilada, & Harper, 2010). Moreover, a manual evaluation can be a become a tedious and time intensive process, especially where evaluators check a website which includes the same template but different content on the pages (Casado Martínez, Martínez-Normand, & Olsen, 2009). For the most part, most researchers suggest that website accessibility evaluation should ideally be done by combining automated tools and manual evaluation. The Unified Web Evaluation Methodology (UWEM) version 1.2 contains documents and instruments to support the evaluation of web accessibility regarding WCAG 2.0 and combines expert evaluation and fully automated evaluation as follows: two automatic assessment tools check accessibility problems and possible overlapping function issues, whilst expert evaluators focus on the results

from automatic testing (Velleman et al., 2007) and check the areas that were picked up in the automatic testing. In addition, the UWEM suggests efficient evaluation by including user testing, as this can identify problems that are not identified through other means. Tanaka & Rocha (2011) argue that web accessibility inspectors should show or indicate accessibility problems in a way that human auditors can understand, such as observing users with disabilities actually use the web and to see the context of the issues they encounter (Henry, Abou-Zahra, & Arch, 2010; Tan, Liu, & Bishu, 2009; Yesilada, Conway, & Connor, 2011). King and Thompson (cited in Hong (2007b) also support the idea of merging automated applications with human judgment to produce effective evaluation in web accessibility. In terms of this thesis, a combination of automated testing tools in conjunction with expert (single) manual assessment was used to identify the levels of accessibility in the Thai university websites examined. In particular, this thesis made heavy use of the Website Accessibility Conformance Evaluation Methodology (WCAG-EM) 1.0 released on by the W3C on the 27 March 2012. The evaluation procedure of WCAG-EM 1.0 is divided into five steps (World Wide Web Consortium, 2008e , Figure 2-9).

1. Define the evaluation scope refers to the scope of applicability which is a full website evaluation, the conformance target and, web technologies and environment.
2. Explore the target website mentions all aspects of the target website such as page type, the purpose of website and, the functionality of the website.
3. Select a representative sample concerns the sample of webpages such as size of the website, complexity of the website, and consistency of the website. It is important to select representative webpages in order to detect accessibility problems. A representative sample of the site might consist of 10% of the actual site, and include such pages as the homepage, contacts page, media pages and sitemaps (Conway, 2014).

The WCAG-EM 1.0 also identifies a sample of webpages as follow:

Common webpages	Typically these are linked directly from the main entry point (home page) of the target website, and often linked from the header, navigation, and footer sections of other webpages.
Essential functionality	Explore the target website to identify its essential functionality. While some functionality will be easy to identify, others will need

	more deliberate discovery.
Types of webpages	Webpages and webpage states with varying styles, layouts, structures, and functionality often have varying support for accessibility.
Web technologies relied upon	This includes base web technologies such as HTML and CSS, auxiliary web technologies such as JavaScript and WAI-ARIA, as well as specific web technologies such as SMIL, SVG and PDF.
Other relevant webpages	Some websites include webpages and webpage states that are specifically relevant for people with disabilities and the accessibility of the website.

(World Wide Web Consortium, 2008e, para 2).

4. Audit the selected sample is the audit of webpages identified in step 3 of the process.
5. Report the evaluation findings reports the outcomes from the audit.



Figure 2-9: Five steps of the W3C evaluation procedure

How the WCAG-EM process was applied in this thesis is explained in greater detail in chapter three.

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### 2.1.5 CHALLENGES OF WEB ACCESSIBILITY

Looking at some of the issues faced by different nations in terms of web accessibility, Farrelly (2010, p. 2) found that there are three barriers in implementing web accessibility in Canada, including “*current social and individual values, inadequate guidelines and support, and monetary demands*”. The authors explain that people with disabilities seem to have an invisible status in Canadian society that leads to a lack of awareness of web accessibility. Communities misunderstand the definitions of accessibility, in terms of the ability of users to interact, achieve agreement and share understanding in the adaptation of web content (Y. Yesilada, G. Brajnik, M. Vigo, & S. Harper, 2012). Costin, Ruxandra-Dora, Paul and Maria (2012) reported low levels of web accessibility in Romania, due in part to a lack of uptake of accessibility practices, including pre-release accessibility checking of new websites.

In the paper “An ethnographical study of the accessibility barriers in the everyday interactions of older people with the web” Sayago and Blat (2011) contend that low levels of user experience is a major issue, including the lack of understanding of new technologies, technical terms and assistive technology devices. Physical and mental abilities of older adults can be a challenge when navigating the web, including issues of poor eyesight that can require people to wear their glasses or move closer to the screen when they read web content online (Cavender & Bigham, 2011). A lack of awareness of search engines is an issue when visiting web content and identifying interface problems and the low level of information retrieval (IR) processes that may occur with elderly people (Arrue, Vigo, & Abascal, 2008). The issue of managing new accessibility technologies is addressed in “Government 2.0” (Hoover, 2009).

While developing accessible web content with a variety of multimedia tools is possible, if mainstream applications like Adobe Flash is used, the product will be largely inaccessible to people with visual impairments (Draffan, 2009). Flash content requires the need for specific assistive technologies and the dynamic nature of flash content can cause a limitation in screen readers to read the content in a timely manner (WebAIM, 2013b). Thus, Flash content can be an accessibility barrier in media rich websites, and as seen in the later chapters of this thesis, was indeed an

issue for a number of the university websites examined. Likewise, Portable Document Format (PDF), Microsoft Word and PowerPoint documents can cause significant inaccessibility problems, especially in instances where PDF documents are created by scanning a printed document, or being converted directly from Microsoft Word document. Whilst Microsoft Word and Adobe's latest PDF creation suites do have some level of in-built accessibility checking and can theoretically create accessible documents that work well with assistive technologies such as screen readers, such documents are still considered by some to be antithetical to accessibility goals. Some governments such as Australia, New Zealand and the United States have developed standards and guidelines in order to encourage organisations to provide accessible documents, and according to the Australian Human Rights Commission (2010b),

Organisations that publish documents only in PDF risk complaint under the DDA unless they make the content available in at least one additional format and in a manner that incorporates principles of accessible document design. Additional formats should be published simultaneously with the PDF version, and at least one such format should be downloadable as a single document if the PDF version is available as a single download (para. 3).

Thus, the format of the document can be significant to the accessibility of its contents and the ability of users with disabilities to utilise the information contained within. These discussions of document types and assistive technologies are one issue, however another is that screen readers can be difficult to set up and learn, and require significant training for the users to become proficient in their use (Guercio, Stirbens, Williams, & Haiber, 2011). In particular, most assistive technologies and the guidelines to which they are aligned are based on the assumption of English, which poses a significant barrier to those who speak English as a second language (if they speak English at all). This was certainly a defining barrier to accessibility uptake in Thai universities as evidenced in the final chapters of this thesis.



## 2.2 ONLINE LEARNING

Whilst this thesis is primarily focussing its efforts on the accessibility of Thai universities websites as a whole, it was felt that some discourse on e-learning was required given the learning context of universities as institutions.

### 2.2.1 DEFINITIONS

'E-learning', 'online learning' and 'distance learning' have often been represented as essentially the same technology, however Moore, Dickson-Deane, and Galyen (2011) argue that there is a difference among the terms, such as characteristics, technology tools and techniques of the learning environment. Tavangarian, Leypold, Nölting, Röser, and Voigt (2004) and Garrison (2011) suggest that e-learning is a subset of online learning, whilst Allen, Seaman, & Garrett's (2007) Table 2-3 see the continuum of educational delivery as:

Table 2-3: Diversity of course delivery paradigm

Proportion of Content Delivered Online	Type of Course	Typical Description
0%	Traditional	Course with no online technology used, content is delivered in writing or orally.
1 to 29%	Web Facilitated	Course that uses web-based technology to facilitate what is essentially a face-to-face course. May use a course management system (CMS) or web pages to post the syllabus and assignments.
30 to 79%	Blended/Hybrid	Course that blends online and face-to-face delivery. Substantial proportion of the content is delivered online, typically uses online discussions, and typically has a reduced number of face-to-face meetings.
80+%	Online	A course where most or all of the content is delivered online. Typically have no face-to-face meetings.

It should be noted that the broad terminology uses the terms 'e-learning', 'online learning' and 'distance learning', however a similar definition is that students are not required to attend classroom while at the same time, educators can provide learning materials through the use of technology. From these examples, e-learning is more than just the website which contains information and resources for learners. In other words, e-learning has moved towards how courses and programs are designed and delivered to respond to student needs (Hanafizadeh, Khodabakhshi, & Hanafizadeh, 2011). Where relevant, this thesis will primarily use the term e-learning.

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### 2.2.2 E-LEARNING

E-learning can trace its origins back to the 1980s, the time of online learning modes (Moore et al., 2011). The first teaching machine was invented in 1920 (Pressey, 1927). The machine provided drills and practice materials to let students test themselves. Then in 1954, Skinner developed a teaching machine that was built on Pressey's model (Skinner, 1961). He believed the classroom has a drawback because of the lack of individual attention and so developed the machine which provided immediate and regular reinforcement that moved students progressively toward stronger understanding. The first computer-assisted instruction system was introduced by the Urbana campus of the University of Illinois in the early 1970s (Bitzer, Braunfeld, & Lichtenberger, 1961). It was called Programmed Logic for Automated Teaching Operations (PLATO), and offered university coursework in many forms of online activities such as forums, online testing, and e-mail to current students of the University of Illinois and others. Whilst the tools of modern e-learning systems have evolved significantly since tools like PLATO were developed, the basic toolset and drivers for the use of these systems has changed very little. Modern e-learning systems make heavy use of Web 2.0 applications for online education (Ebner, 2007; Franklin & Harmelen, 2007), where *"Web 2.0 instruments (social software) become increasingly relevant as they further allow the exchange of knowledge and the development of competencies in networks and beyond the net in an optimal way"* (Erpenbeck & Sauter, 2007, p. 162). What Erpenbeck and Sauter define as an "optimal way" can have multiple interpretations, as a staff member developing courseware materials might see their selection of media and delivery platform as ideal for their need, but ultimately create materials that are opaque to the assistive technologies used by students with disabilities.

Two categories of e-learning delivery include asynchronous and synchronous modalities. Channels by which staff or students post content or queries and then receive a response by one or more people at a later date are defined as asynchronous, as not all participants are required to be online at the same time. The key benefits of asynchronous systems are their inherent flexibility and freedom, as students can essentially self-serve their access to learning resources at a time and place of their choosing. In terms of students with disabilities, this can be particularly advantageous as they are under no time constraints to access and assimilate weekly learning materials

according to their own physical and cognitive capabilities. However, as with most systems, asynchronous tools can have limitations, such as a lack of face-to-face communication, lack of students self-motivation and insufficient guidelines for lecturing staff (Carlton, 2011; Ishtaiwa & Abulibdeh, 2012).

Synchronous e-learning refers to face-to-face (or its digital equivalent) interaction by using a variety of media in real time such as chat rooms, desktop video and web conferences (Kozaris, 2010). Chao, Hung & Chen (2012) designed synchronous assessments for a mid-term exam based on Bloom's taxonomy and found that the synchronous delivery mode increased learning performance because learners were relaxed with the process of completing the online assignments. Furthermore, 76% of learners preferred to use online synchronous exams rather than a paper-based one because they preferred to edit answers on the computer rather than on paper, although this is more likely a preference regarding the computing device and less about the synchronous mode of delivery. However, synchronous learners are limited by time, as are their class based counterparts, as learners and lecturers needed more time in online classes, which was limited only to three hours a week, which in turn limited the amount of content and discussion that could be processed in a single learning period (Hrastinski, 2008). Furthermore, there are other challenges of synchronous e-learning, namely logistical (time zone differences), pedagogical (design problems) and technological (bandwidth issues) (Hyder, Kwinn, Miazga, & Murphy, 2007). In the context of accessibility, synchronous environments can create barriers to learning as students are under time constraints to access and assimilate learning materials, whilst also dealing with the issues of whether the synchronous environment is even usable with assistive technologies (H. Armstrong, 2009; J. Seale, 2006b). Armstrong feels that students with the same disability may have different needs that impact on developing accessible e-learning for students with disabilities, indicating that:

Prescriptive parts of the e-learning materials required substantial redesign for accessibility. None of the images or Flash diagrams was accompanied by explanations, with the screen reading applications used by the blind students instead describing the HTML tags. Drag and drop facilities, information presented in tabular formats, online quizzes, examinations and laboratory exercise descriptions and instructions were totally

inaccessible. These problems reinforced the need to more fully consider accessibility issues at the curriculum design and development stages (p. 253).

The understanding of the individual needs of learner is an essential element when developing accessible e-learning such Permvattana, Armstrong, and Murray (2013) presents the VIVID (Vision Impaired using Virtual IT Discovery) Model which is designed in order to ensure accessible e-learning environments for students with acute vision impairments (Permvattana, Armstrong, and Murray, 2013, Figure 2-11). The authors claim that e-learning IT courses are not designed for specific needs of students with vision impairment thus, *“use of this model will facilitate employment and social inclusion through educational programs that include the peer support and networking opportunities currently enjoyed by sighted students in mainstream education”* (Permvattana et al., 2013, p. 7).

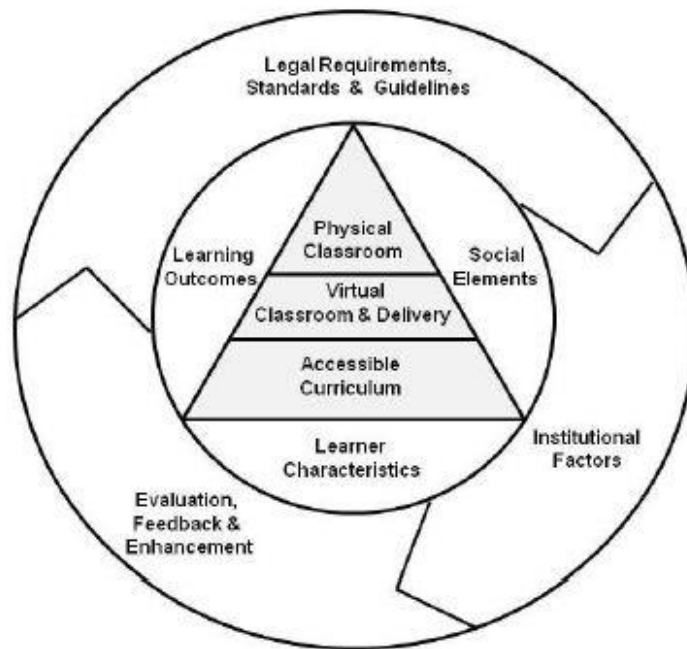


Figure 2-10: the VIVID (Vision Impaired using Virtual IT Discovery) Model

Certainly in terms of this thesis, the VIVID model contains three core aspects which were investigated, including Legal Requirements, Standards and Guidelines, Evaluation Feedback and Enhancement and most importantly, institutional factors which dictate the levels of accessible curriculum and wider university websites.

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### 2.2.3 ONLINE RESOURCES AND ACTIVITIES

There are four media types which are heavily represented in online educational technology: text, audio, images and video (R. Mason & Rennie, 2008). Online lecturers may create materials by using packaged software such as Microsoft Word, PowerPoint and Adobe Acrobat. PowerPoint not only offers the ability to present content in online learning but also provides tools for creating learning activities such as word search puzzles, matching exercises and multiple-choice quizzes. Microsoft Office 2010 provides features to create files that are accessible by many types of screen readers currently available, though only if their content author is appropriately trained in their use (Grauer, 2011). Content providers in education institutions can use in-built or standalone accessibility checkers that provide opportunities for maintaining and repairing accessibility issues in documents, spreadsheets and presentations before uploading content to their webpages (Bianchetti, Erle, & Hofer, 2012; Darvishy, Hutter, Horvath, & Dorigo, 2010b; Darvishy, Hutter, & Mannhart, 2011; Turró, 2008; Zhou, 2010)

Mixing between content management systems (CMS) and learning management systems (LMS) in educational processes would provide more benefit for universities than strictly using one or the other (Alina-Mihaela, 2012). Content management systems (CMS) are used to organise web content creation, publication and management (Cheek, Shehab, Ung, & Williams, 2011), with examples of popular open source Web CMS solutions including Joomla!, WordPress and Drupal. Web CMS tools offer varying levels of web accessibility, and whilst the coming of ATAG 2.0 holds promise for out of the box accessibility for system and end users, at the current time use of Web CMS tools do not necessarily mean a better accessibility outcome (López, Pascual, Masip, Granollers, & Cardet, 2011; Nedbal & Petz, 2010; Said, Fairouz, & Mahieddine, 2012). Learning management systems (LMS) are similar in nature to CMS tools, though with a specific focus on delivering and organising educational content and material for online courses (Soumplis, Koulocheri, Kostaras, Karousos, & Xenos, 2011). Moodle, aTutor and BlackBoard are well-known LMS environments, with all of them offering synchronous and asynchronous communication modes, whilst primarily allowing users to add and manage a rich variety of audio, visual and word processed file types to their course websites (Alina-Mihaela, 2012; University of Pennsylvania, 2012). However, features and functionalities of the LMS are issues of complaint from students with disabilities, the largest proportion of students

with disabilities who face LMS problems are those who are blind when searching for a file (50%) and reading content (50%) and overall, 18.2% of overall students (Unterfrauner & Weiermair-Märki, 2008) with disabilities reported that they have difficulties accessing online materials (López et al., 2011; Nedbal & Petz, 2010; Said et al., 2012).

A number of approaches have been taken in order to address the accessibility of online learning materials, such as through work conducted in Japan on a collaborative improvement, web content transcoding and content authoring tool (Daisuke, Hironobu, Masatomo, Shinya, & Chieko, 2010). For legally blind users there are accessible online library services such as Bookshare which provides scanned or transcribed Braille books by volunteers (Bookshare, 2012). Captioning and subtitle features in YouTube allow users to add captions to uploaded video that then benefits people with audio based disabilities with Google providing a free automated transcription service (Google, 2015). It should be noted that the limitations of such tools include inaccurate translation of speech to text and availability in only one language, namely English (and American accented English at that). We-LCoME offers an e-learning platform that provides collaborations such as captioning support and translators for teachers and students where a community of learners add captions, alt text and other descriptive elements in order to enhance existing learning materials for all users (Ferretti, Mirri, Muratori, Rocchetti, & Salomoni, 2008). The W3C lists over one hundred authoring tools which are applications that help can assist in the development of webpages and web content, with these authoring tools including markup editors, database-backed tools, style sheet editors, multimedia editors, and conversion tools (Henry & May, 2008). For example, Adobe Dreamweaver CS6 provides many features to support accessible web content and applications such as building accessible forms, tables and validated websites for accessibility (Adbobe Systems Incorporated, 2012). Blackboard Learn is also measured and evaluated for accessibility levels by using two standards: WCAG and Section 508 to ensure Blackboard meets the wide range of students with disabilities. In a paper titled "E-learning and accessibility: An exploration of the potential role of generic pedagogical tools", the authors suggest that most pedagogical tools will have advantages and disadvantages in terms of providing accessible e-learning, however a solution might be found by mixing various accessibility tools and pedagogical tools in order to generate e-learning resources (J. Seale & Cooper, 2010). Institutions can take an active role in the provision of e-learning materials and as drivers for 'best'-practice'.

The Web Access concept, which is funded by the EU Lifelong Learning Programme, aimed to provide distance learning via accessible curriculum across a number of vocational areas, including the e-learning environments and teaching and training materials in order to support the special needs of people with disabilities (Craven & Klaus, 2008). In some ways, this proposed model was not unlike the aims of Thailand's Cyber University project. These dedicated accessibility projects in the e-learning space aim to offer equitable access to online learning opportunities where issues such as inaccessible documents, insufficient test times, and non captioned/transcribed audio visual materials were not prevalent. (Fichten et al., 2009; Wald, Draffan, & Seale, 2009).

The response of stakeholders to external drivers plays an important role in the implementation of accessible e-learning in higher education institutions (J. Seale, 2006a). The major components of the model are accessibility stakeholders, accessibility drivers, accessibility mediators and stakeholder responses, as seen in Seale's (2006) Figure 2-11. Whilst Seale's model is very comprehensive and informative, the items highlighted in grey are those that are seen as especially relevant to this research, not just in the formative stage but even more so of this thesis's findings. Legislation, institutional and staff stakeholders and views on disability are critical in any environment where issues of accessibility are in play, but especially so in the case of Thai universities and the people who lecture, develop web content and manage the institutions. The views of these people, linked to their levels of awareness of people with disabilities and the issues of accessibility are critical to the capability of an organisation to change and adapt to be a modern environment for equitable learning. As the latter chapters of this thesis will show, some very interesting (both in the positive and negative sense) results of this work aligned with the categories outlined in Figure 2-11, which in turn drove the development of another model for the adoption of accessible e-learning in Thailand.

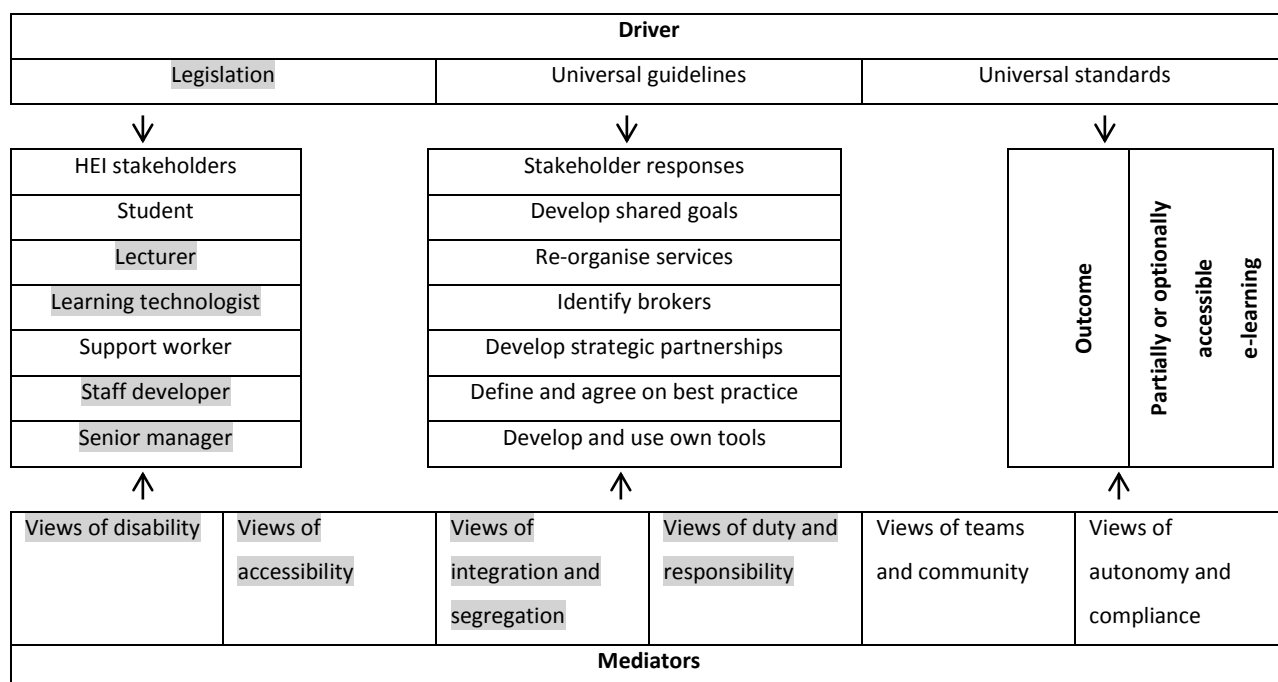


Figure 2-11: A contextualised model of accessible e-learning practice in higher education

As stated previously, the issue of accessible e-learning is important to this research due to its focus on the Thai university sector. However, many of the issues raised, such as media type selection, captions, transcriptions, authoring tools and learning/content management systems also impact the wider university environment. University home pages, contact pages, search forms and general university resources have their accessibility influenced by the above, and will be visited throughout this chapter and the remainder of the thesis.

#### 2.2.4 SPECIAL NEEDS AND ACCESSIBILITY DESIGN

According to the United Nations Convention on the Rights of the Child (1989) and the Salamanca Statement and Framework for Action on Special Needs Education (1994), education for students with special needs is required by law and government policy to allow a student with disabilities to be educated on the same basis as other students. Students with special needs, by definition, is a general term used to describe *“a student who has a disability of an intellectual, physical, sensory, emotional or behavioural nature, has a learning disability or has exceptional gifts or talents”*, states British Columbia Ministry of Education (1989, p. 71). Thus, it is necessary for stakeholders in the education system to understand the characteristics of those students and how those characteristics influence individual learning in order to design and prepare learning materials to meet those needs.



The history of special needs education can track back to as far as the 16th century, though the final stages of the 20<sup>th</sup> century has seen many nations across the world move to a more 'inclusive' education paradigm (Kode, 2002; Poon, Musti-Ra, & Wettasinghe, 2013; A.F. Rotatori, Obiakor, & Bakken, 2011; Rushbrook, 2012). According to Jenkinson (1997), a form of segregation or exclusion in education is experienced when students with special needs are traditionally educated in specialised instructions set apart from regular schools. Special educators felt that they were able to apply curriculum and teach those students with unique needs more efficiently in a controlled environment and with customised curriculum (A.F. Rotatori et al., 2011; Rushbrook, 2012). There was also the belief that students with special needs could benefit from segregation in such 'safe' environments, with students experiencing confidence or self-esteem among classmates having the same disabilities (Jenkinson, 1997). However, researchers and educators are concerned that the segregation of students with disabilities will lead to problems such isolation, accessibility label outside of schools and, slow learning development of disabled students (Dunn, 1968; Jenkinson, 1997). Essentially, if students are segregated in the educational context, the socialisation aspects found within a 'normal' learning environment will be largely lost to these students, and the benefits such socialisation may provide for interactions with the wider community. Specialised education of students with disabilities can impact not just the students but also the educators who can also become isolated, leading to their teaching competencies becoming more defined and limiting (C. R. Smith, 1998). The move towards integrated education is known as 'Mainstreaming' or 'Normalisation', where disabled students are alongside their able bodied peers in the same educational location and context (Hayes, 1989).

According to the findings of the United Nations Educational Scientific and Cultural Organization (1988) showed that most teachers were willing to take on the responsibility for students with disabilities in regular classrooms however, they lacked knowledge of special needs for students with disabilities, a finding that perfectly aligns with the results of the university staff surveys presented in chapters five and six of this thesis. Between 1988 and 1993, the process of implementing training, developing materials for special needs students and for teachers was conducted in a number of countries such as Africa (Kenya), Asia (China), and Europe (Romania), the results of which clearly showed that there significant benefits in improving school practice regarding special needs students (United Nations Educational Scientific and Cultural Organization, 1993). The perceived success of the project

(which had recently completed) leads to the discussion of inclusive education in the Salamanca Statement and Framework for Action (United Nations Educational Scientific and Cultural Organization, 1994). Inclusion education has been high priority approach in many governments and institutions to reform their policy regarding more inclusive direction (Sayed & Soudien, 2005). However, some educators confuse the terminology describing special and inclusive education (Bunch, 1994), to which the Alliance for Inclusive Education (n.d.) Table 2-4 defines the various types of special education as following:

**Table 2-4: Concepts of segregation, integration and inclusion Education**

<b>Segregation</b>	<b>Integration</b>	<b>Inclusion</b>
<p>Disabled people of all ages and/or those learners with 'Special Educational Needs' labels being placed in any form of segregated education setting. This tends to force disabled people to lead a separate life.</p> <p><i>For example: Separate special school, college or separate unit within school/college or on separate segregated courses within mainstream education settings.</i></p>	<p>Disabled people of all ages and/or those learners with 'Special Educational Needs' labels being placed in mainstream education settings with some adaptations and resources, but on condition that the disabled person and/or the learner with 'Special Educational Needs' labels can fit in with pre-existing structures, attitudes and an unaltered environment.</p> <p><i>For example: The child is required to "fit in" to what already exists in the school.</i></p>	<p>Disabled people of all ages and/or those learners with 'Special Educational Needs' labels being educated in mainstream education settings alongside their nondisabled peers, where there is a commitment to removing all barriers to the full participation of everyone as equally valued and unique individuals.</p> <p><i>For example: Education for ALL</i></p>

In other word, all students including students with disabilities should be welcome, accepted and the learning experience made comfortable in accordance to the tenets of the Salamanca Statement and Framework for Action and the Convention against Discrimination in Education.

In terms of online material design, content providers in institutions should be aware of the individual needs of learners in order to ensure that online materials can be accessible to all students. For example, Treviranus, Mitchell, Clark, and Roberts (2014) presents Flexible Learning for Open Education (FLOE), designed to serve personalised and embedded accessible learning. The FLOE is based on Open Education Resource (OER) platforms and aims to ensure that the resources are accessible and meet the needs of all learners including learners with disabilities. The World Wide Web Consortium (2012d , para 1) states “*How do people who cannot move their arms use your website? What about people who cannot see well or at all? Or people who have difficulty hearing or*

*understanding, or have other accessibility needs?"*. In general, visually impaired students may not be able to detect illustrations or read text on websites. Screen readers such as JAWs NVDA can be used by students who are legally blind or who have reduced vision, however those applications can read only text content but cannot identify the content of images or other multimedia formats. Image content with missing alternative text may be ignored by screen readers, which is not a problem for purely decorative items, but is an issue for visual items containing required informational content. Consequently, providing alternative text (ALT) properly is essential for screen readers to interpret images. For example, the ALT can be presented in many ways:

- For a purely decorative image, ``
- For long description attribute, ``

In the above, the first ALT="" can be used as an indicator that there is no informational value associated with this image (as in this case it is decorative) whilst in the second ALT example this attribute is paired with a longdesc (long description) attribute that points the user to a file containing a longer description of the image content. There is no set rule regarding the length of ALT but experts suggest that 125 characters or fewer is good for screen readers such as JAWS that read such content to users (The Pennsylvania State University, n.d.). Also, hearing-impaired students may not always hear audio information that is available on the internet, such as podcasts, thus text transcripts of that audio is necessary for them to make use of the audio medium. Similarly, videos without subtitles or full text transcripts are of little use to students with hearing impairments. Physically impaired students who cannot use a mouse must rely on a keyboard or alternative pointing device such as a mouth stick. Munro & McMulin (2009, Table 2-5) noted that students with disabilities may have problems from interacting with e-learning, as outlined in the following table.

Table 2-5 : Accessibility issues in e-learning

Visual Disability	Auditory Disability	Motor/Mobility Disability	Cognitive/Neurological Disability
<i>Indicate issues with text, hypertext and navigation</i>			
<ul style="list-style-type: none"> <li>Screen layout or navigator is irregular.</li> <li>Visual layout and arrangement used to represent information.</li> <li>Disordered structure of information.</li> <li>Use of Flash technology.</li> </ul>		<ul style="list-style-type: none"> <li>Content does not support assistive technology such as voice recognition software.</li> <li>Navigator requires special pointer.</li> <li>Lack of logical structure.</li> </ul>	<ul style="list-style-type: none"> <li>Screen layout or navigator is irregular.</li> <li>Content does not support assistive technology such as speech software.</li> <li>Use of Flash technology.</li> <li>Unclear indication of page language.</li> </ul>
<i>Indicate issues with images, pictures, diagrams</i>			
<ul style="list-style-type: none"> <li>They cannot be adjusted to scale.</li> <li>Lack of alternative text.</li> <li>Disordered structure of information.</li> </ul>			<ul style="list-style-type: none"> <li>Disordered structure of information.</li> </ul>
<i>Indicate Issues with interaction</i>			
<ul style="list-style-type: none"> <li>Interaction requires activities on screen.</li> <li>Interaction is not supported by keyboard.</li> </ul>		<ul style="list-style-type: none"> <li>Interaction requires intensive pointer.</li> <li>Interaction is not compatible with alternative device such as voice recognition software.</li> </ul>	
<i>Indicate Issues with animation media</i>			
<ul style="list-style-type: none"> <li>They cannot be adjusted to scale.</li> <li>They are designed with colour alone.</li> <li>Lack of synchronised alternative support.</li> <li>Audio media cannot be controlled.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of synchronised text based support.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of alternative devices such as voice recognition software support.</li> </ul>	<ul style="list-style-type: none"> <li>Lack of warning support.</li> <li>Media cannot be controlled.</li> </ul>

In terms of the accessibility of e-learning materials, a majority of these needs can be met by adherence to accessibility guidelines and best practice.

There is a relationship between accessibility quality and complexity depending on the amount of elements present in a web page (Lopes & Gomes, 2010), meaning that the quality of accessible sites can depend on the simplicity of design and the structure of the webpage and its content. A well-designed accessible website can make web content more readable for dyslexic users (Rello, Kanvinde, & Baeza-Yates, 2012) with 63.64% of participants choosing the biggest font size (26 points) available to them. Fryia and colleagues (2009) also support a similar concept that students with cognitive and learning disabilities (CLDs) perform well on tasks with online materials that are designed specifically to meet the needs of students with CLDs, such as participants being easily and quickly able to locate all links without requiring further instructions. Users who are deaf or hard of hearing benefit from the addition of sign language interpreter modules alongside site content such as video, audio, subtitles and media navigation controls on websites (Debevc, Kosec, Rotovnik, & Holzinger, 2009). This research shows that 92% of participant users maintained a high interest and were satisfied with the transparent sign language, and agreed that it was a useful feature, though it does raise an interesting issue of then making that content more regionalised given the wide variety of sign languages currently used across the nations of the world.

### **2.3 ACCESSIBILITY AND ONLINE LEARNING IN THAILAND**

The Office of the Ministry of Public Health (2005) reported that there are 20 ministries within the government structure in Thailand. The Thai government provides policies and legalisations that applied to all government agencies to improve the quality of life and serve the needs and concerns of Thai society including accessibility concerns that require engagement among Thai government entities, including higher education institutions to protect and promote the rights of students with disabilities.

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### 2.3.1 ACCESSIBILITY POLICIES IN THAILAND

With respect to Article 40 of the Convention on the Rights of Persons with Disabilities, “*the State Parties shall meet regularly in a Conference of State Parties in order to consider any matter with regard to the implementation of the present Convention*” (United Nations, 2008 , para. 1). All state parties have to submit reports which keep track of implementation of the Convention to the UN Committee every four years, including Thailand.

After Thailand ratified the *Convention on Human Rights* in 2007, the Thai government passed a number of laws which aim to protect Thais from certain kinds of discrimination in real life, and from breaches of their human rights by government departments and agencies (United Nations, 2008). There are five important pieces of legislation relating to discrimination on the grounds of disability, as outlined below by Thailand Ministry of Foreign Affairs (2011 , para. 2):

- Firstly, the Constitution of the Kingdom of Thailand B.E. 2550 (2007) contains anti-discrimination provisions and guarantees accessibility to social welfare and services for persons with disabilities
- Secondly, the Persons with Disabilities' Quality of Life Promotion Act B.E. 2550 (2007), an amendment to the Rehabilitation of Persons with Disabilities Act B.E. 2543 (2000), is a comprehensive rights-based law for persons with disabilities and also contains a strong anti-discrimination section
- Thirdly, the National Persons with Disabilities' Quality of Life Developmental Plan (Volume III) B.E. 2550 2554 (2007-2011) is an integrated approach and guideline for disability development practice for all authorities concerned
- Fourthly, the Persons with Disabilities Education Act B.E. 2551 (2008) which is intended for persons with disabilities to be able to access education services and other resources at all levels and to improve the Thai educational system to enhance their quality of life and independent living through empowerment

- Fifth, the Strategy to Promote Human Rights of Persons with Disabilities in Thailand (2009-2012) has been formulated by the National Office for the Empowerment of Persons with Disabilities under the Ministry of Social Development and Human Security.

To this end it seems clear that the Thai government has made a commitment to people with disabilities to provide greater independence and opportunities for enhanced participation in Thai life regarding what the Thailand Office of the Prime Minister (2011, p. 23) defines as “*a happy society with equity, fairness and resilience*”.

In terms of information technology, the Thailand Information and Communication Technology (ICT) Policy Framework (2011-2020) is the ICT master plan which provides seven strategies associated with the Thai government’s vision to develop a ‘*Smart Thailand 2020*’ (Ministry of Information and Communication Technology & The National Electronics and Computer Technology Centre, 2011, Figure 2-12).

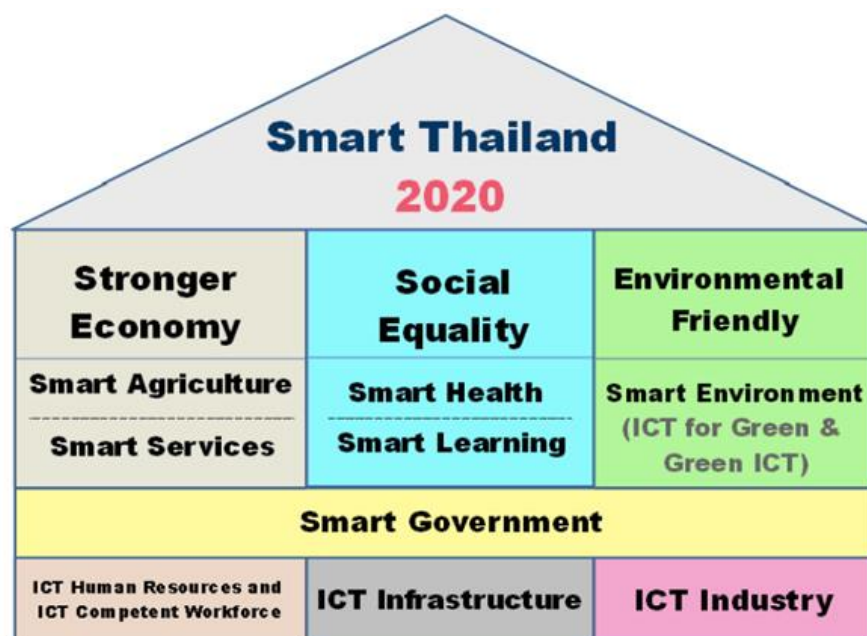


Figure 2-12: ICT Policy Framework 2011-2020

Particularly, the Thai government strives to enhance accessible online learning resources through “*Smart Learning*” in the sixth strategy is to:

Encourage the creation and application of innovation and digital content for learning at all levels, including informal education. At the same time, create e-books to disseminate

in learning centers which can be accessed by all learners. Promote the creation and dissemination by teachers and students of e-content or lessons for education at all levels in diverse formats. The creation of content, database, online content which promotes lifelong learning, the development of school websites and other digital content should follow the web accessibility standard (Ministry of Information and Communication Technology & The National Electronics and Computer Technology Centre, 2011, p. 23)

The Thai government also published two action plans for bridging the digital divide through the Bridging the Digital Divided Strategic Plan (2008-2010) and, developing Thailand's own web accessibility standards namely, the Thai Web Content Accessibility Guideline (TWCAG) (Centre for Internet Society & Global Initiative for Inclusive Information and Communication Technologies, 2012). TWCAG 2008 is based on a modified version of WCAG 2.0 and provides recommendations on web accessibility guidelines to government agencies and commercial organisations (Office of the Ministry of Information Communication Technology, 2008).

The accessibility and learning commitments outlined above and represented in the Smart Thailand ICT Policy Framework provides the core of what this thesis is setting out to test, that is, are these laudable ideals being manifested as accessibility activity in a measurable way in the Thai university sector, and if not, why not.

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### 2.3.2 THAI EDUCATION SYSTEM

The primary education law in Thailand is the National Education Act B.E. 2542 (1999) and Amendments (Second National Education Act B.E. 2545 (2002)) which promotes the concept of "*Lifelong education for all*" (Office of the Ministry of Education, 1999, p. 5). There are three types of education system in Thailand: Formal, Non-formal and, Informal education (Pinyakong, Virasilp, & Usa, 2007).

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#### 2.3.2.1 TERTIARY EDUCATION IN THAILAND

Formal education in Thailand is divided into basic education and higher education (Pinyakong et al., 2007). Thailand's higher education refers to public and private universities, institutions, colleges, and community colleges



under the jurisdiction of the Office of the Higher Education Commission (OHEC), part of the Ministry of Education (Office of the Higher Education Commission 2008). The OHEC reported that there were 173 higher education institutions in Thailand as of 2014 (Office of the Higher Education Commission, 2014). The OHEC is responsible for advancing the role of education literacy across the activities of Thai higher education institutes whilst at the same time ensuring that colleges and universities are complying with the governing policy of the OHEC on curriculum standards. Under the *National Education Act* (1999: Section 47-51), Thai higher institutions are required to perform national quality assurance (QA) processes alongside internal quality assurances (IQA) as well as external quality assurances (EQA). It is the responsibility of each institution to govern the internal quality assurance (IQA) as part of a process of education, however the Office for National Education Standards and Quality Assessment (ONESQA) is responsible for the external quality assurance (EQA). There are three dimensions to the key performance indicators (KPIs) regarding quality assurance: basic indicators which involve compulsory and fundamental indicators, true identity indicators which refer to the identity of the institution, and social responsibility indicators whereby there is participation in social or community services (Office of National Education Standards and Quality Assessment, 2012). As required by the Act, each Thai higher institution is committed to satisfy the need for the standards of IQA and EQA. It is significant to note that the policies of Thai universities were heavily influenced by the national QA process and the OHEC, a level of influence that some participants in this study felt was not being suitably utilised in terms of accessibility uptake and compliance in the Thai university sector.

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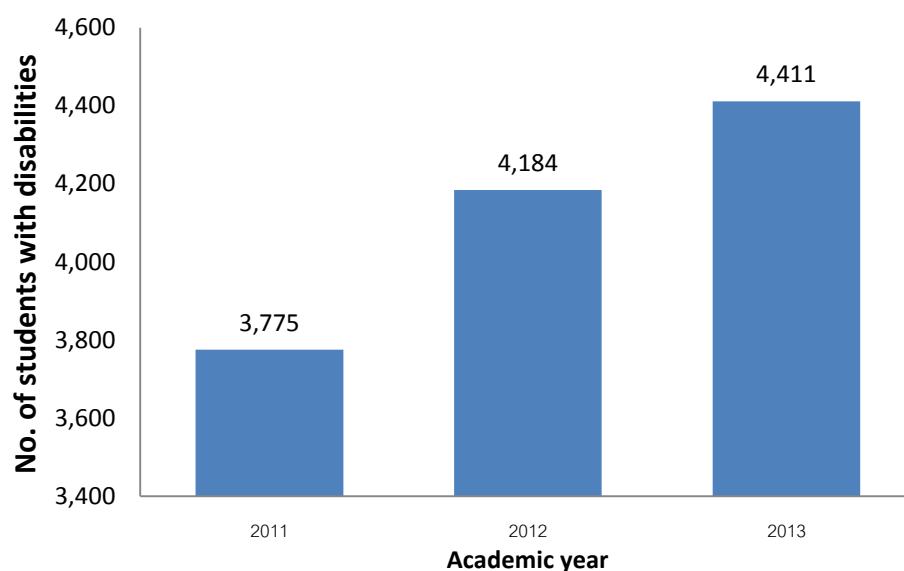
#### 2.3.2.2 THAI STUDENTS WITH DISABILITIES IN TERTIARY EDUCATION

According to the Thailand National Statistical Office (2012) approximately 1.5 million Thais (2.2 per cent of the total population) had a disability and participated in education in 2012. Almost 80% of those people were educated to less than primary school level (57.6%) and were defined as not attending school (22.4%), whilst only 1.1% achieved a bachelor's level degree or higher (Thailand National Statistical Office, 2012, Table 2-6).

**Table 2-6: The percentage of people with disabilities achieving academic programs in Thailand in 2012**

Academic achievement	Percentage
Less than primary school	57.6
Not attending school	22.4
Primary School	10.4
High School	7.8
Bachelor's degree or higher	1.1
Diploma	0.7

Particularly, The OHEC (2013) reported that the number of Thai students with disabilities who enrolled in universities was 3,775 people in 2011, rising to 4,411 in 2013 (Figure 2-13). This rise in the number of students with disabilities participating in higher education in Thailand is important, as these students requirements will need to be addressed in terms of not just their physical access to university campuses, but even more importantly, the online materials which dictate their learning experience and outcomes.



**Figure 2-13: The number of students with disabilities enrolling in Thai universities between 2011 and 2013**

The report of Office of the Basic Education Commission of Thailand (2012, p. 3) presented figures indicating that there were 73 of 169 Thai universities where at least one or more disabled persons is studying as of 2010. The report of the Thailand Bureau of Student Development (2012) showed that Disability Support Service (DSS) Centres were located within 31 Thai universities across all regions of the country in 2012 with the breakdown indicating: North (9 universities), Northeast (8 universities), Central (9 universities) and East (2 universities) and South (3

universities) however, the admissions policy for students with disabilities in most Thai universities is unclear, as latter parts of this thesis will show. Some universities provide specific admission requirements that impact on people with disabilities in terms of attending faculties in the areas of engineering, technical education and arts (Association of University Presidents of Thailand, 2014). For example, one university provides admission requirements for six programs across five faculties as *“Candidates must not be people who are totally blind”* (Association of University Presidents of Thailand, 2014, p. 253).

In terms of university policy addressing disability, most Thai universities do not provide specific policy addressing accessibility on university policy’s webpages however, accessibility is embedded in the organisation’s activities. For example, Thammasat University offers a quota for students with disabilities in its admission policy, the number of students with disabilities was approximately 73 students as enrolled in 2009 (Kittitouch, 2010). Specifically, the Disabled Student Service Centre (DSSC) in Thammasat University provides support to students with disabilities, with physical, academic and moral support and, DSSC coordinates with all faculties and departments with a view to accommodate students with disabilities. Chulalongkorn University, which is the oldest and one of the most prestigious universities in Thailand, assistive technologies and hosts an assistive technology laboratory which encourages researchers to develop assistive technology projects such ChulaDAISY (Chulalongkorn University, n.d.; Punyabukkana et al., 2012). Ramkhamhaeng University, which is one of two open universities in Thailand, provides Disability Support Services Center including learning materials for students with disabilities such as e-learning, RU.Internet TV.11 and RU.Internet Radio (Ramkhamhaeng University, n.d.). Ratchasuda College, established under Mahidol University, is a higher education institution for people with disabilities and provides education and academic services based on the concept of equality and cooperation (Ratchasuda College, 2012). Ratchasuda College also provides two degree programs: a Bachelor of Arts Program in Deaf Studies, and a Master of Arts Program in Rehabilitation Science for persons with disabilities moreover, they offer online learning resources (RS Online) for their students. This last finding in the review of the literature was particularly interesting as it raises the concern of organisations perhaps doing the wrong thing for the right reasons, in this case, creating courses that are specifically tailored to servicing students with disabilities. On the surface this might be viewed as a positive activity, in that a course has been designed specifically to cater for the needs and requirements of

students with a variety of physical and cognitive impairments. However, examined more broadly, such approaches could be seen as mild forms of educational segregation, whereby a container is created into which all persons students with disabilities are placed, with their subject areas and learning outcomes defined by the university hosting such a course. If a student with a disability were to then indicate a desire to study computing and engineering at such an institution, would that student be denied entrance, and pointed to the above two degrees as the only two that were ‘relevant’ to their needs, based purely on their physical and cognitive parameters. As chapters five through seven will illustrate, this concept can be taken to an even higher level, whereby some university staff in Thailand maintain attitudes that as there are specialised higher education institutions for students with disabilities, all such students should study at these institutions and these institutions only.

### 2.3.2.3 THAI ONLINE LEARNING

The Thailand Ministry of Science and Technology (2003) states e-Education goals *“To develop and prepare the country’s human resources at all levels in support of the development of a knowledge-based society”* (p. 19). The Thai government also announced the national Information and Communication Technology (ICT) Master Plan 2002-2006 and the follow-up Thailand ICT plan (2009-2013) as summarised below in Table 2.6 (Laohajatsang, 2010, Table 2-7).

**Table 2-7: Summary of the Thai ICT policy on education**

	<b>Ministry of Education (MOE) ICT Master Plan (2000-2002)</b>	<b>ICT For Education Master Plan (2004-1006)</b>	<b>ICT For Education Master Plan (2007-2011)</b>
Major Issues	<ul style="list-style-type: none"> <li>• Prepare Thais for IT and knowledge society</li> </ul>	<ul style="list-style-type: none"> <li>• Equal access and benefits from ICT for lifelong learning</li> </ul>	<ul style="list-style-type: none"> <li>• Smart Thais with information literacy</li> </ul>
Key Polices	<ul style="list-style-type: none"> <li>• Distribution of computers and networks in schools</li> <li>• Professional development in ICT</li> <li>• Digital content and curriculum development</li> </ul>	<ul style="list-style-type: none"> <li>• ICT for effective management</li> <li>• Professional development in ICT</li> <li>• ICT information and infrastructure</li> </ul>	<ul style="list-style-type: none"> <li>• Educational human resource and professional development</li> <li>• ICT information and infrastructure</li> <li>• Digital content in every subject area</li> </ul>
Teaching-Learning	<ul style="list-style-type: none"> <li>• ICT literacy</li> <li>• Introduction of ICT use in classrooms</li> </ul>	<ul style="list-style-type: none"> <li>• Internet as an educational tool</li> </ul>	<ul style="list-style-type: none"> <li>• Integrating ICT into I/L</li> <li>• Blended learning</li> </ul>

Successes	<ul style="list-style-type: none"> <li>• Internet backbone, pilot project i.e. SchoolNet project</li> </ul>	<ul style="list-style-type: none"> <li>• Awareness of change/paradigm shift</li> <li>• Projects for remote areas i.e. IT princess</li> </ul>	<ul style="list-style-type: none"> <li>• Quantum jump policy/strategies and budget to acquire hardware, software and digital content</li> </ul>
Unfinished Projects	<ul style="list-style-type: none"> <li>• Educational infrastructure and human development</li> </ul>	<ul style="list-style-type: none"> <li>• Educational infrastructure and human development</li> </ul>	<ul style="list-style-type: none"> <li>• Systematic/holistic approach to restructure the entire system</li> <li>• Appropriate use of the internet</li> </ul>

Table 2-6 clearly shows that the Thai government has introduced a broad range of reforms to improve the Thai education system, especially in terms of the importance of ICT as a driver for educational innovation. These changes are designed to create greater choice for all students, including students who are unable to sit in classrooms for the entirety of the course delivery. One significant outcome in terms of achieving online learning is the Thailand Cyber University Project (TCU), founded by the Office of the Higher Education Commission (OHEC) and the Ministry of Education. The TCU vision is that *“the central body of cooperative activities among universities is to promote and support online distance education (e-learning) in Thailand”*, states Theeraroungchaisri (2012, p. 3). The mission of the TCU is:

- To conduct research and development in the use of IT to deliver learning online, using a Learning Management System (LMS), for the Cyber University.
- To research, develop, discover and use educational innovations and new technologies for e-learning, while maintaining internationally accepted educational standards and ensuring a high level of productivity by using established development processes.
- To cooperate with higher educational institutions to develop lessons for each course, using quality e-learning study programs for formal education. To be efficient they will share educational and human resources.
- To cooperate with state and private educational institutions, as well as e-learning experts, to develop informal courses as study guides and short certificated courses.
- To create a mechanism to promote and support the dissemination of all knowledge, including advanced technologies and local knowledge in the form of non-formal e-learning.

- To coordinate with relevant agencies, for the supervision and management of online learning, to ensure it meets quality standards.

(Thailand Cyber University Project, 2004 , para. 4).

However, Kuakiatwong (2010) pointed out that none of the sample webpages from the TCU (13 web pages) passed the WCAG 2.0 level A when testing those pages with automated tools (Achecker and ASTEC), which could probably be considered a poor result given the TCU's focus on purely online education which aims to be accessible to all. With respect to Thai educational policies, a number of Thai universities have developed e-learning policies and strategies which aim to meet the needs for lifelong learning and improving accessibility of online materials for all Thai students, which it can be assumed, includes students with disabilities. Assumption University was the first educational institution in Thailand to offer a complete e-learning degree, namely the Master of Science Program in Management, starting in January 2006 (Chatelier, 2009). Since that time, most Thai universities have turned their attention towards investing in e-learning environments and to support online course materials, with research by Boondao, Komlayut, and Punnakan (2009) stating that there are five key drivers for operating online courses in Thailand: clear policy and planning, adequate financial support, the readiness of team members, building the infrastructure, and evaluation and follow-up procedures. However, the barriers of e-Learning development in Thailand include the lack of motivation, inadequate support and poor interface design (Pagram & Pagram, 2006), issues which share synergies with the common issues encountered in uptake of accessible web design.

## 2.4 CONCLUSION

This chapter has presented a range of issues covering web technologies, content development, accessible technologies, special education, barriers to accessibility adoption and government policies regarding web accessibility. The last two sections focused on Thailand's commitment to e-learning as well as the commitment (from a policy perspective) towards accessible ICT. This chapter has primarily attempted to make the case that, for better or worse, that WCAG 2.0 is the standard by which most national organisations, including Thailand, wish to measure accessibility conformance. The case has also been made that many nations have created legislative and

policy frameworks which make web accessibility adoption mandatory, not optional, though how heavily such approaches are enforced is highly variable and not always clear. Most importantly of all, the Thai government has made clear a number of key commitments, namely, that equality of education, web accessibility and ICT are key factors in the future goal of a 'Smart Thailand'. This thesis, based in part on the discourse of the stated literature, sought to test these commitments from the perspective of the education providers across the Thai university sector.

### 3 METHOD

This chapter outlines the research techniques and design that was utilised in this research, focussing specifically on the quantitative and qualitative research instruments, the sequence in which they were conducted and their overall relationship to the research questions they aimed to address. As stated in the ethics application for research involving human participants: the researcher (this author) is responsible for all activities associated with the conduct of research under the supervision of the student supervisor within the area of web accessibility and web programming. The team also included a research assistant who works in the Thai-English translation (certified) of questionnaire instruments and results.

#### 3.1 THEORETICAL FRAMEWORK

This thesis' theoretical framework, based on the literature presented in Chapter 2, took the view that where nations have made commitments to web accessibility, through legal and policy frameworks, and set specified targets for levels of accessibility conformance, then some accessibility activity should then result. In terms of the Australian NTS example, a policy was put in place and targets were set, and whilst meeting of targets was not achieved, a great deal of accessibility work did result (Australian Government Information Management Office, 2010b; Conway, 2014; Wood & Hollier, 2014). In the case of Thailand, the literature showed a number of policy documents and ministry commitments to e-learning, inclusive education and web accessibility, with the latter targeted at WCAG 2.0 via Thailand's TWAG instrument. Based on these three factors, this thesis assumed to a certain level that Thai universities, which are impacted by all three government commitments, would be demonstrating accessible design concepts to some recognisable level, and that staff in these institutions would be aware of the concepts of web accessibility and the Thai government's commitment to it. The following discussion of research methodology and design outline the data instruments and their delivery which the researcher used to test this theoretical framework and the research questions that developed out of it (outlined in Chapter 1).



### 3.2 RESEARCH METHODS

This thesis aimed to investigate web accessibility conformance inherent in Thai university websites, including the awareness of accessibility by Thai university staff, barriers to accessibility implementation and possible drivers for accessibility uptake. In order to collect data to address the above elements both quantitative and qualitative research methods were deemed as necessary.

Sema (2008) contends that a research design is a plan for undertaking research in order to explore research questions. Creswell (2009) gives three components in a framework which describes the interaction between research and participants including the philosophical worldview of assumptions, strategies consistent with that worldview, and the research methods used. Kurt, cited in Lee (2006) explains :

Researchers who share a commitment to a particular paradigm are committed to the same rules and standards for scientific practice. His approach has been influential within the social sciences within which two broad research paradigms are often identified – the quantitative and the qualitative. Each paradigm rests upon distinctive foundations and applies a specific approach to researching the social world (p. 213).

According to Creswell (2009), post positivism, interpretativism or constructivism, participatory, and pragmatism are four paradigms that a researcher needs to consider in the design of their research. For this research, a largely pragmatic paradigm, which McCaslin describes as *“the practical philosophy in which truth is not seen as an absolute but a moveable and usable construct for understanding the nature of reality”* (McCaslin, 2008, p. 672) was adopted, utilising a mixed methods approach. Specific reasons for adopting the pragmatic paradigm include those outlined by Mason (2006) which include rhetorical logic, social science considerations and problem-centred approaches. Each is briefly outlined below.

#### **(i) A rhetorical logic:**

The study focuses on web accessibility in Thai universities and this it was deemed necessary to add some depth to the analysis in order to capture the whole picture (ie the ‘nature of reality’) of the state of accessibility in those

institutions. J. Mason (2006, p. 3) states that mix methods can provide a *“close-up illustration of a bigger picture”*, or in the case of this research, using quantitative means to ascertain the level of the accessibility of Thai university websites and then using qualitative means via participant surveys and interviews to discover any issues and identify the root causes of a problems related to accessibility conformance.

## **(II) Social science considerations:**

In order to investigate web accessibility in Thai universities, it is necessary to explore issues of awareness of accessibility as a concept and barriers which might be related to web accessibility in such institutions, issues which are grounded in sociology, educational and disability law dimensions. The research must identify social science phenomena relevant to the research question (Tashakkori & Teddlie, 2010) and to achieve this, the voices of humans need to be heard in a qualitative manner, as the purely quantitative analysis of accessibility conformance provides evidence, but not explanation.

## **(III) Problem-centred**

In the context of this thesis, the problem is twofold (the what and the why), with the first problem being to discover ‘what’ the levels of accessibility conformance are in Thai university websites, and then secondly, to gain insight as to the ‘why’ of those results. The ‘what’ aspect is relatively straightforward to answer using qualitative methods, or in the case of this research, using automated and manual assessment techniques, however the ‘why’ requires deeper consideration and extrapolation in order to understand the outcomes of the study in a wider context (Feilzer, 2010). As the later chapters of this thesis will demonstrate, the ‘what’ aspect of the research turned out to be perhaps somewhat unsurprising, however the ‘why’ produced some expected but very interesting results.

There are two main categories of mixed methods approaches: Mix model and Mixed method (Creswell, 2014). Mix model refers to quantitative and qualitative approaches that are blended in the methodology of a study such as in the data collection phase, while mixed methods means integrating two approaches across all stages of the research process such as conceptualization, data collection, data analysis (Tashakkori & Teddlie, 1998). In the case of this study the mixed methods approach was seen as residing in an overarching case study method which had Thai universities as a case study for accessibility in wider Thailand. According to Yin, cited in Woodside (2010, p.

4), “A case study in an empirical inquiry that investigates a contemporary phenomenon within its real life context, especially when the boundaries between phenomenon and context are not clearly evident” and refers to qualitative and quantitative data integration using multiple information sources. Eisenhardt is cited in Armstrong and colleagues (2011), where a limited number of cases can commonly be studied, it is reasonable to choose cases which involve processes that are transparently observable (ie Thai university websites and some of the e-learning components). Leitner and Strauss (2008) conducted an “*Exploratory Case Study Research on Web Accessibility*” by using embedded and multiple case studies with the researchers dividing the case study into four groups including tourism, financial services, retail, and information and communication to permit investigation of the benefits of web accessibility in e-business. Conway (2014) also used a case study approach when examining the web accessibility of Australia government websites and the effectiveness of the National Transition Strategy. In Thailand, there were 173 higher education institutions under the supervision of the Office of the Higher Education Commission in 2014 (Office of the Higher Education Commission, 2014), of which a selection of the top 46 plus 4 special universities were used as a representative case study of universities and their adherence to web accessibility standards.

### 3.3 DATA COLLECTION

Creswell and Plano Clark (2007) contend that qualitative and quantitative data collection should address stages in the research process such sampling procedures, permissions needed, information to be collected, recoding the data and administering data collection. For example:

If quantitative data are used to answer the primary question in a correlational design and qualitative data are embedded the mechanisms that relate the predictor and outcome variables, then the choice of design is the Embedded Design-correlational model (Creswell & Plano Clark, 2007, p. 85).

Creswell gives recommendation that a researcher should consider three questions when choosing a methods design as following:

- What will the timing of the quantitative and qualitative methods be? (Concurrent/Sequential timing)
- What will the weighting of the quantitative and qualitative methods be? (Equal/Unequal weight)
- How will the quantitative and qualitative methods be mixed? (Merge/Embed/Connect the data)

(Creswell, 2009, p. 38).

Using these recommendations as a base, this research was designed using the following techniques.

- The research was conducted using elements of sequential and concurrent timing, in that the quantitative website assessments and qualitative surveys were conducted at the same time (concurrently) whilst the qualitative interviews were conducted after initial findings of that first phase were completed so as to inform the interview questions.
- Unequal weight plays important role in this research and also gives quantitative emphasis. The research will present the results as the collection of survey and support them by interview data.
- The research is decided to embed qualitative data within a larger quantitative design

This study employed elements of both concurrent and sequential data collection through a variety of data collection methods such as survey, follow-up interview and web assessment (Figure 3-1). The website assessment and survey phases were designed to be run concurrently, while the follow-up interview phase was run sequentially, with data from the surveys and web assessments informing some of the questions raised in the interviews.

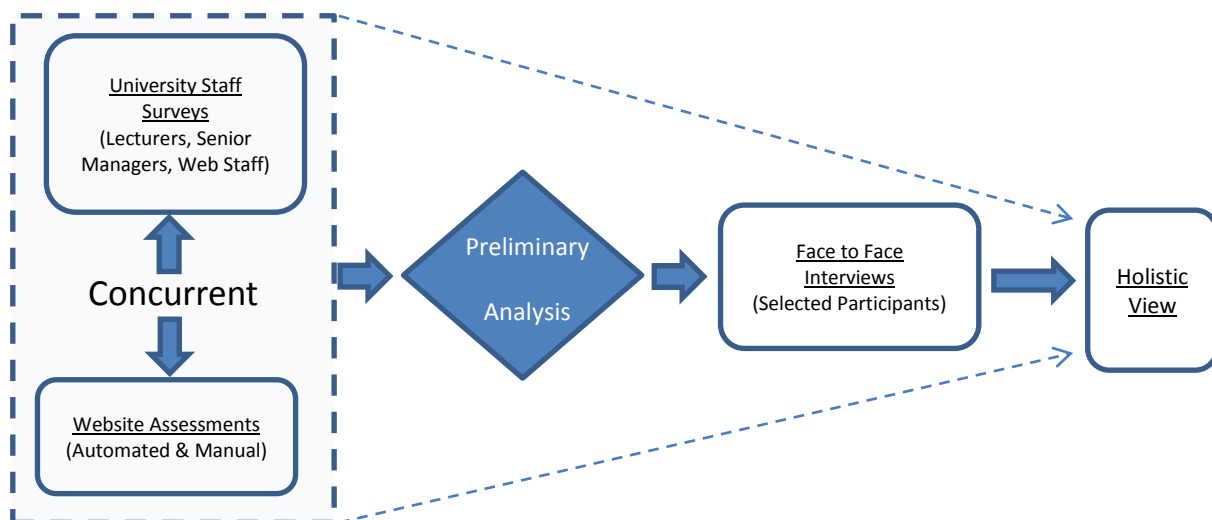


Figure 3-1: Multi-methodological convergent approach

The overall data collection process was designed to be run over a six month period, with approximately four months being allocated to the staff survey and web assessment phase, around a month for preliminary analysis of that data and then a further month to conduct the face to face interviews.

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### 3.3.1 WEBSITE ASSESSMENT

In terms of page sampling methods for the website assessments, Hackett and Parmanto (2009) found that auditing a homepage alone is not enough to reflect the whole picture of accessibility in the website because the result shows that the Web Accessibility Barrier (WAB) scores of the sample's homepages do not correspond with the WAB scores of the rest of the site. As stated in the literature, the Website Accessibility Conformance Evaluation Methodology (WCAG-EM) 1.0 advises to:

Select web pages and web page states that reflect;

- (1) common web pages,
- (2) essential functionality,
- (3) types of web pages,
- (4) web technologies relied upon, and
- (5) other relevant web pages. (World Wide Web Consortium, 2008e, para. 2).

For this reason, this research conducted manual evaluations not only on homepages but also a selection of other pages, with the following priorities:

- University homepage
- Library Page
- E-learning homepage
- E-learning Forum page
- Contact Us page
- Email page
- E-learning content page

A number of other studies have used similar approaches when selecting pages for assessment, including Conway's (2014) study of the National Transition Strategy in Australian, Vigo et al (2013) comparison of automated assessment tools and Vellerman and van der Geest's (2013, p. 1) testing of the WCAG-EM via "*selection of 13 specific pages*". Brajnik, Mulas and Piton (2007) raise the primary concern with any sampling approach, whereby the given sample may not be representative of the entire website, or that a sample may not be totally random. In

this study, for manual expert assessment, specific pages were picked so as to represent those related to accessing learning materials (where possible) and those sites which support the learning process, making contact with staff, identifying learning resources and finding out what is happening within the wider university. The pages assessed within the Thai university websites included only those that were publically available, which was particularly relevant to the e-learning materials. This decision was driven by two matters of practicality, one being that asking for deeper levels of access (ie a student level account) from each university website seemed unlikely to yield positive responses, and two, automated tools cannot 'see' inside secure environments when being run from outside that environment. If there was deemed to be too little in the way of publically accessible e-learning materials available on the Thai university websites, the organisations would have been approached to participate in this research by allowing some limited access, even though as stated above, it seemed unlikely that this approach would have been successful. Ultimately, enough e-learning materials were found to be publically available or available via 'guest' level access for the purposes of this study, and requests for greater levels of access were not deemed necessary.

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#### 3.3.1.1 AUTOMATED TOOLS

The automated tool selected for use in this study was Sortsite from Powermapper Software. Sortsite provides website validation, quality checking as well as web accessibility evaluation, and can analyze a websites level of accessibility against WCAG 2.0 and Section 508 requirements (PowerMapper, 2012). Vigo et al. (2013) demonstrated that Sortsite provides the most accurate results among six automated tools with qualities including 30% completeness and 95% correctness (p. 8), whilst SortSite and WAVE were used to compute findings coming from the manual assessment process.

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#### 3.3.1.2 EXPERT MANUAL TESTING

According to de Souza and Mont'Alvão (2012), web accessibility issues require human inspection to ensure more effective evaluation than can be obtained with automatic evaluation tools. For example, automatic tools can give incorrect results when they test alternative text for non-textual components however whilst human evaluators are able to identify such issues. Manual accessibility testing is auditing by humans who may (should be) web

accessibility experts or users who can make informed judgments about accessibility issues in a website (Petrie et al., 2011). A number of researchers (Power, Freire, & Petrie, 2009; Vigo et al., 2013) state that the results of automatic tools vary substantially among the different tools currently available and validation of automatic tools outcomes is frequently not available, leading to inaccuracies in testing. Furthermore, they also noted that the use of expert evaluators is important for improving testing website accessibility. Consequently, this research will audit the sample sites using expert manual evaluation of the page types listed above with a selection of tools as outlined below:

1. NonVisual Desktop Access (NVDA) is a free screen reader (NV Access Ltd., 2015).
2. Vocalizer Expressive for NVDA is a commercial speech synthesiser which provides Thai language (Kanya) with two variants: Premium High and Plus (Nuance Communications Inc., 2013).
3. The Colour Contrast Analyser is a freeware tool and is compatible with WCAG 2.0 requirements (Jun & Faulkner, n.d.).
4. The Web Accessibility Toolbar (WAT) is developed in order to assist web developers to perform manual accessibility testing. The toolbar is free plug in which is compatible with Internet Explorer (Jun et al., 2012).
5. W3C HTML Validation Tool checks the markup validity of web contents (World Wide Web Consortium, n.d.-b).
6. The Acrobat X Pro is a commercial application which provides the Accessibility Checker for testing the accessibility of PDF documents (Adobe Systems Incorporated, 2011).

It was not possible to explore all pages in each Thai university website (certainly in terms of manual assessment) thus, 7 webpages from each of the 50 university websites was selected. The automated assessment (using SortSite) and manual assessments (using the variety of tools outlined above) happened simultaneously in order to compute the results. Figure 3-2 below shows the five steps of the WCAG-EM web page assessment methodology as mapped against the procedures used in this study.

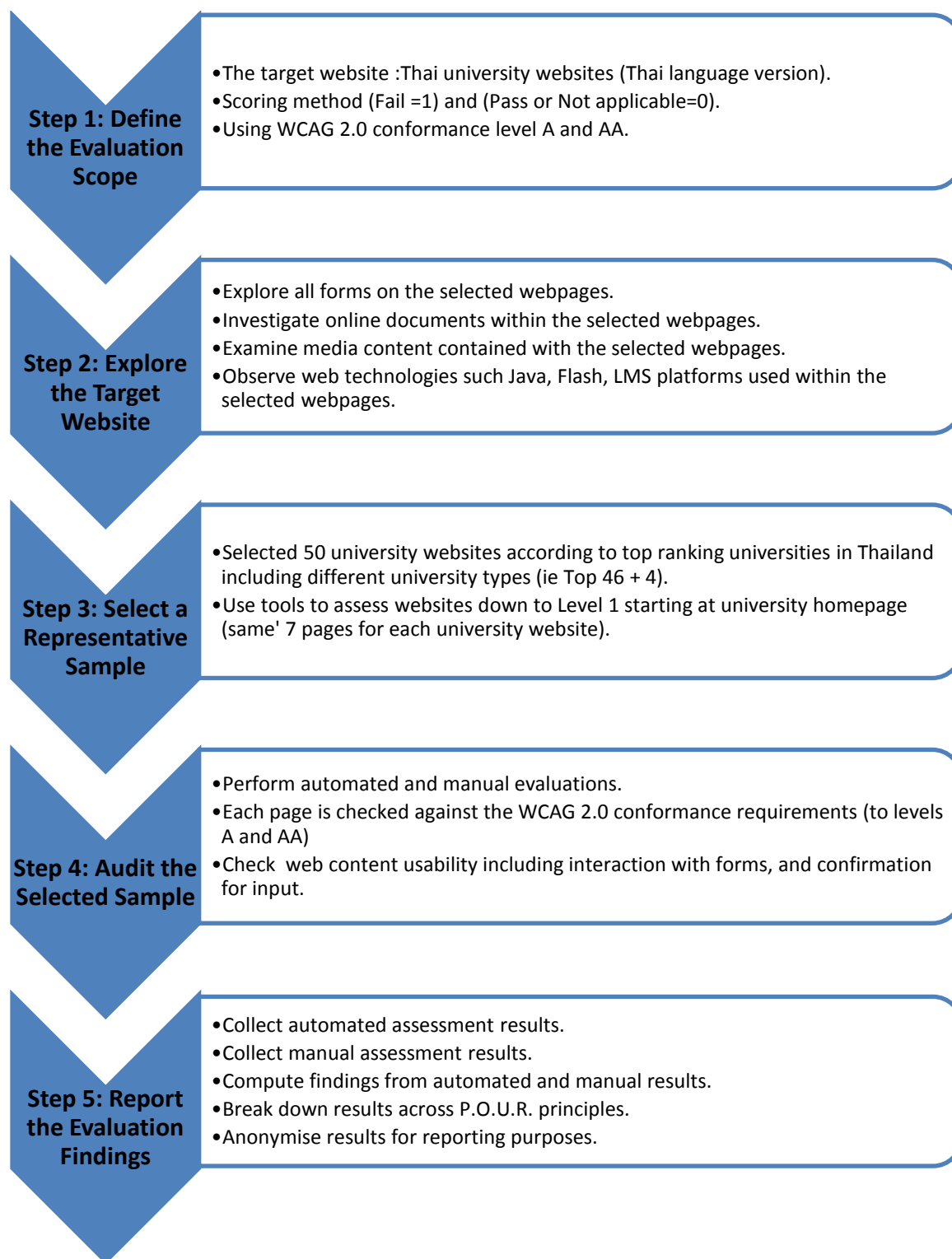


Figure 3-2: Website assessment process mapped to Website Accessibility Conformance Evaluation Methodology (WCAG-EM) 1.0



Using WCAG-EM as a guiding method for the website assessment aspect of this research was most useful, and when mapped to the tools and techniques utilised in this research made for a time consuming, but predictable and repeatable set of data collection steps.

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### 3.3.2 SURVEY INSTRUMENT AND RECRUITMENT

Questionnaires are tools for collecting data in survey research, and web based surveys allow researchers to gather data from a large number of respondents while at the same time decrease duration and cost for data collection, decline in transcription errors, and the possibility of more sophisticated interactions with participants (Gaiser & Schreiner, 2009). This research was conducted using a web-based questionnaire, a link to which was included in an email invitation to Thai university staff to participate in this study (Appendix 9-3). Possible participant's email addresses were located via publicly available sources, such as university staff listings and university e-learning materials, with these three groups being Lecturers, Web Admins and Senior Managers. Each person in each group was emailed an invitation to participate, which included a coded identifier for them to enter at the beginning of the survey should they choose to participate. Upon receiving the invitation email which explained the purpose and rationale of this study, participants could opt-in by clicking the link to the online survey instrument, entering their coded identifier and commencing the survey. Participants were assured that their responses would remain de-identified, with each participant being identified only via the anonymising id value in the reported result, using re-coding techniques to disguise the names of individual staff and the organisations they worked for. During the questionnaire development, it was important to map the research questions across the survey instrument(s) in order to ensure that the questions helped to address the supporting research questions #1, #2 and #3 (Appendix 9-4). Figure 3-3 shows a snippet from the mapping that was developed, indicating which questions in which sections of the survey were aligned to which group of participants (L for Lecturer, S for Senior Admin and W for Web Admins) and in turn, which of the supporting questions they contributed towards. As an example, The first question in Section 2: University website and e-learning experiences of the survey applied to all three groups of participants, and contributed in part to the first supporting question of 'What level of awareness is there for web accessibility in Thai universities?'.

Questions	Groups of participant			Supporting research questions		
	L	S	W	#1 Awareness	#2 Barrier	#3 Driver Exit
<b>Section 1 : Identification and personal details</b>						
Entering participant ID	x	x	x			
Gender	x	x	x			
Age	x	x	x			
Length of work experience	x	x	x			
Academic rank	x					
Teaching Discipline	x			✓		
Highest level of qualification			x			
Job Description			x			
<b>Section 2 : University website and e-learning Experiences</b>						
Do you use the university website/e-learning as a part of the job?	x	x	x	✓		
How often do you use the university website/e-learning?	x	x	x	✓		
Did you receive formal training in the use of the university website/e-learning?	x	x	x	✓	✓	
To what extent do you feel your students are taking advantage of the university website/e-learning?	x	x	x	✓	✓	
Have you developed your own e-learning materials or improved existing e-learning materials by yourself?	x			✓		
Who developed it for you? (Please check all that apply).	x			✓		
What aspects of your teaching do you use e-learning for? (Please check all that apply)	x			✓		
What types of content do you place in the university website/e-learning	x		x	✓	✓	
Which Learning Management System (LMS) software do you use?	x			✓	✓	
Do you assist lecturing staff with e-learning content?			x	✓		
How often are you ask to develop / modify e-learning contents?			x	✓		
Which technology do you use the university website/e-learning? (Please check all that apply)			x	✓	✓	
Please feel free to add any further comments or thoughts on the use of university website and e-learning at your institution	x	x	x	✓	✓	✓

Figure 3-3: The example of mapping questions in the survey

After the questionnaire was designed, a questionnaire pilot was conducted on a small sample of assistants from the target population in order to any problems with the research instrument and reduce questionnaire problems. Importantly, the researcher recruited expert 'testers' with various levels of knowledge and experience of web accessibility and information technology. Moreover, these testers had to be familiar with the Thai university environment. The pilot study testers were drawn from the target population (lecturer, senior manager and web staff) but were not included in the main study. The pilot study of the questionnaire was designed to:

- Check questionnaire design (i.e. the logic flow in the questionnaire)
- Evaluate tester understanding of language and terminology
- Observe behaviour such as the time it takes a tester to answer a question in order to estimate how many questions should be contained in the interview (one hour per interview)
- Identify potential problems during gathering data.

One extremely obvious ‘technical’ issue picked up in this pilot testing was that the coded id’s given to testers in the recruitment email was up to four digits long, whilst the initial questionnaire only allowed for three digits. Another change included some fine tuning of the Thai language translation of the questionnaire, as a number of the testers felt that some of the terms or phrases had not translated well into Thai. Obviously the questionnaire was initially written in English for the purposes of the proposal and ethics clearance processes, however a qualified English ->Thai language translator assisted with the Thai language wording of the final version. In the end, none of the testers in the study reported any issues with the final Thai language version of the survey instrument.



**Figure 3-4 : The outline of survey instrument**

Figure 3-4 illustrates the outline of survey instrument and the three sections into which the questions were separated. Section (1) contained identified demographic details of the participants; section (2) ascertained the participant’s university website usage and e-learning experiences whilst section (3) gathered views on the participant’s experience and attitudes towards accessibility. All three of the survey instruments (for Lecturers, Web Admins and Senior Managers) contained common questions (particularly in terms of the demographic details) and then a series of contextualised questions relevant to each specific survey. All three surveys are presented in Appendix 8-10, however the discussion below will present a number of the questions from the surveys along with an explanation of the reasoning behind the questions.

### **Section 1 : Identification and personal details**

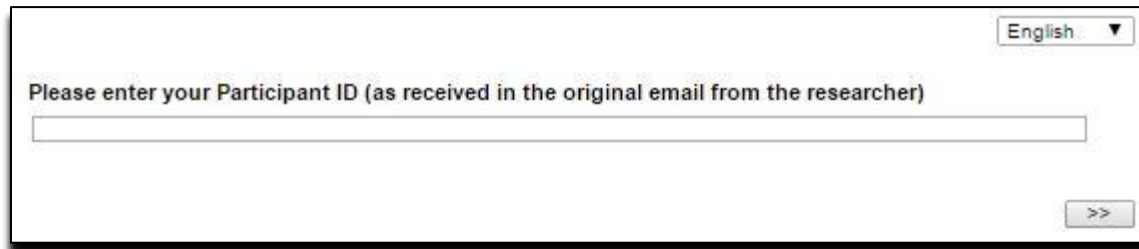
A screenshot of a web survey interface. At the top right, there is a language selection dropdown menu currently set to 'English'. Below this, a text prompt reads 'Please enter your Participant ID (as received in the original email from the researcher)'. Underneath the prompt is a single-line text input field. At the bottom right of the section, there is a button with the text '>>'.

Figure 3-5 : Example of identification questions – All participant groups

Section one of the web survey focused on identification and personal details. Figure 3-5 illustrates two statements: language selection and, participant's ID. The first statement provided a language selection option for the survey, either the English language version or the validated Thai language version (a majority of participants selected the Thai language version). The next statement requested the participant's ID number that was sent to them as part of the invitation to participate letter (Appendix 9-5).

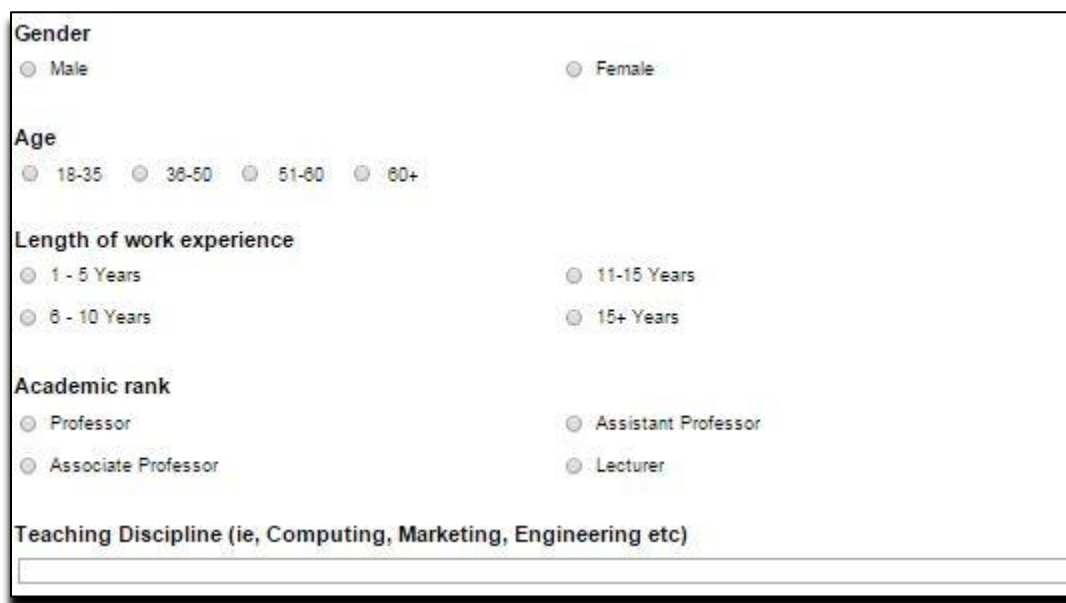
A screenshot of a web survey interface for the lecturer group. It contains several sections of questions, each with radio button options. The 'Gender' section has 'Male' and 'Female'. The 'Age' section has four options: '18-35', '36-50', '51-60', and '60+'. The 'Length of work experience' section has four options: '1 - 5 Years', '6 - 10 Years', '11-15 Years', and '15+ Years'. The 'Academic rank' section has four options: 'Professor', 'Associate Professor', 'Assistant Professor', and 'Lecturer'. At the bottom, there is a section titled 'Teaching Discipline (ie, Computing, Marketing, Engineering etc)' followed by a text input field.

Figure 3-6 : Example questions about personal details – The lecturer group

Figure 3-6 shows an example of questions designed to gather demographic data including personal details, role, gender and work experience. The work experience question was important, as participants who indicated more than six years of work experience were specifically targeted in requests to participate in follow up interviews due to their longer term experiences in the Thai university system. For the lecturers group, the next statement addressing academic rank was asked in order to identify teaching and research experiences. The lecturers holding

at least an associate professor role were also targeted to participate in the interview phrase. The fourth statement sought to ascertain the teaching discipline of lecturer respondents, so that links between discipline and accessibility awareness could be examined. For example, if a respondent taught computer/information technology, he or she might be expected to have higher levels of awareness of web accessibility and assistive technologies.

## **Section 2 : University website and E-learning experiences**

**What types of content do you place in the E-Learning system? (Please check all that apply)**

☐ Word documents
 ☐ Flash contents
 ☐ YouTube

☐ PowerPoint documents
 ☐ Flickr
 ☐ Surveys

☐ Audio-clips
 ☐ Twitter
 ☐ Online tests

☐ Video clips
 ☐ Facebook
 ☐ Other (please specify)

☐ PDF documents

**Which Learning Management System (LMS) software do you use?**

☐ Blackboard
 ☐ Sakai
 ☐ Joomla
 ☐ Other (please specify)

☐ Moodle
 ☐ Wordpress
 ☐ Do not know

**Please feel free to add any further comments or thoughts on the use of the university website and E-Learning system at your institution.**

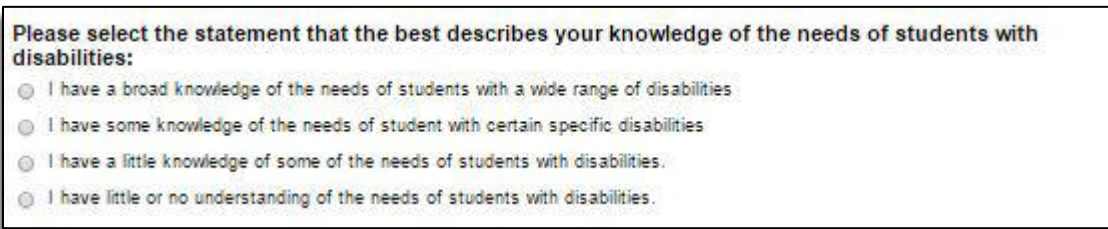
**Figure 3-7: Example questions about types of content in used – The lecturer group**

As Hollier (2011) found, a number of accessibility issues in social media tools such as Facebook, YouTube and Flickr are known to exist and persist, whilst issues of inaccessible documents on websites such as PDF documents are also well documented (Gornitsky, 2011; Turró, 2008). Built on these issues, statements attempted to identify the types of online materials lecturing staff were utilising as part of their teaching (Figure 3-7). This section also attempted to identify any LMS software that might have been in use at the participant's university. An open-ended statement requested all respondents (lecturers, senior managers and web staff) to expand on any of issues/opinions that the respondents felt was valuable in terms of the use of university website and e-learning systems of their institution.

### **Section 3 : Experience and attitude towards accessibility**

The third section of the web survey sought to elicit views of university staff members in terms of students with disabilities and their perspective on accessible online resource, so that, as Seale comments:

This response will be mediated by stakeholders views and understandings of a range of issues including: disability, accessibility and inclusion; the extent to which they view themselves to have a duty and responsibility to respond; the extent to which they feel their personal autonomy is threatened and the extent to which they feel it is necessary or beneficial to respond as a community or team (2006a , para.3).



**Please select the statement that the best describes your knowledge of the needs of students with disabilities:**

- ☐ I have a broad knowledge of the needs of students with a wide range of disabilities
- ☐ I have some knowledge of the needs of student with certain specific disabilities
- ☐ I have a little knowledge of some of the needs of students with disabilities.
- ☐ I have little or no understanding of the needs of students with disabilities.

**Figure 3-8 : The example question regarding the special needs awareness – All participant groups**

As stated in the literature and Seale, the accessibility of e-learning and online materials for students with disabilities required special needs knowledge and, the view of stakeholders such as lecturers, learning technologist (web admins) and senior managers towards accessibility and people with disabilities (Gornitsky, 2011; J. Seale, 2006a; United Nations Educational Scientific and Cultural Organization, 1993). The statement in Figure 3-8 attempted to identify the level of special needs knowledge of respondents, especially university content providers (lecturers and web staff) who might be expected to be familiar with the special needs of students with disabilities in order to design online learning materials to meet the specific needs of those students.

Experience/Attitude towards Students with disabilities and Accessible online materials			
	Yes	No	Not Sure
Have you taught students with disabilities?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does your university provide any accommodation / assistance for students with disabilities? (e.g. extra exam time, captioned videos, computer with speech output)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you been approached about making Accessible online materials for students with disabilities?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are you aware of any existing resource(s) that explain how to make accessible online materials for students with disabilities?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are the accessible online materials in your university tested for their accessibility to meet the special needs of students with disabilities?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In your opinion, should students with disabilities be provided with facilitates and services by the university to assist their learning needs?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you ever had a student with special needs complain about not being able to make use of the university website/e-learning?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 3-9 : Example questions regarding experience and attitude - the lecturer group

Figure 3-9 commences with a statement around awareness and opinion of respondents towards providing inclusive support for students with disabilities. The investigation builds upon staff experiences in providing online learning materials for specific needs of students with disabilities. The next statements revolved around attitudes towards accommodations for students with disabilities that could impact on staff intention for delivering those accommodations in Thai universities.

**Do you know the meaning of the term Web Accessibility?**

☐ Yes
 ☐ No

Figure 3-10 : The example question regarding web accessibility awareness – All participant groups

Having established the type of learning materials used by participants, their levels of teaching experience and their views and understanding of students with disabilities, the survey then specifically attempted to identify the awareness of university staff members about web accessibility (Figure 3-10). If a respondent answers 'yes' (meaning they had experience/awareness), he or she will be requested to provide more details about web accessibility in the open-ended statement (Figure 3-11). In other words, if a respondent answer 'no' (meaning they had no experience), he or she will be skipped over the open-ended statement (Figure 3-11) to another question.



Please explain your own understanding of the concept of Web Accessibility

Figure 3-11 : The example open-ended statement regarding web accessibility explanation – All participant groups

The open-ended statement (Figure 3-11) requested respondents to expand the term of web accessibility in their own understanding in order to double check that respondents demonstrated an understanding of web accessibility consistent with the usage made in this thesis and the wider literature.

What, for you, is the most significant barrier to creating accessible online materials for students with disabilities? Please rank, in order to importance, each of the following;

*Allocate a rank of **1** to the ***MOST*** significant barrier.  
Allocate a rank of **10** to the ***LEAST*** significant barrier.*

- Lack of knowledge of the needs of students with disabilities
- Lack of knowledge of technologies to create Accessible online content
- Lack of knowledge of Assistive Technologies
- Lack of Accessibility training and awareness
- Lack of Assistive Technology equipment and software (e.g. Screen Reader, Dynamic displays devices)
- Lack of financial support from a university
- Lack of time
- Lack of support network
- Lack of commitment to Accessible design standards and resources
- Lack of demand for Accessible resources

Figure 3-12 : The example question regarding accessible online materials - All participant groups

Figure 3-12 examines potential barriers to accessible online materials in Thai universities, though as the literature review indicated, inaccessible online content was a result of a number of issues such as:

Most webmasters that responded to the survey supported the concept of web accessibility, but cited roadblocks to accessibility such as lack of time, lack of training, lack of managerial support, lack of client support, inadequate software tools, and confusing accessibility guidelines (Lazar, Dudley-Sponaugle, & Greenidge, 2004, p. 284).



Tandy and Meacharm (2009, p. 320) also pointed out that “*there are multiple issues and problems that infuse and surround accessibility, including the invisibility of disability, the increasing complexity of technology, and technical barriers for instructors*”. Thus, the statements in Figure 3-12 attempted to look around barriers to developing accessible online materials in Thai university, and identify the priority of problems and what the key issues are in order to better understand the root causes of current situation, be it good or bad.

In order to increase Web Accessibility within the university, to what extent do you agree with the following statement?	Strongly agree   Agree   Neither Agree nor Disagree   Disagree   Strongly Disagree				
	Increasing penalty in laws and legalisations for non compliance to Accessibility	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting Web accessibility must start with university policy.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providing training and workshops is necessary.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing cooperation among stakeholders in university (e.g. Senior managers, Lecturer and Support Staff).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Giving rewards (e.g. Promotions, Research Grants etc).	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provision of equipment and technology is crucial.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Support in terms of finance for Accessibility projects is crucial.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Figure 3-13 : The example questions addressing web accessibility solutions - All participant groups

Figure 3-13 examines participants’ views on potential solutions (or drivers) to accessibility issues, with the literature contributing towards the development of this question via such statements as “*stronger investments in training and in the promotion of consciousness about the law may be pointed as the most important tools to help a more effective policy on Web accessibility in Brazil*” (Freire et al., 2008, p. 149). Participant responses to the statement outlined in Figure 3-13 were instrumental in contributing to the proposed model of accessibility adoption in Thai universities as presented in chapter seven.

Thank you for all your responses so far. Please feel free to add any further comments or thoughts regarding any of the issues raised above.

Would you be willing to participate in an interview in the future for the purpose of gathering more information about accessible online resources and web accessibility within your institution?

☐ Yes, for future interview.
 ☐ No thanks

Figure 3-14 : The end of survey instrument - All participant groups

The web survey concluded with an open-ended statement (Figure 3-14) requesting respondents to write comments on any aspect of the survey that had participated in. The final question on the survey invited participants to take part in the face to face interview element of the research, which was once again, opt-in with assurances of anonymity, or de-identification of their responses.

Overall, the survey instrument was envisaged as being no more than 30-50 questions so as not to lead to participant abandonment of the instrument. The survey was also to be used to recruit participants to take part in the interview phase of the research. As stated, the above represent a small but key selection of the survey questions posed to participants, whilst the full set of questions and results are presented in great detail in chapter five.

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### 3.3.3 FACE-TO-FACE INTERVIEWS

Reid and colleagues (2008) claim that there are many research tools to gather personal data such as experiences, ideas and concepts however, the most efficient way to gather such information is to actually ask a person in the form of a semi-structured interview. Ayres (2008) stated that:

The semi-structured interview is a qualitative data collection strategy in which the researcher asks informants a series of predetermined but open-ended questions. The researcher has more control over the topics of the interview than in unstructured interviews, but in contrast to structured interviews or questionnaires that use closed questions, there is no fixed range of responses to each question (p.811).

In-depth interviews are commonly used in conjunction with semi-structured interviews because the researcher can maintain some control of the direction of the interviews whilst participants are also free to describe information they see as important (Cook, 2008). This research was conducted using this combination of semi-structured and in-depth interviews so as to 'fill in the gaps' between a participant's survey responses and their actual real-world knowledge of web accessibility and students with special needs.

There are reasons why qualitative (interview) samples are usually small in size can include:

If the data are properly analysed, there will come a point where very little new evidence is obtained from each additional fieldwork unit. This is because phenomena need only appear once to be part of the analytical map. There is therefore a point of diminishing return where increasing the sample size no longer contributes new evidence (Ritchie, Lewis, Nicholls, & Ormston, 2013, p. 118).

Generally, there are three sample strategies in a qualitative (interview) approach: a convenience sample, a judgement sample and a theoretical sample, and in particular, for judgement samples, *“the researcher actively selects the most productive sample to answer the research question”* (Marshall, 1996, p. 523). Due to the large number of participants in this study, it was not possible to interview all voluntary participants so the selection of participants occurred based on work experience and seniority for each group, in order to ensure that specific questions could be answered by the participants. Thus, interviews were conducted with participants with the following levels of university working experience;

**Table 3-1: Work experience requirements in the interview**

Participant groups	Specification
Lecturer (3)	Having at least 10 years work experience or holding academic ranks such as Assistance professor, Associate professor and Professor.
Senior Manager (3)	University board members who have experience of at least 10 years.
Web Staff (3)	University web developers who have experience of at least 5 years.

The preliminary results of the web evaluation and survey phases informed the questions asked during the interviews, especially in terms of clarifying any ambiguous results or particularly interesting responses. Again mapping question technique was conducted as show in Table 3-2.

Table 3-2 : Mapping questions during interview question development

Questions	Sought to Clarify	Supporting research questions		
		#1 (Awareness)	#2 (barriers)	#3 (Drivers exist)
Are there students with disabilities in the university? Do you know how those students use the internet?	The awareness of participants about students with disabilities.	x		
Would you agree to making the university's website or e-learning materials more 'web accessible'?	Attitude towards web accessibility and accessible online materials.	x	x	x
Have you ever heard of the term 'web accessibility'?	Web accessibility awareness	x		
In your view, what does 'web accessibility' mean?	Own understanding about web accessibility meaning	x		
From the survey conducted through automated and manual testing, it has been found that the university website and e-learning materials have the following deficiencies. As you are the web staff/ lecturer, which of these have you been involved in and why? 1. Lack of Alternative Text (the checkpoint 1.1.1 of WCAG 2.0) 2. Lack of purpose of links (the checkpoint 2.4.4 of WCAG 2.0) 3. Lack of language of page (the checkpoint 3.1.1 of WCAG 2.0) 4. Lack of parsing (the checkpoint 4.1.1 of WCAG 2.0) 5. Inaccessible documents such as using PDFs with no alternative options.	The reasons why the university websites failed to meet WCAG 2.0 requirements. Particularly, most errors were found at the checkpoints 1.1.1, 2.4.4, 3.1.1 and 4.1.1 of WCAG 2.0 guidelines. The university webpages also contained inaccessible documents.	x	x	x
From the results of the survey, it has been found that the main obstacle for creating accessible online materials for students with disabilities is the lack of knowledge of the needs of students with disabilities. What do you make of this and what method would you propose in order to solve this problem?	The reasons why the lack of knowledge of special needs was the main barrier.		x	
From the survey results, it has been found that in developing the university's website to become web accessible, "Support in terms of finance for accessibility projects is crucial", "Provision of equipment and technology is crucial" and "Starting with university policy" are required. What do you make of the above points?	Participant opinion about solutions.			x
Who should be the driver any such accessibility projects?	Main stakeholders in web accessibility			x

As an executive/a web staff member/senior manager, how do you stimulate/encourage/support the university's website to become more accessibility?	Own responsibility for improving web accessibility.			x
Do you have anything further you would like to add on web accessibility and Thai universities?	Respondent's comments about web accessibility in Thai universities.	x	x	x

Most of the interviews took around one hour to conduct and took place on the university campus, with the researcher using a digital voice recorder and notepad for data collection. Full analysis and discussion of the interview results are presented in chapters five and six.

### 3.4 VALIDITY AND RELIABILITY

When using quantitative and qualitative methods it is important to ensure, as much as is possible, that the research instruments and their application are done in manner that gives confidence as to the outcomes which can be drawn from the data collected (Golafshani, 2003). In terms of the research instruments used in this study, reliability was addressed as far as possible with the survey instruments by pre-testing the survey with expert non-study participants (i.e. people working in the Thai university sector) to identify any errors or problems with the survey itself or the questions posed within. Again, the expert testers were people who worked in Thai universities, however it was not a specific requirement that this had to be the work experience of participants. The experts should have an information technology background or be involved with university websites in some capacity. These expert testers were crucial in checking the reliability of the survey instrument in terms of its Thai language version, and also for the English->Thai translator to provide assurance that the Thai version of the survey had the same implicit meaning as the English version. In terms of survey data validity, any response that was less than 80% completed (i.e. less than 80% of the questions were answered by the participant) was excluded from the final analysis data set. In terms of the construct validity (Litwin, 1995) of the questions posed in the survey, i.e. the questions asked and the measures against which answers were gathered (ie Likert scale) two processes were undertaken to address this concern. Firstly, a large number of open-ended text response fields were provided in

the survey instrument to allow participants to clarify their responses or add more information, responses which were analysed to establish if the participant was actually answering the question in the desired context, especially the web accessibility and assistive technology questions. This was taken a step further in the face to face interviews, where more detailed probing questions were posed to interview participants to establish areas where ambiguity arose. As the later chapters will indicate, there did seem to be some instances where construct validity of the survey proved to be an issue, as respondents were giving answers which indicated that misconstrued the question being asked, once again, especially in terms of the web accessibility and assistive technologies concepts. It should perhaps be noted that these issues might not necessarily relate to the validity of the questions in the survey, but rather the complete lack of awareness of some respondents as to the concept of web accessibility and people with disabilities using the web. In hindsight, the researcher should have provided the English version of the survey instrument to local web accessibility experts (In Perth, Western Australia) and asked for feedback as to the clarity of the questions being asked.

The reliability of the manual and automated web assessment phase of this research was based primarily on evidence provided earlier in this chapter as to other researchers having used the same sets of tools and techniques, but with the addition of the 'Thai voice' add-on to NVDA. In terms of the reliability and validation of the web assessment, the main issue that affects all assess is the 'manual expert' evaluation phase. What defines an 'expert' and their ability to identify all errors that could impact on all users? The researcher, and the literature, feels that as there no set 'metric' against which expert evaluators can be tested and certified, that all such an 'expert' can do is be consistent in the manner in which they test pages, record their data and apply their automated tools.

### **3.5 ETHICS**

As data collection involved investigating a group of people it was important to take ethical issues into consideration from the beginning stages of the research activity (Paul, 2010). Moreover, ethical questions were

considered in such as personal disclosure, authenticity and problems of personal privacy through online data collection. Therefore, this research started with consent mechanisms for both the survey and interview phases. The survey recruitment email sent to each participant included full details of the research title, research aims and people involved in the research (student, supervisor, ethics officer) ensuring that each participant had a clear understanding of their role in the research. Participants were informed in the recruitment email that their responses would be de-identified in the final thesis analysis (via the use of the unique ID provided to each participant) and that their consent to participate was implied by clicking on the link to the survey instrument. Participants were assured that they could withdraw their participation at any time. In terms of the face to face interviews, a consent form was presented to each participant by the researcher before the interviews commenced, and again the participants were assured that their interview answers would be de-identified in the final thesis analysis.

This chapter shows the data analysis derived from the website evaluation methods as discussed in Chapter 3. These tests are based primarily on the Website Accessibility Conformance Evaluation Methodology (WCAG-EM) 1.0 (World Wide Web Consortium, 2008e). The methodology provides guidance for evaluating websites, such as selecting web accessibility evaluation tools and conformance claims in order to address the research questions. Website testing was conducted at two priority levels, WCAG 2.0 A and AA. This chapter contains descriptive results in order to explore the accessibility of university websites, in particular seeking an understanding of violations that occurred against WCAG 2.0 and its four principles of Perceivable, Operable, Understandable and Robust.

### 4.1 WEBSITE EVALUATION CHECKLIST AND SCORING METHOD

Website Evaluation checklists are applied from conformance claims of WCAG-EM 1.0 (Table 4-1). The results of the data collection include automatic tools and manual expert evaluation. For the purposes of this study the researcher has chosen to adopt two automated assessment tools namely, WAVE and SortSite. The researcher conducted automated and manual testing for each of the 50 university websites included in this study. The results are given according to the scoring method of 'Not Applicable', '0' and '1'. 'Not Applicable' applies when the webpage is not available on the university website so it should be counted as missing values. '0' score represents webpages that either pass the test or where errors are not able to be detected by the software due to the limitations of automated tools. A score '1' means a fail at that checkpoint.

Table 4-1 is a representation of the checklist mechanism that the researcher used during the data collection process. This checklist is largely adapted from that provided by the WCAG-EM documentation, though in the case of this research the tools used as part of the data collection have been added to the document. Table 4-2 shows an example of a completed checklist based on W3C's Before and After (BAD) website accessibility example.



Table 4-1: Website Evaluation Checklist

Website Evaluation						
Guidelines title:	WCAG 2.0					
Conformance level satisfied:	Level A and AA					
Page:						
Url:						
Date:						
WCAG 2.0 Principles and Guidelines	Level	Automatic		Comment	Manual	Comment
		WAVE	SortSite			
		Score	Score		Score	
1. Principle: Perceivable						
1.1. Text Alternatives						
1.1.1. Non-text Content -	A					
1.2. Time-based Media: Provide alternatives for time-based media						
1.2.1. Audio-only and Video-only (Prerecorded)	A					
1.2.2. Captions (Prerecorded)	A					
1.2.3. Audio Description or Media Alternative (Prerecorded)	A					
1.2.4. Captions (Live)	AA					
1.2.5. Audio Description (Prerecorded)	AA					
1.3. Adaptable						
1.3.1. Info and Relationship	A					
1.3.2. Meaningful Sequence	A					
1.3.3. Sensory Characteristics	A					
1.4. Distinguishable						
1.4.1. Use of Colour	A					
1.4.2. Audio Control	A					
1.4.3. Contrast (Minimum)	AA					
1.4.4. Resize Text	AA					
1.4.5. Images of Text	AA					
Total Score for principle 1						
2. Principle: Operable						
2.1. Keyboard Accessible						
2.1.1. Keyboard	A					
2.1.2. No Keyboard Trap	A					
2.2. Enough Time						

2.2.1 Timing Adjustable	A					
2.2.2. Pause, Stop, Hide	A					
2.3. Seizures						
2.3.1. Three Flashes or Below Threshold	A					
2.4. Navigable						
2.4.1. Bypass Blocks	A					
2.4.2. Page Titled	A					
2.4.3. Focus Order	A					
2.4.4. Link Purpose (In Context)	A					
2.4.5. Multiple Ways	AA					
2.4.6. Headings and Labels	AA					
2.4.7. Focus Visible	AA					
Total Score for principle 2						
3. Principle: Understandable						
3.1. Readable						
3.1.1. Language of Page	A					
3.1.2. Language of Parts	AA					
3.2. Predictable						
3.2.1. On Focus	A					
3.2.2. On Input	A					
3.2.3. Consistent Navigation	AA					
3.2.4. Consistent Identification	AA					
3.3. Input Assistance						
3.3.1. Error Identification	A					
3.3.2. Labels or Instructions	A					
3.3.3. Error Suggestion	AA					
3.3.4. Error Prevention (Legal, Financial, Data)	AA					
Total Score for principle 3						
4. Principle: Robust						
4.1. Compatible						
4.1.1. Parsing	A					
4.1.2. Name, Role, Value	A					
Total Score for principle 4						
Total Score						

#### 4.1.1 EXAMPLE WEB EVALUATION CHECKLIST

The World Wide Web Consortium (2014a) provides Easy Check as preliminary check before implementing WCAG-EM. Moreover, the check provides a simple definition and provides a 'Before and After Demonstration (BAD)

document which presents examples of inaccessible webpages. Figures 4 -1 shows an example of a BAD homepage which was used as an example of how scoring of web accessibility evaluations was performed as part of the data collection in this chapter.

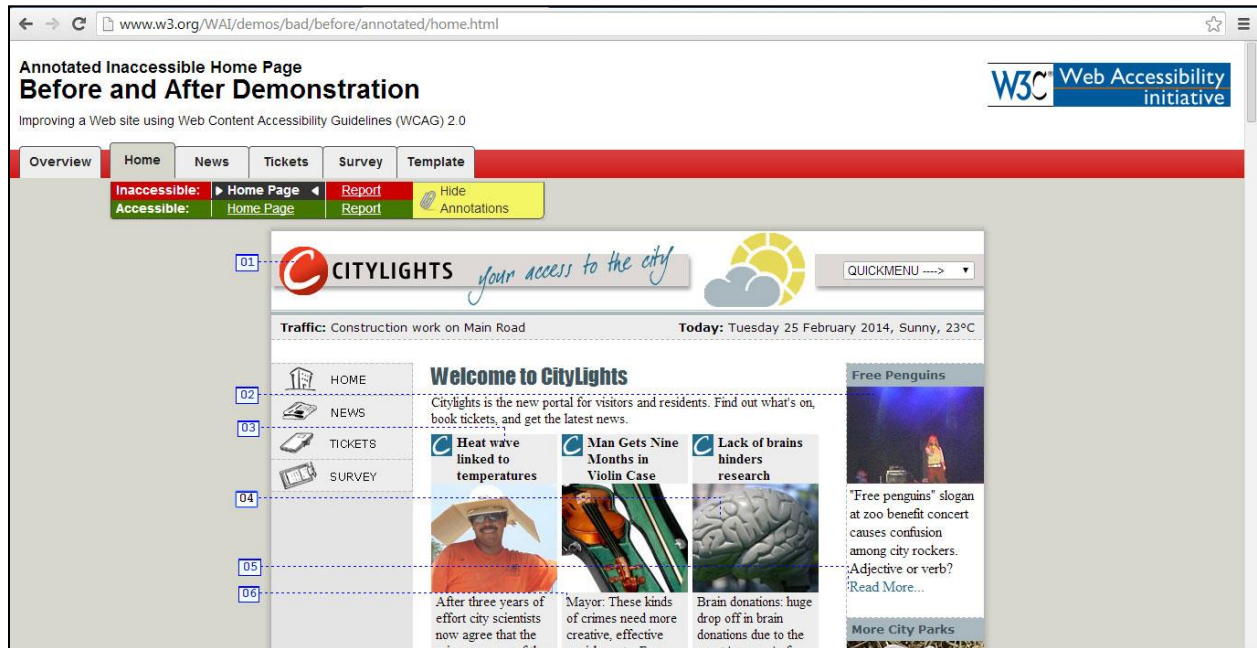


Figure 4-1: The Before and After Demonstration (BAD) homepage

### **Automatic testing**

For each of the sampled webpages, automated tools (WAVE and Sortsite) provide a full diagnostic test. The outcome is the accessibility violations of each webpage.

### **Manual expert testing**

For each of the sampled webpages, a manual expert full diagnostic test was applied for observing visual elements and coding elements to note violations against WCAG 2.0. Results were rechecked with software tools such as, NDVA with Thai language (Kanya), Colour Contrast Analyser and Adobe Acrobat X Pro (for PDF documents found on websites). The outcome gives the total accessibility violations for each page.

The results from each tool were kept completely separate after combining both manual and automated assessments in order to confirm accessibility violations on websites, the checklist for the BAD homepage is presented in Table 4-2.

Table 4-2: Example mapping WCAG violations (BAD homepage) into Website Evaluation Checklist

Website Evaluation						
<b>Guidelines title:</b>	WCAG 2.0					
<b>Conformance level satisfied:</b>	Level A and AA					
<b>Page:</b>	Before and After Demonstration (BAD) homepage					
<b>Url:</b>	<a href="http://www.w3.org/WAI/demos/bad/before/home.html">http://www.w3.org/WAI/demos/bad/before/home.html</a>					
<b>Date:</b>	12-Dec-13					
WCAG 2.0 Principles and Guidelines	Level	Automatic		Comment	Manual	Comment
		WAVE Score	SortSite Score			
<b>1. Principle: Perceivable</b>						
<b>1.1. Text Alternatives</b>						
1.1.1. Non-text Content -	A	1	1	IMG tags must have an ALT attribute.	1	Image such 123456789, Link and Form elements missing ALT.
<b>1.2. Time-based Media: Provide alternatives for time-based media</b>						
1.2.1. Audio-only and Video-only (Prerecorded)	A					
1.2.2. Captions (Prerecorded)	A					
1.2.3. Audio Description or Media Alternative (Prerecorded)	A					
1.2.4. Captions (Live)	AA					
1.2.5. Audio Description (Prerecorded)	AA					
<b>1.3. Adaptable</b>						
1.3.1. Info and Relationship	A	1	1	This form control has no associated LABEL element. Identify row and column headers in data tables using TH elements.	1	Images (Killer bees and Onions) are used as link but this structural information is not represented in the HTML code.

1.3.2. Meaningful Sequence	A				1	Using an HTML layout table. Three columns have not been built in logical order.
1.3.3. Sensory Characteristics	A					
<b>1.4. Distinguishable</b>						
1.4.1. Use of Colour	A					
1.4.2. Audio Control	A					
1.4.3. Contrast (Minimum)	AA					
1.4.4. Resize Text	AA		1	Use relative rather than absolute units in FONT SIZE attributes		
1.4.5. Images of Text	AA					
<b>Total Score for principle 1</b>		<b>2</b>	<b>3</b>		<b>3</b>	
<b>2. Principle: Operable</b>						
<b>2.1. Keyboard Accessible</b>						
2.1.1. Keyboard	A		1	Using only pointing-device-specific event handlers (including gesture) for a function.		
2.1.2. No Keyboard Trap	A					
<b>2.2. Enough Time</b>						
2.2.1 Timing Adjustable	A					
2.2.2. Pause, Stop, Hide	A					
<b>2.3. Seizures</b>						
2.3.1. Three Flashes or Below Threshold	A					
<b>2.4. Navigable</b>						
2.4.1. Bypass Blocks	A					
2.4.2. Page Titled	A					
2.4.3. Focus Order	A					
2.4.4. Link Purpose (In Context)	A	1	1	Each A tag must contain text or an IMG with an ALT tag.	1	Using null on ALT of image link. The collection of "Read More" link.
2.4.5. Multiple Ways	AA					

2.4.6. Headings and Labels	AA	1		Missing form label		
2.4.7. Focus Visible	AA		1	This field removes focus when tabbed to making it impossible for disabled users to navigate this form via the keyboard		
<b>Total Score for principle 2</b>		<b>2</b>	<b>3</b>		<b>1</b>	
<b>3. Principle: Understandable</b>						
<b>3.1. Readable</b>						
3.1.1. Language of Page	A	1	1	Use the LANG attribute to identify the language of the page.		
3.1.2. Language of Parts	AA					
3.2. Predictable						
3.2.1. On Focus	A		1	This field removes focus when tabbed to making it impossible for disabled users to navigate this form via the keyboard.		
3.2.2. On Input	A		1	SELECT lists cannot be operated from the keyboard if they have an ONCHANGE handler.		
3.2.3. Consistent Navigation	AA					
3.2.4. Consistent Identification	AA					
<b>3.3. Input Assistance</b>						
3.3.1. Error Identification	A					
3.3.2. Labels or Instructions	A	1		Missing form label		
3.3.3. Error Suggestion	AA					
3.3.4. Error Prevention (Legal, Financial, Data)	AA					
<b>Total Score for principle 3</b>		<b>2</b>	<b>3</b>		<b>1</b>	

<b>4. Principle: Robust</b>						
4.1. Compatible						
4.1.1. Parsing	A		1	This page has markup errors, causing screen readers to miss content.		
4.1.2. Name, Role, Value	A		1	This form control has no associated LABEL element. Identify row and column headers in data tables using TH elements.	1	Using null ALT on an image where the image is the only content in a link.
<b>Total Score for principle 4</b>		<b>0</b>	<b>2</b>		<b>1</b>	
<b>Total Score</b>		<b>6</b>	<b>11</b>		<b>5</b>	

According to the scoring method above, if the sampled webpage does not meet the checkpoints of WCAG 2.0 Level A and AA assessment then we give '1' score at the checkpoint for each tool (WAVE, Sortsite and Manual expert). For example, the webpage was tested by tools regarding the checkpoint 1.1.1 Non-text Content. The results confirmed that all tools could detect the error on the webpage due to missing 'ALT' attribute of image. Therefore, we give '1' for each tool (Figure 4-2).

Website Evaluation						
Guidelines title:	WCAG 2.0					
Conformance level satisfied:	Level A and AA					
Page:	Before and After Demonstration (BAD) homepage					
Url:	<a href="http://www.w3.org/WAI/demos/bad/before/home.html">http://www.w3.org/WAI/demos/bad/before/home.html</a>					
Date:	12-Dec-13					
WCAG 2.0 Principles and Guidelines	Level	Automatic		Comment	Manual	Comment
		WAVE Score	SortSite Score		Score	
<b>1. Principle: Perceivable</b>						
<b>1.1. Text Alternatives</b>						
1.1.1. Non-text Content -	A	1	1	IMG tags must have an ALT attribute.	1	Image such 123456789, Link and Form elements missing ALT.

Figure 4-2: Example of scoring against checkpoint 1.1.1 Non-text Content

After recording failing scores for each tool, the total scores of sampled websites were summarised on the researchers spreadsheet in order to observe the level of web accessibility on Thai university websites.

Kane et al. (2007) evaluated the accessibility of 100 international university websites using manual and automated tests across WCAG 1.0 priority 1,2 and 3. For the automated test, Kane and his colleagues arrived at the total of accessibility errors by combining all the violations found by Bobby and Cynthia in order to discover the average accessibility violations on each page. For this study, using a similar approach to Kane et al (2007), each page was checked three times, once by SortSite, once by WAVE and once as part of the manual expert assessment. The combined results of WAVE, SortSite and the manual expert were presented in order to reduce the number of false negatives and false positives from relying on a single tool (Brajnik, 2006; Vigo et al., 2013). For each page, the numbers of accessibility failures found by each of the tools were recorded and computed a combined total over the four POUR principles across the WCAG 2.0 checkpoints (level A and AA), and then converted these values to percentages of errors represented against each checkpoint.

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#### 4.1.2 WEB PAGES SAMPLING

The sample for the web testing was done on 50 Thai university websites. Choosing institutions from the top 46 Thai universities in 2013 which was ranked by the webometrics (Cybermetrics Lab, 2013). The Webometrics Ranking of World Universities is collects data on the web and measures aspects of websites such as the visibility and impact of web publications according to link analysis. Two distance education universities, one special institution for students with disabilities and one online university (which is more of a 'project' in online delivery than an actual university) because accessible online materials of those universities are important in the context of students with disabilities. The testing was done in the following order: WAVE, SortSite, and manual expert testing.

The automated evaluation tool would scan each page and report the number of errors found in two priorities (A and AA). Hackett & Parmanto (2010) suggest that accessibility evaluation should be limited to the homepage and level one of websites because of high accuracy results and saving resource management. As stated in the literature, the Website Accessibility Conformance Evaluation Methodology (WCAG-EM) 1.0 suggests that the



webpages are selected using a variety of approaches such as common webpages, essential functionality and types of webpages. For this reason, web evaluation in this study was conducted to scan pages at level one from the homepage and six selected pages as shown in Figure 4-3.

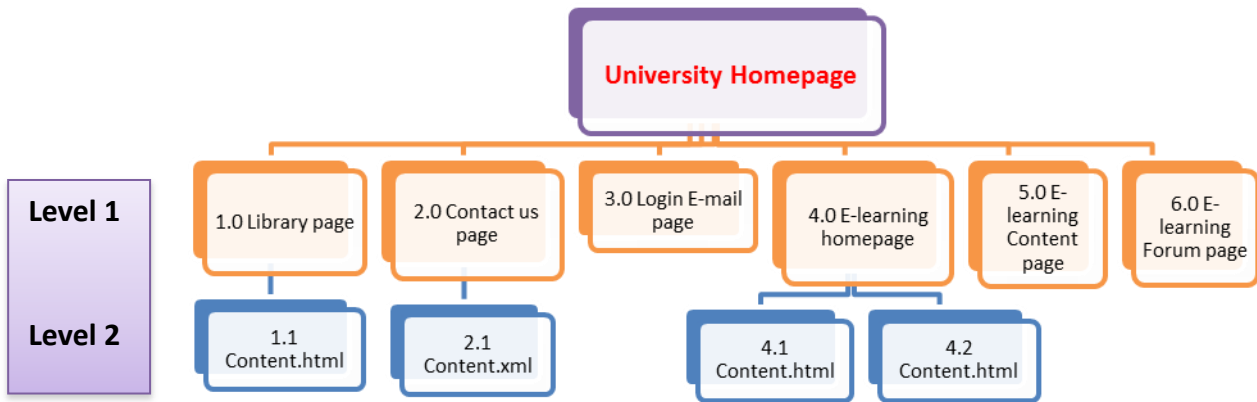


Figure 4-3 : Web testing method to scan pages

## 4.2 THE RESULTS OF AUTOMATIC AND MANUAL TESTING

A representative set of webpages are compared to 38 checkpoints in website evaluation regarding the POUR principles in WCAG 2.0.

### 4.2.1 MOST ACCESSIBILITY VIOLATIONS

The guidelines and success criteria are divided within WCAG2.0 into the *Perceivable*, *Operable*, *Understandable* and *Robust* principles. Each of these principles is important to users wishing to make use of the web as outlines:

**Perceivable** - Information and user interface components must be presentable to users in ways they can perceive. This means that users must be able to perceive the information being presented (it can't be invisible to all of their senses)

**Operable** - User interface components and navigation must be operable. This means that users must be able to operate the interface (the interface cannot require interaction that a user cannot perform) 4.2.1

**Understandable** - Information and the operation of user interface must be understandable. This means that users must be able to understand the information as well as the operation of the user interface (the content or operation cannot be beyond their understanding)

**Robust** - Content must be robust enough that it can be interpreted reliably by a wide variety of user agents, including assistive technologies. This means that users must be able to access the content as technologies advance (as technologies and user agents evolve, the content should remain accessible)

***If any of these are not true, users with disabilities will not be able to use the Web*** (World Wide Web Consortium, 2008d, para. 2).

Given the importance of these principles, and other research which has also mapped results against them (Conway, 2014), this analysis broke down the results according these POUR principles in order to identify accessibility problems within Thai university websites.

Table 4-3 : the number of success criteria in level A and AA under the POUR principles of WCAG 2.0

The POUR principles of WCAG 2.0	Level A	Level AA	% of total
Perceivable (P)	9	5	37
Operable (O)	9	3	32
Understandable (U)	5	5	26
Robust (R)	2	0	5
Totals	25	13	100

The POUR principles provide 38 success criteria across levels A and AA (Table 4-3). The Perceivable principle has the most checkpoints (37%), followed by the Operable principle (32%), the Understandable principle (26%), and finally the Robust principle (5%).

## The POUR Violations

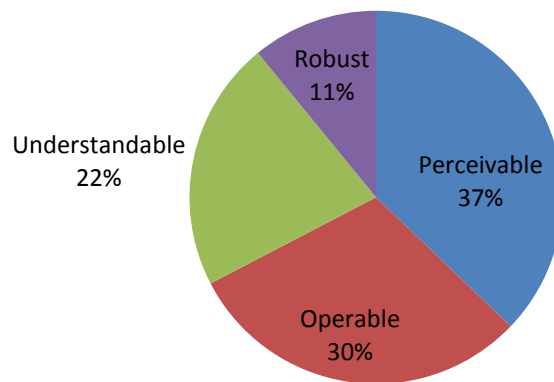


Figure 4-4 : Breakdown accessibility errors regarding the POUR principles of WCAG 2.0

Figure 4-4 displays the percentage of errors found on Thai university webpages regarding the POUR principles of *Perceivable*, *Operable*, *Understandable* and *Robust*. Most errors were found at *Perceivable* (37%) followed by *Operable* (30%), *Understandable* (22%) and *Robust* (11%). It can be seen that the failed score at the *Perceivable* principle was high, whilst the failed score at the *Robust* principle showed less problems. It may be because the *Perceivable* principle had the highest numbers of WCAG assessment points (37%), followed by *Operable* (32%), *Understandable* (26%) and *Robust* (5%) principles (Table 4-3). Luján-Mora (2013, para. 15) observed the top 10 web accessibility problems from thirteen sources, and found that the most common problems are:

1. Alternative text (alt attribute) missing or inappropriate.
2. Use of colour to convey information.
3. Lack of sufficient contrast between the foreground and background colour.
4. Complex forms or form controls not properly labelled.
5. Lack of headings to structure the content of the webpage.
6. Use of JavaScript in a non-accessible way.
7. Lack of keyboard support.
8. Multimedia content without an accessible alternative.
9. Lack of 'skip to main content' or 'skip navigation' links.

#### 10. Complex tables or tables without appropriate markup.

From the list above, it seems that the most common web accessibility problems were found at Perceivable (5 problems) followed by Operable (2 problems), Understandable (2 problems) and Robust (1 problem) principles. Therefore, the largest number of checkpoints regarding the Perceivable principle may lead to it having the highest failed score, which accords with the findings of Conway (2014). Perceivable content applies to the visual aspect of the website. It requires the content to be perceivable via sight, hearing or touch.

**Table 4-4: The most actual failures for each POUR principles**

The checkpoints of WCAG 2.0	Failed Scores	
	Frequency	Percent within principle
1.1.1 Non-text Content	675	28
...	...	...
<b>Total Perceivable</b>	<b>2379</b>	<b>100</b>
...	...	...
2.4.4 Link purpose (in context)	592	31
...	...	...
<b>Total Operable</b>	<b>1934</b>	<b>100</b>
...	...	...
3.1.1 Language of page	563	40
...	...	...
<b>Total Understandable</b>	<b>1391</b>	<b>100</b>
4.1.1 Parsing	372	53
...	...	...
<b>Total Robust</b>	<b>699</b>	<b>100</b>

Data in the table 4-4 are extracted from Appendix 9.1 which illustrates the total failed score of university websites regarding the POUR principles. The highest failed scores were found for each POUR principle: Perceivable (the checkpoint 1.1.1-Non-text Content with 28% of webpages), Operable (the checkpoint 2.4.4-Link Purpose with 31% of webpages), Understandable (the checkpoint 3.1.1 Language of Page with 40% of webpages) and Robust (the checkpoint 4.1.1-Parsing with 53% of webpages). The dataset indicates that Thai university websites have critical accessibility problems regarding ‘no alternatives for non-text information’, ‘loss of language on the webpage’, ‘incorrect web coding’. Therefore, the university websites failed to meet the minimum of WCAG assessment (Level A), resulting in:

**The checkpoint 1.1.1 Non-text Content:** All non-text content that is presented to the user has a text alternative that serves the equivalent purpose, except for the situations listed below. (Level A)

**The checkpoint 2.4.4 Link Purpose (In Context):** The purpose of each link can be determined from the link text alone or from the link text together with its programmatically determined link context, except where the purpose of the link would be ambiguous to users in general. (Level A)

**The checkpoint 3.1.1 Language of Page:** The default human language of each Web page can be programmatically determined. (Level A)

**The checkpoint 4.1.1 Parsing:** In content implemented using mark-up languages, elements have complete start and end tags, elements are nested according to their specifications, elements do not contain duplicate attributes, and any IDs are unique, except where the specifications allow these features. (Level A), states the World Wide Web Consortium (2008c).

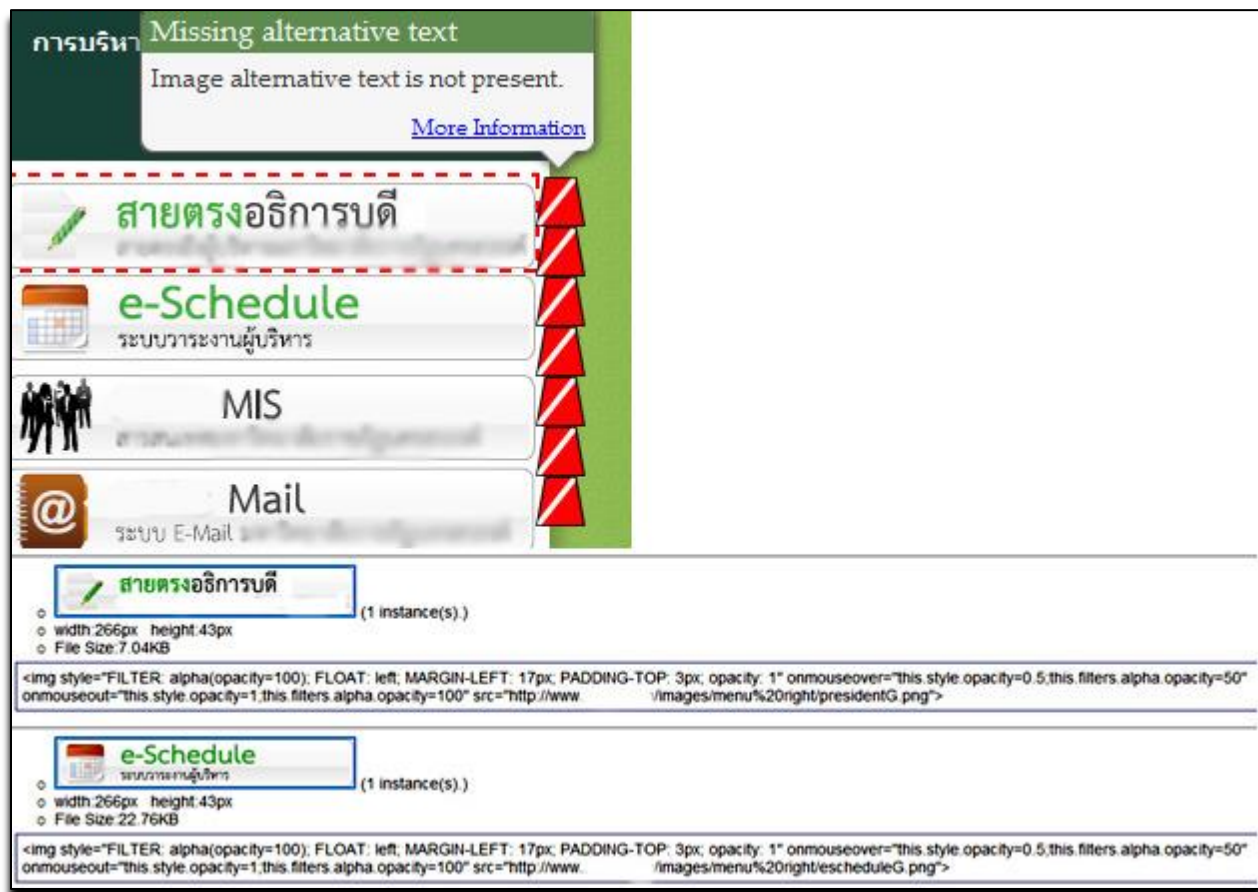


Figure 4-5: Example of Failure of Success Criterion 1.1.1 Non-text Content tested by WAVE from university 01

Figure 4-5 illustrates that the example of university webpage failed to meet the checkpoint 1.1.1-Non-text Content. The webpage contained images which had no 'ALT' attributes. If the webpage presents the image without ALT attribute or using null (ALT=""), Assistive Technologies (AT) such as screen readers will ignore those images. Whilst decorative images can have null ALT attributes, the example in Figure 4-5 has the entire image acting as a button, so that a null ALT attribute here means that users with visual impairments would not know how to contact the person in question.

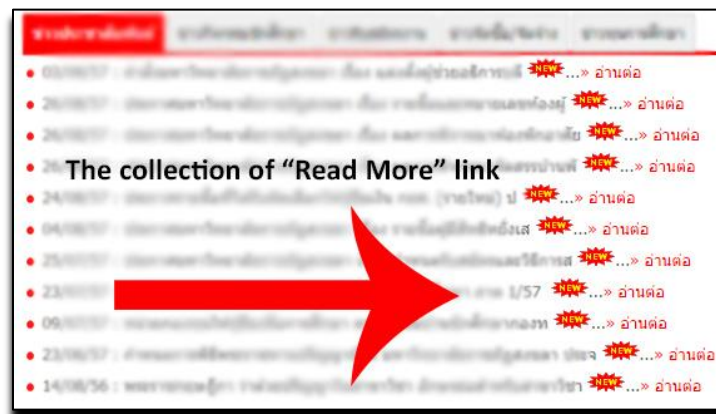


Figure 4-6: Example of a violation of success criterion 2.4.4 Link Purpose (In Context) from university 22

Figure 4-6 shows that the example of university webpage failed to meet the checkpoint 2.4.4 Link purpose due to the collection of 'read more' links that may confuse users with disabilities as to the destination of the links.

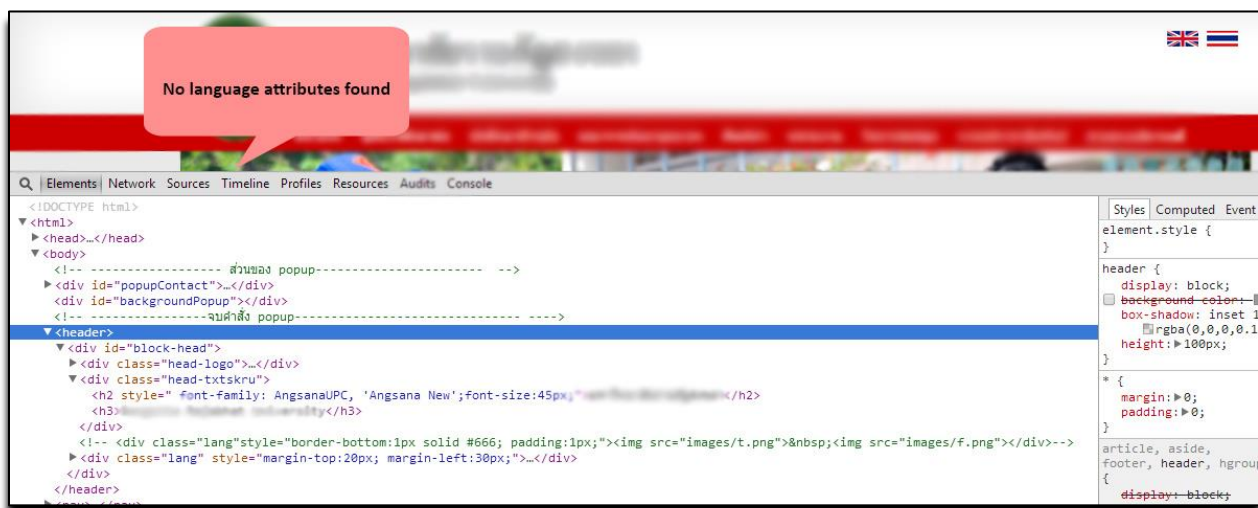


Figure 4-7: Example of a violation of success criterion 3.1.1 Language of Page from university 08

Figure 4-7 presents that the example of a university webpage not providing any language attributes; the page is written in Thai and English. When using some types of assistive technology, it is important for the tool to know the language of the webpage otherwise, the tool cannot load appropriate pronunciation rules.

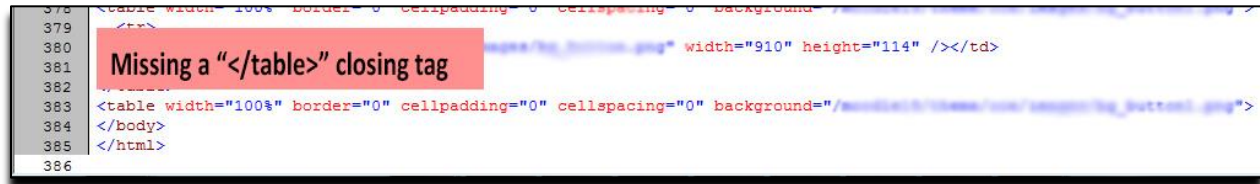


Figure 4-8: Example of violation of success criterion 4.1.1 Parsing from university 37

Figure 4-8 shows that the example of university webpage failed to meet the checkpoint 4.1.1 Parsing because the webpage is written with incorrect use of start and end tag elements on the page such as `<table>` `</table>`. Any such errors which would lead to a page not meeting html validation rules would in turn lead to a failure an automatic failure of 4.1.1.

The above are just a few representative examples from all the pages assessed via the manual expert approach, however these types of errors were extremely common across a majority of the websites and pages examined.

#### 4.2.2 RELATIONSHIPS BETWEEN UNIVERSITY CATEGORY AND ACCESSIBILITY COMPLIANCE

By looking at the collected data, the researcher compared the accessibility violations of university webpages across five factors: administration (private, public or autonomous university), size of university, course mode (common, online, special or open university), sitemap (university pages or e-learning pages) and the page purpose in order to explore the relationships between these variables and accessibility compliance. Figure 4-9 shows that this stage takes into account the number of errors found in the webpages by analysing the data:

- Step 1: Testing the hypothesis in order to find how variables might be related for each factor. The researcher tested the total accessibility violations of webpages across five different university variables (from Figure 4-9): administration, size, course mode, sitemap, and the purpose of the webpage. The results indicated any relationships identified between the accessibility violations found and type of university variable. However, where evidence of a significant relationship was found, only the presence of

the relationship could be determined, not why it existed. In such cases, a post hoc test (Step 2) was conducted in order to ascertain the cause of the relationship.

- Step 2: Comparing means ( $\bar{x}$ ) could determine where any differences lie between the variables. Salkind (2008, p. 238) states that *“the mean is the most often-used measure of central tendency and is usually defined as the sum of all the scores in a data set divided by the number of observations”*. Thus, the researcher breaks down the results into the average accessibility violations of university webpages by using means ( $\bar{x}$ ) in order to identify a key factor which has an influence on the violations.

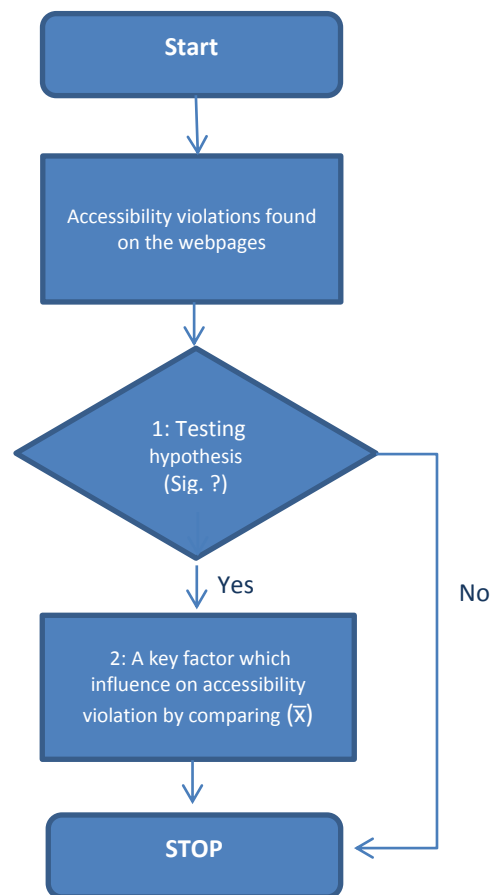


Figure 4-9 : Relationship testing process

Before testing, it is important to perform normality test in order to reject or accept the null hypothesis that the data come from a normally distributed population.

The assumption of normality in data sets is important as it dictates the methods that are appropriate for statistical tests, and it is risky to assume normality without actually testing for



it. Testing normality in data sets through graphical approaches generally works well if there are a moderate or large number of observations. However for small data sets, these graphs can be quite ambiguous and perhaps misleading in some cases... The most reliable method of testing normality is through statistical procedures such as the Kolmogorov-Smirnov (K-S) or the Shapiro-Wilk (S-W) normality tests. For each test the key column to observe is the “Sig.” column, which gives the p-values of the normality tests. If the p-value of the test is greater than 0.05, then we can assume that the data are normally distributed, states Lo (2012, p. 10).

Therefore, a test for normality was conducted for the total number of errors found on university webpages regarding the WCAG 2.0 assessment. When establishing the data normality, the hypotheses for each of these tests was written according to the formula below:

**H0:** The total number of errors found on university webpages was not significantly different than a normal population.

**H1:** The total number of errors found on university webpages was significantly different than a normal population.

**Table 4-5: Results of the normality tests on the total number of errors found on university pages against WCAG 2.0 assessment**

Tests of Normality						
	Kolmogorov-Smirnov <sup>a</sup>			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
TotalFailedScore	.142	872	.000	.947	872	.000

a. Lilliefors Significance Correction

Table 4-5 presents the results from the Kolmogorov-Smirnov Test and the Shapiro-Wilk Test. The compiled results showed that we rejected H0 and accepted H1 with p-values of the Kolmogorov-Smirnov and Shapiro-Wilk tests at  $0.000 < \alpha = .05$ . It can be interpreted that the total number of errors found on university webpages was significantly different from what might be considered a normal distribution of such errors. Therefore, we use nonparametric tests for analysing the data in this chapter (Conway, 2014).

#### 4.2.2.1 ACCESSIBILITY VIOLATIONS AND ADMINISTRATIVE STRUCTURE

According to data from the Office of the Higher Education Commission (2014), Thailand had 65 public universities, 16 autonomous universities and 41 private universities in 2014. The Thai Government had encouraged public higher education institutions to transform their status to autonomous universities. Both public and autonomous universities are funded by the Thai government however, private universities are all privately funded. Thus, universities can be categorised according to administrative structure. In order to investigate the administration type of the universities in this study, and whether that administration type has a relationship to the level of accessibility of its website, it is necessary to conduct a comparison between the university webpages and each administrative category in terms of WCAG 2.0 assessments. The number of sampled websites (50 sites) was broken down by administration category variable as shown in Table 4-6.

Table 4-6: Number and Percentage of Websites in Sample

Category	# of websites	% of total
Public	32	64
Private	10	20
Autonomous	8	16
Total	50	100%

From the data above, it can be seen that the number of university in sample were public 32 (64%), private 10 (20%) and autonomous 8 (16%) institutions respectively. An analysis was conducted to test the accessibility of webpages regarding WCAG 2.0 assessment.

The Kruskal-Wallis test is a nonparametric test and provides the comparison of more than two independent groups (Schmidt, 2010) and was used here to evaluate the webpages of public, private and autonomous universities and, the total accessibility violations for each. The hypotheses for these tests were written according to the formula below:

**H0:** There were no differences in the total failed score of public, private and autonomous university webpages.

**H1:** There were differences in the total failed score of public, private and autonomous university webpages.

**Table 4-7: Test statistics for the total number of violations according to university administration**

Test Statistics <sup>a,b</sup>	
	TotalScore
Chi-Square	1.140
df	2
Asymp. Sig.	.565

a. Kruskal Wallis Test

b. Grouping Variable: Sector

Table 4-7 demonstrates the total number of violations within the university webpages regarding the administration category. The results of this analysis indicate that there were not statistically significant differences in the failed scores of public, private and autonomous universities at  $\chi^2(2, N = 872) = 1.14, p = .57$ . Therefore, the alternative hypothesis (H1) is rejected and the null hypothesis (H0) can be accepted. It can be interpreted that there were no differences in the total number of violations of public, private and autonomous universities. Since there is no statistical difference in the number of accessibility violations of those university webpages, a post-hoc test was not necessary.

#### 4.2.2.2 ACCESSIBILITY VIOLATIONS AND UNIVERSITY SIZES

According to the annual report of Thailand's Office of the Higher Education Commission (2009), Thai public and autonomous universities are segmented by size, which corresponds to the annual subsidy received from the Thai government (Table 4-8). At the time of writing, the majority of the income for those universities comes from government sources. University income has become commonly used as the budget underpinning core teaching and learning, research and service activities. Therefore, we observe the impact of university size and budget on the accessibility of its website.

**Table 4-8: the higher Education Commission Standard**

University Size	The annual subsidy (Thai Baht)
Large	> billion
Medium	500 – 1,000 million
Small	< 500 million

The Kruskal-Wallis test was once again used to evaluate the webpages of small, medium and large universities and any relationships to their total accessibility violations. The hypotheses for these tests were written according to the formula below:

**H0:** There were no differences in the total failed score of small, medium and large university webpages.

**H1:** There were differences in the total failed score of small, medium and large university webpages.

Table 4-9: Test statistics for the total number of violations according to university size using the Kruskal-Wallis test

Test Statistics <sup>a,b</sup>	
	TotalFailedScore
Chi-Square	4.525
df	2
Asymp. Sig.	.104

a. Kruskal Wallis Test

b. Grouping Variable: university size

Table 4-9 presents the total number of violations on the university webpages regarding the category of university size. The results of this analysis indicates that there were no statistical significance in the total failed scores of small, medium and large university webpages at  $\chi^2(2, N = 654) = 4.52, p = .10$ . Therefore, the alternative hypothesis (H1) is rejected and the null hypothesis (H0) can be accepted. Once again, since there was no statistical difference in the number of accessibility violations of those university webpages, a post-hoc test was not necessary.

#### 4.2.2.3 ACCESSIBILITY VIOLATIONS AND COURSE MODES

Modern universities offer a number of flexible delivery options to students such as on-campus learning, distance learning, and totally online learning, supported via specially commissioned learning materials and other resources. Most Thai universities provide the on-campus mode of learning, however there are only two open universities and special institutions under the Higher Education Commission provision (Office of the Higher Education Commission, 2012). Therefore, we analysed the data regarding course mode as per the following Table 4-10.

Table 4-10: Type of university regarding the course mode category

Course modes	Definition
On campus	An institution provides primarily on-campus teaching and some online courses. Students are required to meet attendance standards in the on-campus mode.
Open	An institution provides offline and online courses. Students sometimes are required to be physically present on campus, such as when taking examinations.
Online	An institution provides all of its courses online.
Special	An institution provides special education for people with disabilities.

The Kruskal-Wallis test was applied to evaluate if the university course mode variable of on-campus, open, online and special in terms of the total number of violations for each of the websites. The hypotheses for these tests were written according to the formula below:

**H0:** There were no differences in the total failed score of the on campus, open, online and special webpages.

**H1:** There were differences in the total failed score of the on campus, open, online and special webpages.

Table 4-11: Test statistics for the total number of violations within course mode category

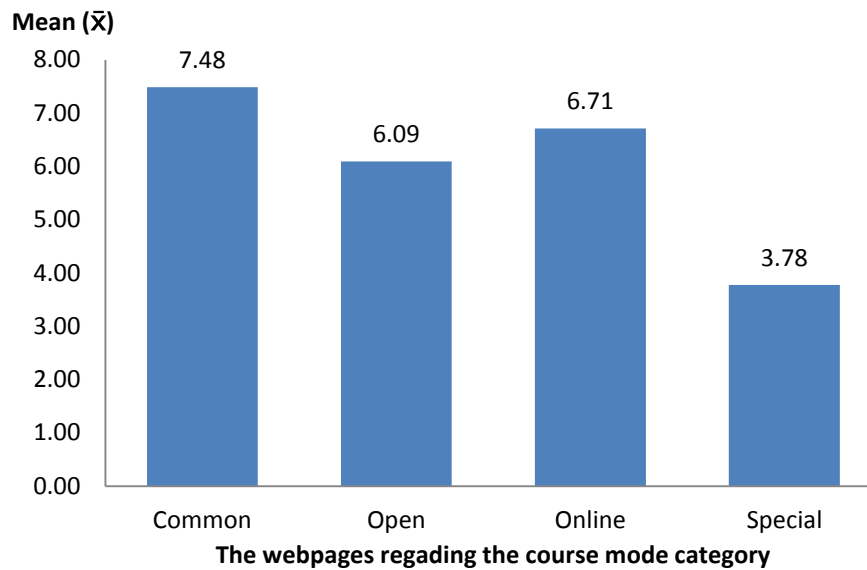
Test Statistics <sup>a,b</sup>	
	TotalFailedScore
Chi-Square	15.717
df	3
Asymp. Sig.	.001

a. Kruskal Wallis Test

b. Grouping Variable: CourseMode

Table 4-11 illustrates the total number of violations within the university webpages regarding the course mode category. The results of the analysis indicates that there were statistically significant differences in the failed score according to the on campus, open, online and special variables at  $X^2(3, N = 872) = 15.71, p = .00$ . The null hypothesis (H0) is therefore rejected and the alternative hypothesis (H1) can be accepted. It can be interpreted that the failed scores of the on campus, open, online and special webpages are differences. Since, there is

statistical difference in the total number of violations on different university course modes, a post-hoc test is necessary.



**Figure 4-10 : Violations per page against university type**

The researcher tested the failed score per page of the various course mode variables of: common, open, online and special groups (Figure 4-10). The highest scores were found on common university webpages ( $M = 7.48$ ,  $SD = 4.71$ ), followed by online ( $M = 6.71$ ,  $SD = 4.12$ ), open ( $M = 6.09$ ,  $SD = 4.33$ ) and special ( $M = 3.78$ ,  $SD = 3.040$ ) university webpages. In particular, the errors of the common university webpages ( $M = 7.48$ ) were higher than the special university ( $M = 3.78$ ) by 50 per cent and is one reason why 'there is statistical difference in the total number of violations on different university course modes ( $p < .05$ )' as shown in Table 4-11. Thus, it is possible to say that the common and online institutions demonstrated poor accessibility of their websites, while the special institution presented the greatest accessibility performance. Fuller, Bradley, and Healey (2004) confirm that institutions for students with disabilities are often committed to providing inclusive education, and thus the special institution in this study is more likely to provide accommodations for students with disabilities, including developing an accessible website and delivering accessible materials. In the case of the special university variable in this study, as well as higher levels of accessible site design and content, the special university was one of the few to have a stated policy on supporting students with disabilities. As later chapters of this thesis will indicate, this

one was of the few examples of strong accessibility commitment and awareness demonstrated by the target population of universities included in this study.

#### 4.2.2.4 ACCESSIBILITY VIOLATIONS AND THE SITEMAP CATEGORY

In order to examine the accessibility violation in Thai universities, the webpages were grouped by the categories: common i.e. main university webpages and e-learning webpages. The Mann–Whitney U test is a nonparametric test and is used to compare two independent samples (Hinton, 2010), or in this case, general university pages and e-learning webpages and their total violations. The hypotheses for these tests were written according to the formula below:

**H0:** There were no differences in the total failed score of the common and e-learning webpages.

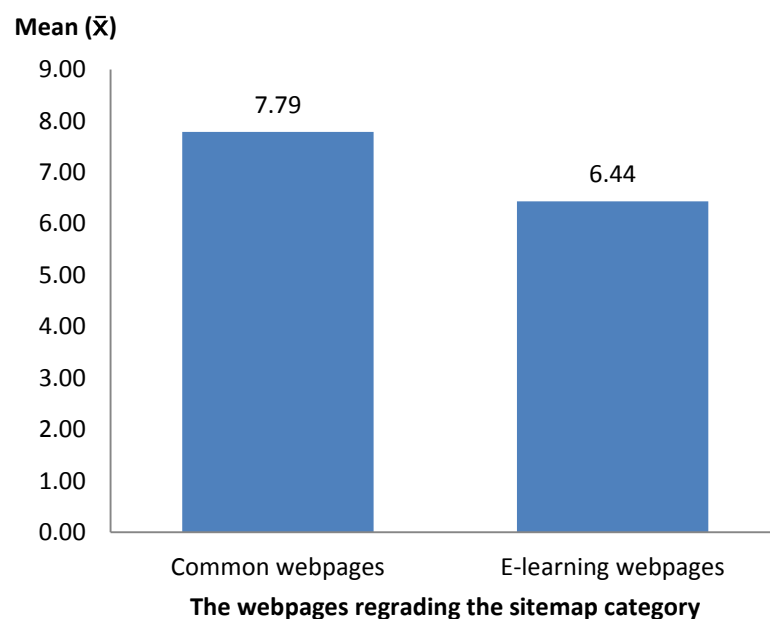
**H1:** There were differences in the total failed score of the common and e-learning webpages.

Table 4-12: Test statistics for the total number of violations within the sitemap category

Test Statistics <sup>a</sup>	
	TotalFailedScore
Mann-Whitney U	70445.000
Wilcoxon W	111773.000
Z	-3.875
Asymp. Sig. (2-tailed)	.000

a. Grouping Variable: Sitemap

Table 4-13 illustrates the total violations within the university webpages regarding the sitemap category. The results of the analysis indicates that there were statistically significant differences in the failed score of common and e-learning webpages at ( $U = 70445$ ,  $p = .00$ ), and therefore the null hypothesis (H0) is rejected and the alternative hypothesis (H1) can be accepted. It can be interpreted that the failed scores of the common and e-learning webpages are difference in terms of total violations.



**Figure 4-11: Violations per page against the sitemap category**

There were differences between the average errors of the common and e-learning webpages (Figure 4-11). In particular, the average error of common webpages ( $M = 7.79$ ,  $SD = 4.80$ ) was higher than the e-learning webpages ( $M = 6.44$ ,  $SD = 4.34$ ). The results indicate that the e-learning webpages are more accessible than the common webpages, and therefore the sitemap category has a major impact on the accessibility of websites. This is consistent with Laohajaratsang (2009) finding that Moodle and ATutor are the most popular Learning Management Systems (LMS) in Thai educational institutions. Tanya (2010) outlined that Moodle provides various accessibility features to increase the accessibility of a website. Hence, the accessibility features in Moodle is more likely to increase the accessibility of e-learning webpages. Another factor that may have been at play in this result is discussed in the next section, in that many of the homepages included in the common university category were very ‘busy’ in terms of images, animations and other visual media that can impact on accessibility outcomes.

#### 4.2.2.5 ACCESSIBILITY VIOLATIONS AND THE PURPOSE OF WEBPAGES

In order to identify accessibility issues in greater detail, it is necessary to analyse the webpages in relation to the page purpose. The Kruskal-Wallis test is used to evaluate the relationship between the page purpose of the seven selected pages per site in terms of total violations. The hypotheses for these tests were written according to the formula below:



**H0:** There were no differences in the total failed score of the webpages (university homepage, contact us, login email, library, e-learning homepage, e-learning forum, and e-learning content).

**H1:** There were differences in the total failed score of the webpages (university homepage, contact us, login email, library, e-learning homepage, e-learning forum and e-learning content).

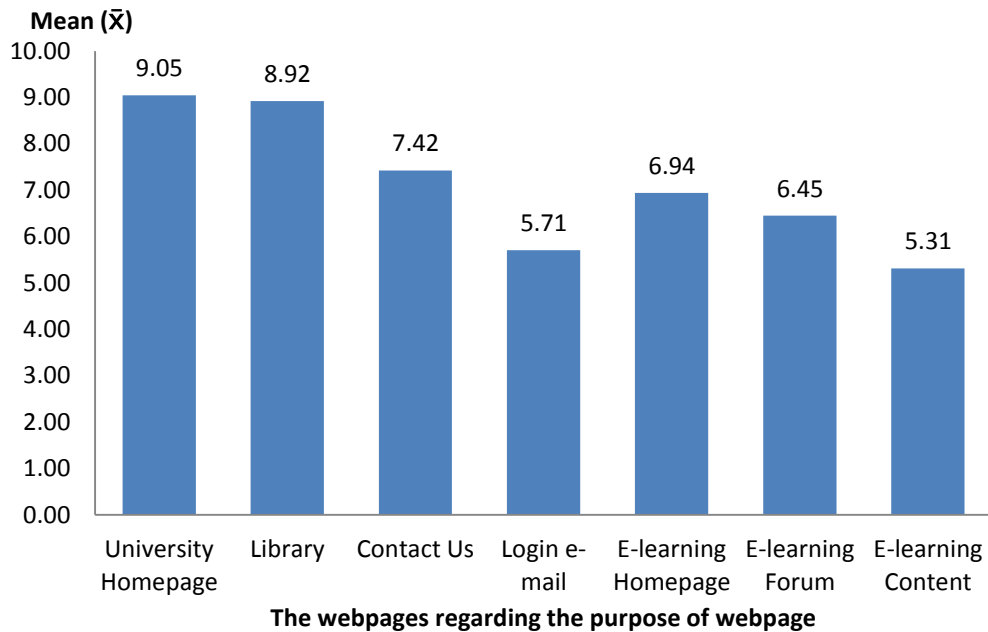
Table 4-13: Test statistics for total number of violations of webpages

Test Statistics <sup>a,b</sup>	
	TotalFailedScore
Chi-Square	58.601
df	6
Asymp. Sig.	.000

a. Kruskal Wallis Test

b. Grouping Variable: page

Table 4-13 demonstrates the total number of violations within the university webpages according to the purpose of webpage variable. The results of the analysis indicates there were statistically significant differences in the total failed scores of the webpages regarding the webpage's category at the total failed score,  $\chi^2(6, N = 872) = 58.60, p = .00$ . Therefore, the null hypothesis (H0) is rejected and the alternative hypothesis (H1) can be accepted. It can be interpreted that the total failed scores of the webpages (university homepage, contact us, login email, library, e-learning homepage, e-learning forum, and e-learning content) indicate differences.



**Figure 4-12: Violations per page against the webpages regarding the purpose of webpage**

Looking at the average of errors, the highest errors were found at the university homepage while, the e-learning content was the lowest (Figure 4-12). In particular, the university homepage had the highest score at 9.05 ( $SD = 5.35$ ) followed by library ( $M = 8.92$ ,  $SD = 5.23$ ), contact us ( $M = 7.42$ ,  $SD = 4.34$ ), e-learning homepage ( $M = 6.94$ ,  $SD = 4.47$ ), e-learning forum ( $M = 6.45$ ,  $SD = 4.02$ ), login email ( $M = 5.71$ ,  $SD = 3.23$ ) and e-learning content ( $M = 5.31$ ,  $SD = 4.37$ ). Thus, the results indicate that the different purposes of the webpages influence its accessibility and that the university homepage and library pages presented the most accessibility issues. As stated above for the university homepages this could be a result of the large amount of animations, images, slide carousels and links that were present, but not implemented in an accessible way. Even the library pages tended to be image heavy, with images of books, links to books and then search forms for books. The login pages had only two or three form fields for the login process, thus presented fewer overall opportunities for errors to occur. The contact us pages also presented user forms, but as these forms tended to have more form field items, thus the mean of reported errors tend to be higher.

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#### 4.2.3 THE BEST AND WORST GROUPS OF UNIVERSITY WEBSITES

The university websites were then divided into two groups based on mean ranking: the best and worst groups. A group is created to represent the level of accessibility performance of those websites, as measured by the highest and lowest mean scores (Appendix 9.2). An analysis was conducted to test the accessibility of webpages regarding the POUR violations. Detailed assessment results for each group are available in Table 4-14 below.

**Table 4-14: Mean values of the top 5 best and worst university websites**

The best university websites				The worst university websites			
Ranks	University code	Mean	Std. Deviation	Ranks	University code	Mean	Std. Deviation
1	Uni45	3.78	3.04	50	Uni21	10.07	5.599
2	Uni40	5.5	3.761	49	Uni31	10	5.444
3	Uni29	5.56	4.949	48	Uni1	9.29	5.071
4	Uni8	5.75	3.671	47	Uni33	9.14	4.84
5	Uni22	5.81	3.919	46	Uni14	8.72	4.099

By comparing the mean scores ranked from 1 (best) through to 50 (worst), we found that the worst group had a higher score which was at least two and half times the mean number of reported errors of the best university. For example, the average mean of errors for Uni45 was at 3.78 ( $SD = 3.04$ ) compared to Uni21, which was at 10.07 ( $SD = 5.59$ ). It should be noted that Uni45 was one that specialised in providing educational services to students with disabilities.

It is critical to note however that rankings, whilst informative of the gaps in performance between best and worst institutions in terms of accessibility, does not tell the most important story, which is that not one of the 50 institutions included in this study achieved even WCAG 2.0 Level A compliance for any website or web page.

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#### 4.2.4 CRITICAL FAILURES

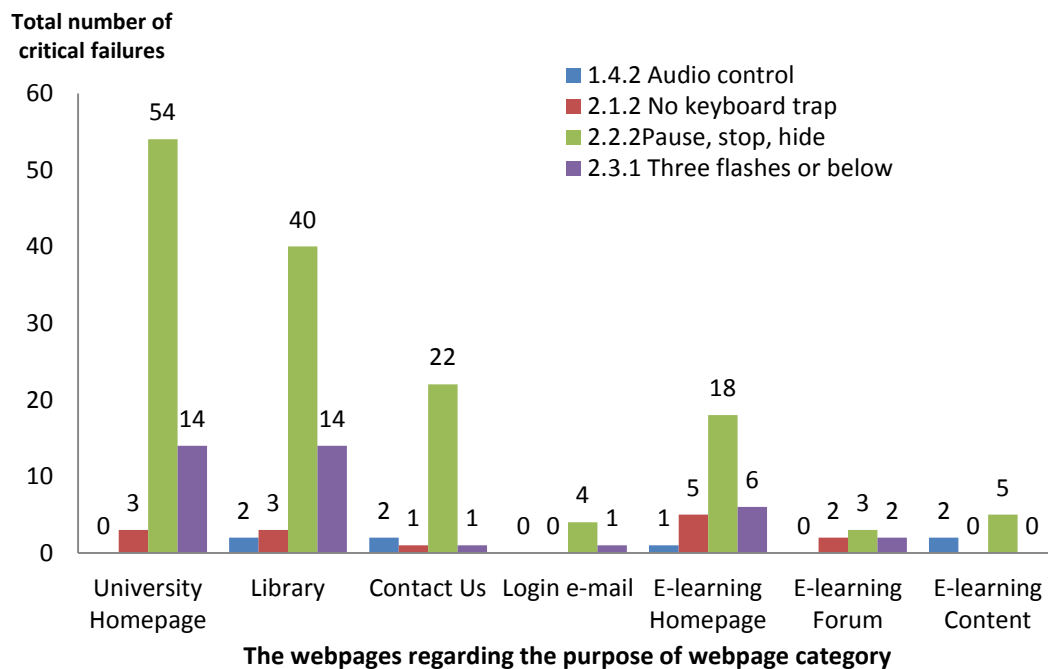
World Wide Web Consortium (2008b) states that any unsupported accessibility technologies can be used as long as they do not prevent users from using the webpage. This means the technologies must be supported by user agents such as assistive technologies to access and reveal any content on websites for users. The failure in the

following success criteria in WCAG 2.0 can lead to inaccessibility of the website, and what is defined as a ‘critical failure’ (Table 4-15).

**Table 4-15: The critical failures of WCAG 2.0 guideline**

Critical failures regarding WCAG 2.0 guidelines	
1.4.2	Audio control
2.1.2	Keyboard trap
2.2.2	Pause, stop or hide for moving content
2.3.1	Three flashes or below threshold

Therefore, the researcher felt it necessary to break down the test results according to critical failures. Each university webpage was evaluated on four checkpoints across the following two factors: sitemap and the purpose of webpages.



**Figure 4-13: Breakdown of violations within critical failures**

Figure 4-13 above presents the total critical failures grouped by the purpose of webpage category. Overall, all university webpages containing critical failures had at least one error. The most common critical failure was found at checkpoint 2.2.2 (Pause, stop, hide) and the least common was found at checkpoint 1.4.2 (Audio control). Moreover, the university homepage had the largest number of failures in this context, whereas the smallest

number was at the login page. It was interesting that the contact us page had quite a high number of issues against 2.2.2, which appeared to be caused in part by quite a heavy reliance animation, images and even embedded Google Maps to indicate contact methods for the university in question (Figure 4-14).

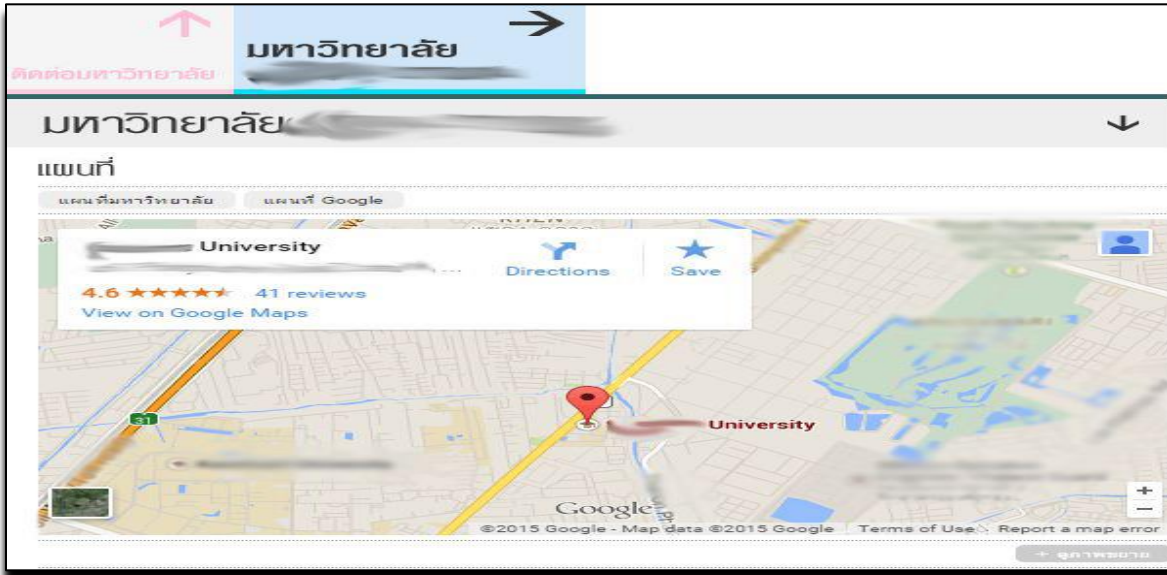


Figure 4-14 : Example of violation of success criterion 2.2.2 (Pause, stop, hide) on university 02

Overall though, this data indicates that the entry point to most of these universities, ie their homepages, would not present users with disabilities with a positive accessibility experience upon arrival at the university's website. Figure 4-15 demonstrates an example of violations on the university homepage regarding the checkpoint 2.2.2 (Pause, Stop, Hide), in this case, the page containing blinking content which move automatically for more than five seconds or are updated automatically without allowing users to control that action.

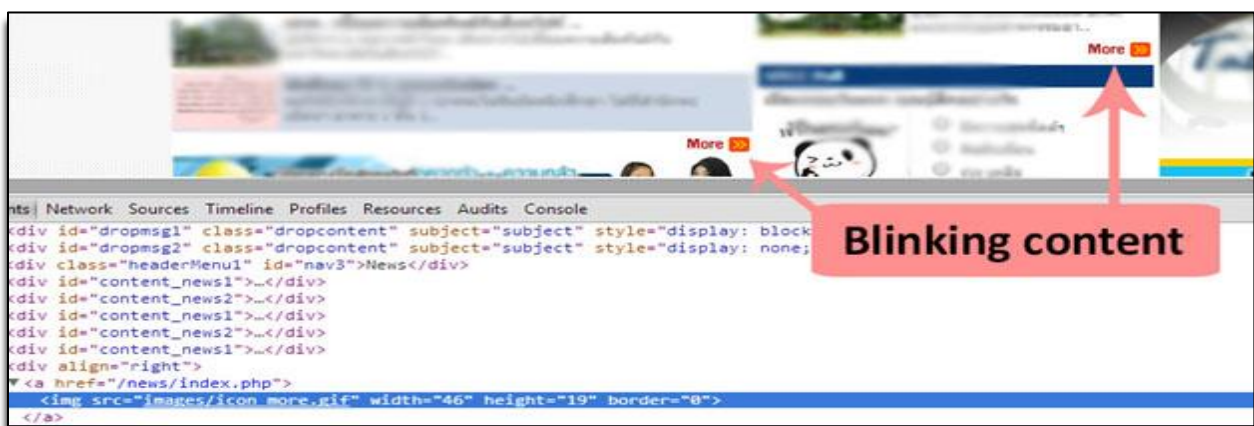


Figure 4-15: Example of violation of success criterion 2.2.2 (Pause, stop, hide) on the university homepage

#### 4.2.4 DOCUMENT ACCESSIBILITY

Websites provide information in many forms, such as images, text and documents electronic documents, including PDF, Word and PowerPoint documents. WCAG 2.0 provides techniques to support PDF as well as Microsoft Word documents, with both document types largely being able to be authored in an accessible way when using correct techniques (Bohman, 2004; Green & Huprich, 2009; Peters & Bradbard, 2010). Due to the issue that electronic documents can pose in terms of accessibility, the researcher broke down the results to identify where issues existed in terms of accessible electronic documents Thai on university websites.

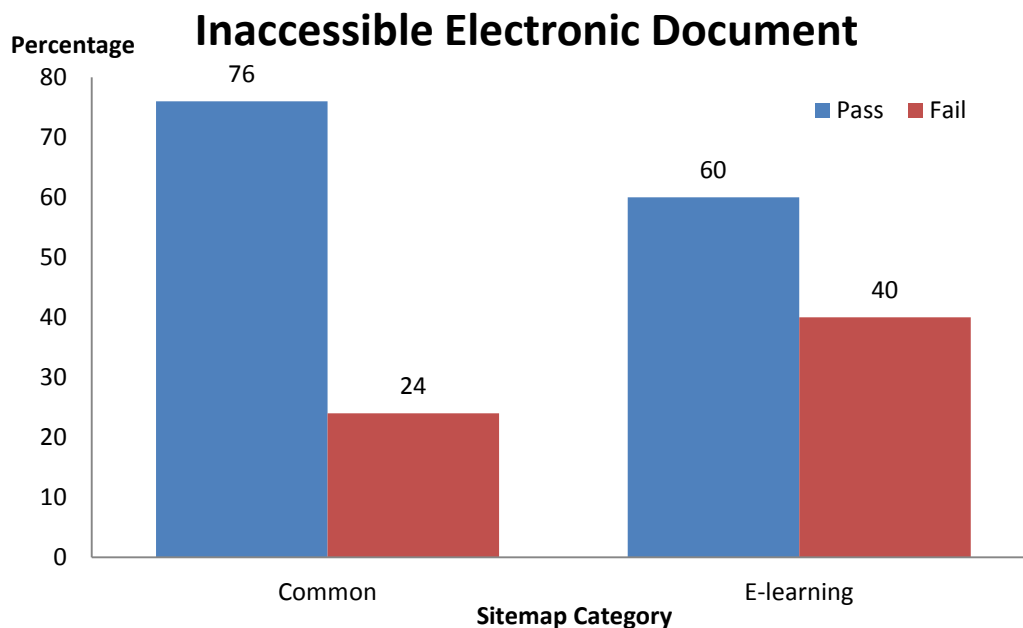


Figure 4-16: The percentage of accessible electronic document on the webpages

Figure 4-16 illustrates the percentage of accessible electronic documents for university webpages grouped by the sitemap category: common and e-learning webpages. Overall, the percentage of inaccessible electronic documents for the e-learning webpages was higher than the common webpages. In terms of electronic documents which were deemed to be inaccessible (via keyboard and screen reader) 40% were within the e-learning category whilst only 24% of the common page electronic documents tested as inaccessible.

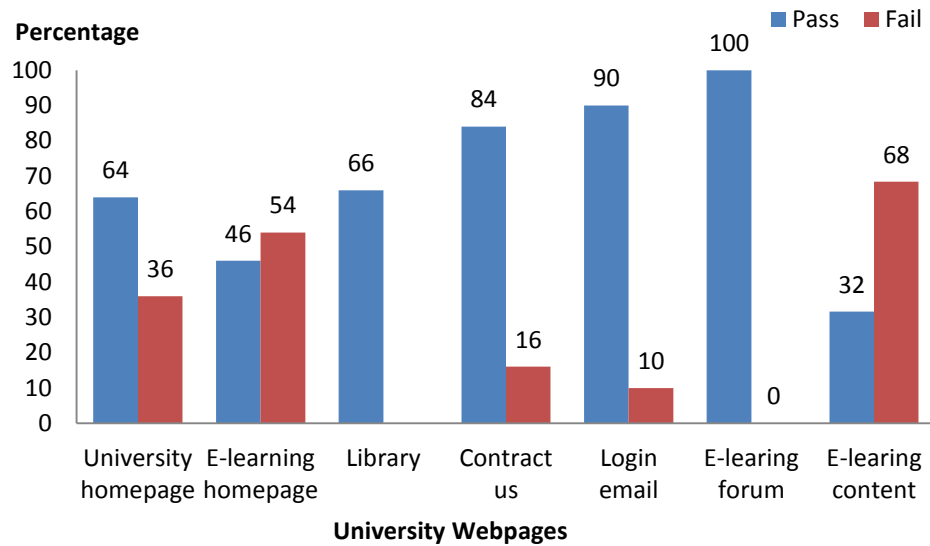


Figure 4-17: Breakdown of violations within inaccessible electronic documents

Figure 4-17 shows the percentage of inaccessible electronic documents for university webpages grouped by the purpose of webpage rather than just by sitemap category. Whilst Figure 4-17 shows the breakdown in a little more detail, it is perhaps unsurprising that most of the errors appeared in documents contained in the e-learning aspects of the sites examined.

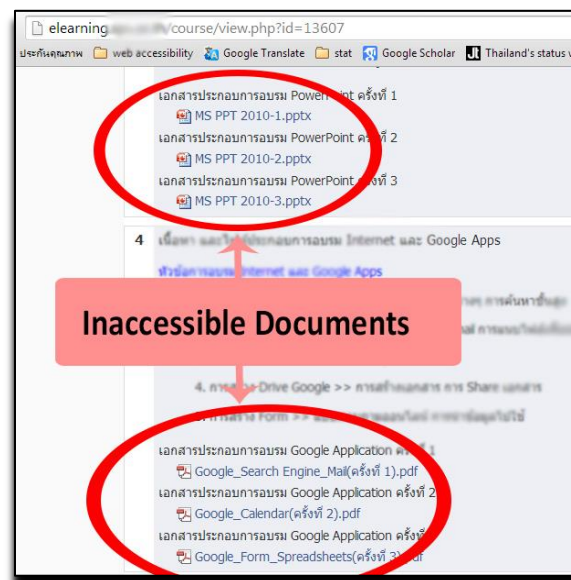


Figure 4-18: Example of inaccessible documents on the e-learning content page

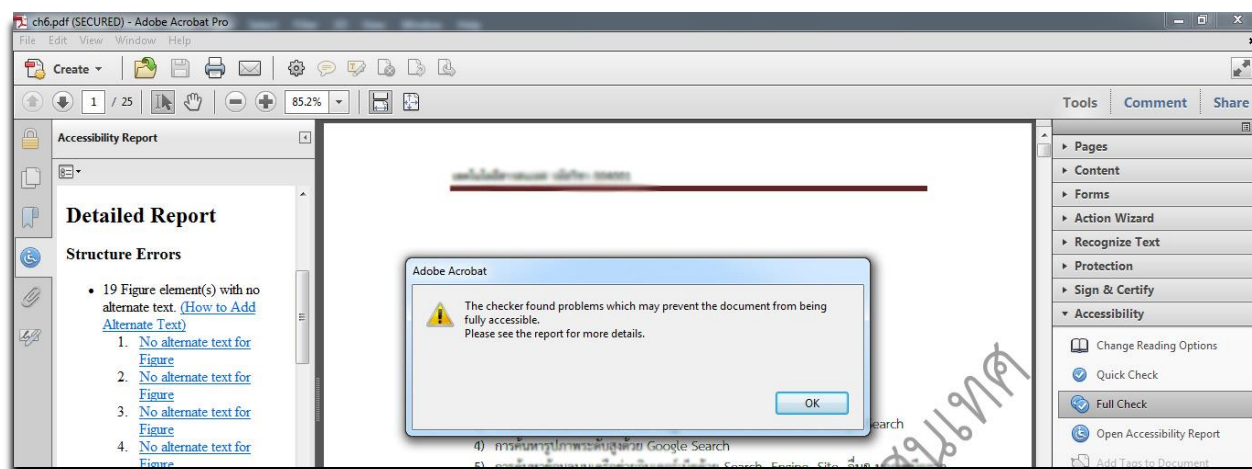


Figure 4-19: Example of inaccessible PDF documents to be tested by Adobe Acrobat X Pro

The researcher feels that this is an interesting finding, in that earlier it was shown that the e-learning areas of universities were seen as more accessible than other parts of the website, perhaps due in part to the use of LMS tools which supported some level of accessible design, however the content of the e-learning pages was lower. This seems to be linked to the number and variety of documents available across these pages, as well as the lack of awareness of document authors to accessibility design principles (as demonstrated in chapters five and six).

#### 4.2.5 SUMMARY OF WEBSITE TESTING

The data presented in this chapter shows that web accessibility is not inherent in Thai university websites, and that whilst errors and violations exist across a number of website categories and seemed linked to a number of variables, ultimately none of the examined pages met even the basic levels of WCAG 2.0 accessibility compliance. Even though this outcome became apparent early in this chapter, the full set of tests and analysis were presented in order to demonstrate that a thorough and rigorous process was followed to identify not just a lack of conformance, but what the distribution of errors was across the tenets of the POUR.

Whilst initially these results might be construed by the casual reader as being disappointing and somewhat of an indictment on the Thai university system in terms of their website quality, the following chapters will provide what this researcher believes to be the social, political and policy context to the results shown above.



This chapter presents the qualitative instruments utilised in this study, namely survey and interview instruments that were designed to explore the levels of awareness of website accessibility amongst Thai university staff. As chapter three outlined, the web based surveys were run concurrently with the automated and manual website assessments, whilst follow up interviews were conducted after initial analysis of the survey and assessment results. The data collected via the surveys and interviews was always designed to contextualise, and where possible, explain the findings of the automated and manual website assessment results. The core themes of this chapter are awareness and attitudes, both in terms of accessibility concepts and attitudes to the support of students with disabilities in the Thai university system. The Surveys targeted three staff types within the Thai university sector, namely lecturers (as content providers), web staff (as content providers and website facilitators) and senior managers (those responsible for university policy and overall student support).

### 5.1 WEB SURVEY DATA

The questions in the web surveys were designed to gain an understanding of understand the respondents' experiences and attitudes towards the accessibility of the e-learning and university websites contained within their institution. The web surveys were sent to the participant's email, these emails being identified via publically available university websites. The survey mechanism used for the delivery of the web surveys and subsequent data collection was the Qualtrics online web survey management tool.

The surveys were online for approximately 14 weeks. Of the three targeted groups: lecturer, senior manager and web staff, 416 surveys were actually emailed out, of which 115 were returned with usable information. The results of the surveys were divided into four sections: personal details, university website and e-learning experiences, experiences/attitudes about accessibility, and open-ended questions, each of which was contextualised according

to staff type. As a consequence of the survey data analysis, a number of key themes emerged which the researcher then explored further via a number of in-depth interviews with selected participants.

#### 5.1.1 PART ONE: PERSONAL DETAILS

Demographic questions collected data about the characteristics of the participant population in terms of gender, age, position or roles within the participant's university, work experience, academic rank, teaching disciplines, and web staff job titles and highest level of qualifications.

**Table 5-1: Gender and age**

Gender and age	18-35 yrs	36-50 yrs	51-60 yrs	60+ yrs
Male	21	24	6	4
Percent within group	38%	44%	11%	7%
Female	24	27	8	1
Percent within group	40%	45%	13%	2%
<b>Total</b>	<b>45</b>	<b>51</b>	<b>14</b>	<b>5</b>

From Table 5-1, it can be seen that most of the respondents were between the ages of 36 and 50. Most of the males were between 36 and 50 (44%) years of age and most of the females (45%) were in the same age range. The second most common age range for university staff was 18-35 years, with 38% of males and 40% of females, followed by 51-60 years, and over 60 years. This table also indicates that a majority university staff were middle-aged, with an almost even split in gender until the 60+ age group. In terms of this study, it was pleasing to find an almost equal gender balance in respondents, without bias towards one gender or the other, whilst having a strong representation of staff members in what might be considered an 'internet generation' age range (ie 18-50 years old).

Table 5-2: Position (role) at university

Position at university	No. of questionnaires	
	Sent	Returned
Lecturer	147	62
Percent within group	35%	54%
Web staff	215	34
Percent within group	52%	30%
Senior manager	54	19
Percent within group	13%	16%
<b>Total</b>	<b>416</b>	<b>115</b>

Table 5-2 presents respondents' positions or roles within their university. A total of 416 surveys were sent within the three groups, including 215 to web staff, 147 to lecturers and 54 to senior managers. Of the 115 completed responses, 54% were from lecturers, 30% from web staff and 16% from senior managers. This indicates a 42% response rate from the targeted lecturer population, a 15% response rate from the web staff population and a 35% response rate from targeted senior admins. Whilst the response rate for the latter groups could have been better, a 42% response rate from the lecturer population was a positive result given that this group in particular could be considered as being at the 'coal face' of teaching and learning interactions with students.

Table 5-3: Work experience

Length of work experience	1 - 5 Yrs.	6 - 10 Yrs.	11-15 Yrs.	15+ Yrs.
Lecturers	24	16	5	17
Percent within group	39%	26%	8%	27%
Web staff	8	15	7	4
Percent within group	23%	44%	21%	12%
Senior managers	3	9	2	5
Percent within group	16%	47%	11%	26%
<b>Total</b>	<b>35</b>	<b>40</b>	<b>14</b>	<b>26</b>

With regards to the working experience of respondents, Table 5-3 indicates that more than a third of the lecturers had 1-5 years of experience (39%), whilst nearly half of the web staff (44%) and senior managers (47%) had 6-10 years of experience. Overall, this data indicates that findings from these surveys primarily came from Thai university staff with a reasonable level of work experience in their field.

Table 5-4: Lecturer academic rank

Academic rank of lecturers	Frequency	Percentage
Associate Professor	3	5%
Assistant Professor	8	13%
Lecturer	51	82%
<b>Total</b>	<b>62</b>	<b>100%</b>

The distribution of academic rank of the participating lecturers is shown in Table 5-4, with the highest number of respondents in the rank of lecturer (82%), followed by assistant professor (13%), and then those in the rank of associate professor (5%). In the Thai university system, lecturers primarily teach though in some universities they might also do some research. Assistant professors teach as well as conducting some regular research, whilst associate professors are considered research intensive. All three rankings were targeted in this study so as to primarily get the lecturers and assistant professors perspectives from their teaching experience, but with some added views of those conducting research, especially if it was in the field of e-learning or information and communication technologies (ICT).

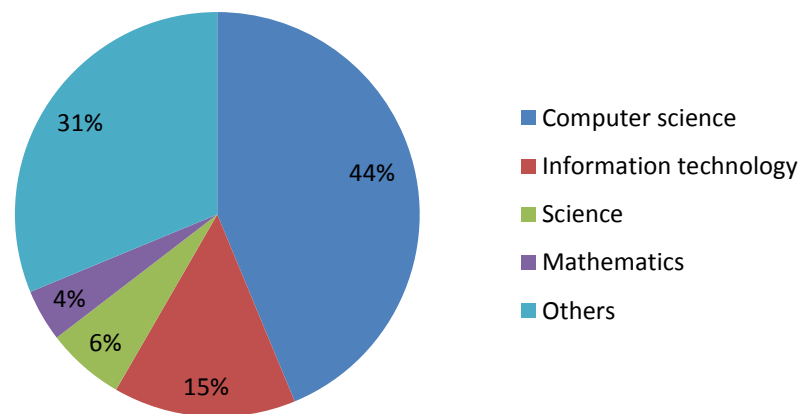


Figure 5-1: Teaching disciplines

Results in Figure 5-1 indicate that more than half of the lecturers are teaching in computer science or ITC related fields. Approximately a third of the responding lecturers teach in 'other' areas. Though overall the data indicates that the respondents have computing knowledge which in turn should have assisted these participants in understanding the technical issues relating to web accessibility.

Table 5-5: Web staff – highest level of qualifications

Highest level of qualifications for web staff	Frequency	Percentage
Master's degree	12	35%
Bachelor's degree	19	56%
Certificate	0	0%
Other such PhD and doctorate degrees	3	9%
<b>Total</b>	<b>34</b>	<b>100%</b>

Table 5-5 shows the distribution of levels of educational qualifications for web staff and that more than half of the web staff hold bachelor level degrees (56%) followed by master's degrees (35%) and other degrees such as doctoral degrees (9%). Whilst not crucial in the overall context of this research, this data indicates that the web staff, those responsible for maintain websites and assisting in the development of web based content, have some level of formal education that has led to their employment.

Table 5-6: Web staff – job titles

Job titles of web staff	Frequency	Percentage
Web Designer	7	20.5%
Web Programmer	3	9%
Database Administrator	1	3%
Web Project Manager	7	20.5%
Other	16	47%
<b>Total</b>	<b>34</b>	<b>100%</b>

Table 5-6 demonstrates the job description of web staff, where it can be seen that there is a large number of 'other' job titles (47%) which included help desk, classroom support, and academic technology consultant. The second most common job titles were web project manager (20.5%) and web designer (20.5%), followed by web programmer (9%) and database administrator (3%). This data confirms that the roles the web admin participants were typically performing were the technology and teaching support roles for which their staff type was originally included in this study.

Overall, the participants in this study were middle aged or younger, were working in a technology related area and were university educated.

### 5.1.2 PART TWO: EXPERIENCES WITH USING THE UNIVERSITY WEBSITE/E-LEARNING SITE

This section presents participant experiences regarding e-learning and online materials within their institution's websites. There were three parts in this section: common questions, senior manager experiences, and lecturer and web staff experiences. Close-ended questions were provided in this section. Importantly, some close-ended questions include multiple responses, such as checklists, ranking questions and rating scales.

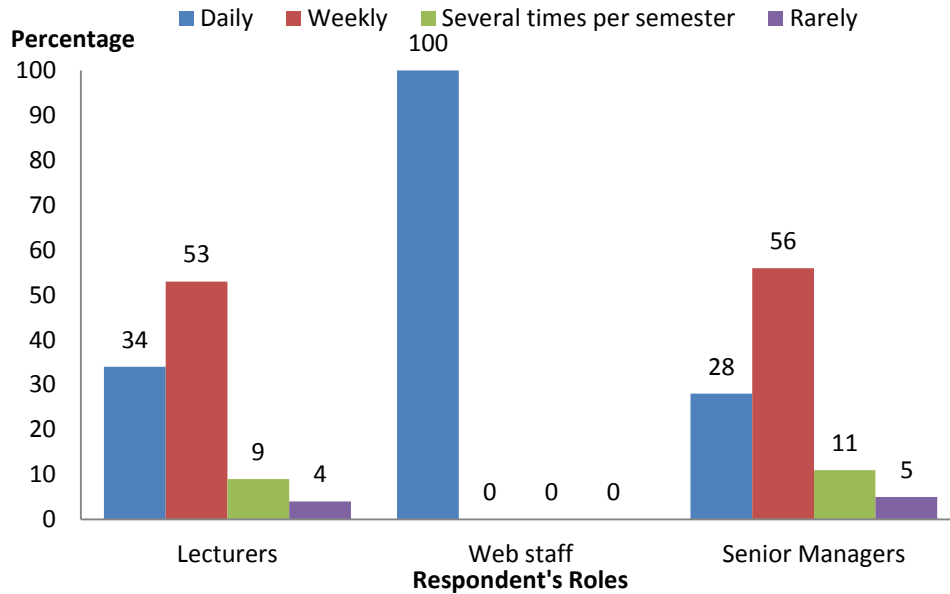
#### 5.1.2.1 COMMON QUESTIONS ABOUT UNIVERSITY WEBSITES AND E-LEARNING

Common questions were asked to all respondent groups about attitudes and experiences with using the university websites and e-learning site in order to compare results between the groups.

Table 5-7: Using the university website / e-learning as a part of the job

Using the university website and e-learning site	Yes	No
Lecturers	60	2
Percent within group	97%	3%
Web staff	34	0
Percent within group	100%	0%
Senior managers	18	1
Percent within group	95%	5%
<b>Total</b>	<b>112</b>	<b>3</b>

Table 5-7 displays the results related to respondents who use the university website or e-learning site as a part of their job requirements. The majority of the respondents use their university website/e-learning sites as part of their job, providing some evidence that nearly all the survey participants have a working knowledge of their institutions web systems. In turn, it is hoped that this provided a measure of reliability of some of the responses they provided as to those sites, their content and operation.



**Figure 5-2: The frequency of using the university website/e-learning**

Figure 5-2 presents a more detailed breakdown of the data shown in Table 5-7, where in this case the participants were asked how frequently they used their institutions website/e-learning site. It can be seen that web staff used the university website/e-learning on a daily basis, as might be expected of such a job role, while lecturers and senior managers used it more predominately on a weekly basis. A similar pattern of usage can be seen for the lecturers and the senior managers. What is missing from this data, and in hindsight should have been asked, is for what purpose each staff type was using the website. Given the weekly teaching pattern in most universities, it might be fair to conclude that the 53% of lecturers accessing their university website once a week might be doing so to update/check teaching materials, whilst the senior managers might be doing something similar depending upon any teaching/teaching management associated with their roles. However, the collected data can neither confirm nor reject such a hypothesis.

Table 5-8: Respondents receiving formal training

Formal training in using the university website/e-learning	Yes	No
Lecturer	32	22
Percent within group	59%	41%
Web staff	24	7
Percent within group	77%	23%
Senior manager	13	6
Percent within group	68%	32%
<b>Total</b>	<b>69</b>	<b>35</b>

Table 5-8 indicates that a majority of the respondents received formal website/e-learning training from their university in the use of the institutional website. The majority of web staff (77%) participated in a website/e-learning training course (which might be considered a somewhat low figure given the responsibilities of this role), followed by 68% of senior managers and 59% of lecturers. This implies that most respondents have some formal knowledge and skills regarding the use of their university's website/e-learning site.

Table 5-9: Respondents' views regarding the benefits of university websites and e-learning sites

Feelings of the benefits of university websites and e-learning to students	Very little	Some	A great deal
Lecturer	2	15	38
Percent within group	4%	27%	69%
Web staff	1	6	24
Percent within group	3%	19%	78%
Senior manager	1	8	9
Percent within group	6%	44%	50%
<b>Total</b>	<b>4</b>	<b>29</b>	<b>71</b>

Table 5-9 presents respondents' views as to the advantage of the university website/e-learning site for the university's students. It is an interesting finding that only 50% of senior managers felt that their institutions website offered 'a great deal' of benefit to students, when one might expect otherwise. Regardless, some of these same participants indicated that students should be able to access on-line learning materials without physically being present in class. For example, participant S728 indicated that *"more features should be added such as video recording in some cases that student need to study again outside the classroom"*.



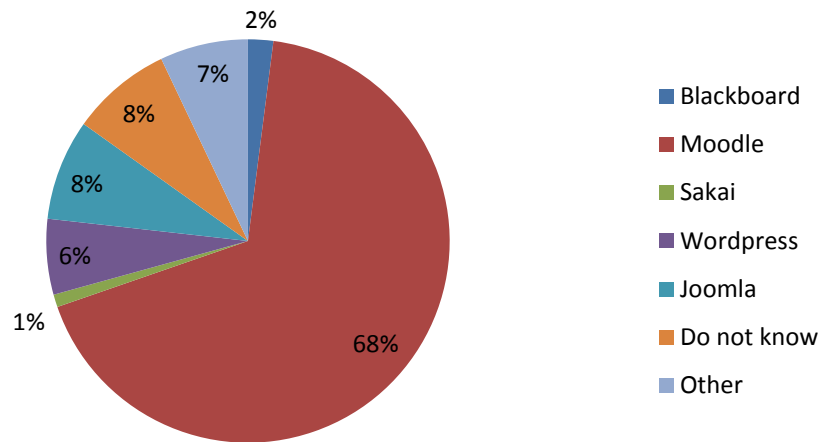


Figure 5-3: Popularity of Learning Management System (LMS) software

In terms of each university's e-learning site, results in Figure 5-3 confirm that Moodle was the most popular learning management system (LMS) with 68% of respondents indicating it was in use at their university, followed by Joomla and a variety of other tools (included in-house developed systems). This is not to say that 68% of the 50 universities in this study used Moodle, but rather that 68% of the respondents knew which LMS was in use in their institution. The reason for Moodle's apparent popularity might in part be due to its free, open source nature, a finding that is not necessarily unique to the Thai university sector (Machado & Tao, 2007). Latter parts of the thesis will discuss the dichotomy of widespread use of Moodle, with its in-built tools that address some aspects of accessibility, but the seemingly poor accessibility outcomes for all e-learning sites, including those that used Moodle.

#### 5.1.2.2 ONLINE RESOURCE EXPERIENCE – SENIOR MANAGERS

Senior managers were asked to complete the following questions in order to observe their attitudes and experiences in regards to university websites and e-learning, especially their university's policy for those materials.

Table 5-10: Awareness of the university having an e-learning policy

Awareness of e-learning policy at university	Frequency	Percentage
Yes	17	86%
No	2	14%
Not Sure	0	0%
<b>Total</b>	<b>19</b>	<b>100%</b>

Table 5-10 indicates that over 80% of senior manager respondents had an awareness of e-learning policy in their university, however almost 20% of respondents lacked such awareness. Garrison (2011) states that universities should provide e-learning strategies in the form of university policy in order to provide clear direction and focus on dealing with integration between Information and communications technology (ICT) and resource management departments. This implies that knowledge of university policy plays a significant role in e-learning quality and improvement at universities (De Freitas & Oliver, 2005; Littlejohn & Pegler, 2014).

**Table 5-11: Universities providing formal training for e-learning**

<b>Formal training for e-learning provided by universities</b>	<b>Frequency</b>	<b>Percentage</b>
Yes	19	100%
No	0	0%
<b>Total</b>	<b>19</b>	<b>100%</b>

The results in table 5-11 show that all senior manager respondents (100%) confirmed that their university offers specific e-learning training for their staff, alongside the general website training as presented in Table 5-8. The result indicates that from a senior managers perspective, their university staff have (or should have) a strong foundation of e-learning knowledge.

**Table 5-12: E-learning developer at university**

<b>E-learning developer at university</b>	<b>Frequency</b>	<b>Percentage</b>
Academic Technology/IT Staff	9	23%
Lecturers	15	38%
Web Staff	10	26%
Other	5	13%
<b>Total</b>	<b>39</b>	<b>100%</b>

In table 5-12, 38% of the senior manager respondents pointed out that staff involved with the development of e-learning content were lecturers, followed by web staff (26%), academic technology/IT staff (23%) and others such as those who were outsourced. The technology/IT staff role exists in a number of Thai universities, and primarily provides media based learning materials at the behest of lecturing staff. This data supports other research which indicates that the key determinants to successful e-learning can be the university's lecturers, that the lecturer's

attitudes plays an important role in the effectiveness of e-learning (Sun, Tsai, Finger, Chen, & Yeh, 2008; Volery, 2001).

### 5.1.2.3 ONLINE RESOURCE EXPERIENCE – LECTURERS AND WEB STAFF

Lecturers and web staff were asked to complete the following specific questions because both of them act as content providers for e-learning materials.

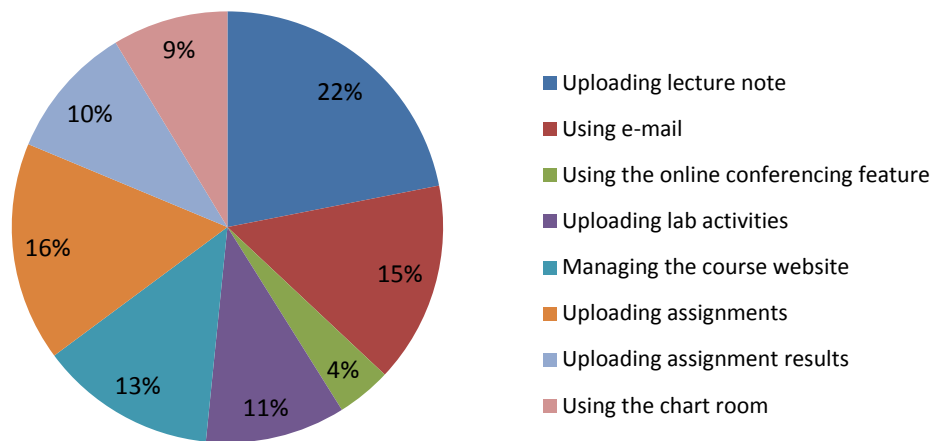


Figure 5-4: Purpose of using e-learning for lecturers

Figure 5-4 demonstrates that uploading lecture notes was the primary purpose for their usage of e-learning tools, followed by a relatively even distribution of other activities such as uploading assignments, sending emails and managing their course websites.

Table 5-13 : Lecturers developing e-learning courses

Lecturers who develop their own e-learning courses	Frequency	Percentage
Yes	38	69%
No	17	31%
Developers of e-learning course (drawn from NO respondents)	Frequency	Percentage
Academic Technology / IT staff	8	47%
Staff in your department	9	53%
Students	0	0%
Web Staff	0	0%
Other	0	0%

Table 5-13 indicates that more than two thirds of the lecturers developed and managed their own e-learning courses, with around one third relying on the support of other university staff (such as the academic technology/IT staff or web admin staff). These results are supported by Table 5-12, which indicates that most e-learning developers were the actual lecturers themselves. In particular, Table 5-16 indicates that Word and PDF documents were the most common type of materials used by content providers on the university websites and e-learning sites. This relationship is highlighted primarily to set the context as to which staff types create and manage the e-learning content, so that responsibility for accessibility compliance (or lack thereof) can be allocated.

**Table 5-14: Web staff assisting lecturers with e-learning content**

<b>Web staff who assist lecturers with e-learning content</b>	<b>Frequency</b>	<b>Percentage</b>
Yes	29	94%
No	2	6%
<b>Frequency of this assistance (drawn from YES respondents)</b>	<b>Frequency</b>	<b>Percentage</b>
Weekly	4	14%
Monthly	8	28%
Once at the beginning of semester	13	45%
Once at the beginning of the year	1	3%
Never	3	10%

Table 5-14 indicates that web staff assist lecturers to manage e-learning content on the basis of at least once at the beginning of each semester. Nearly half of the web staff indicated that they provided help to lecturers at the beginning of semester (45%), followed by monthly (28%), weekly (14%), never (10%) and once at the beginning of the year (3%). These results seem consistent with previous results (Table 5-13) that confirm university staff help lecturers to manage e-learning content, but that lecturers primarily deal with routine management of their e-learning content on their own.

Table 5-15: Using web technologies and software applications on university websites by web staff

Type of web technologies used	Frequency	Percentage
Portable Document Format (PDF)	20	16%
Microsoft Office	20	16%
Adobe Photoshop	16	13%
Adobe Flash	15	12%
MPEG video audio	11	9%
MS (windows media) video or audio	10	8%
QuickTime video or audio	9	7%
JavaScript	7	5%
Real Video or Audio	7	5%
Adobe Shockwave	5	4%
Java Applets	5	4%
Active-X controls	1	1%

Table 5-15 explores the percentage of web technologies and software applications which are used by web staff in the management of their university websites and content. Portable Document Format (PDF) was the most widely used technology, followed by Microsoft Office documents (16%) and Adobe Photoshop (13% respectively). Of the top four technologies listed in Table 5-15, PDF and Microsoft Office documents generally have the most capability of being developed in an accessible manner (using correct techniques), whilst images can pose accessibility issues if not used responsibly alongside alternative texts. Adobe Flash technology does pose significant accessibility issues, and whilst the content of Flash animations can be made accessible, it requires a high level of skill and planning to do so whilst avoiding the issues of keyboard traps created by such objects (Draffan, 2009).

Table 5-16: Contents on university/e-learning webpages by content providers (lecturer and web staff)

Type of file used	Frequency	Percentage
Word documents	69	19%
PDF documents	61	17%
PowerPoint documents	52	14%
Video clips	34	9%
Audio-clips	31	8%
YouTube	28	8%
Flash	17	5%
Facebook	17	5%
Online Tests	18	5%
Twitter	14	4%
Surveys	13	3%
Excel documents	10	3%
Flickr	2	0%

Table 5-16 shows similar results from content provider (lecturer/web staff) respondents, in that they engage heavily with Microsoft Office and PDF documents to create materials for their university and e-learning webpages. Word documents were the most common type of contents used by content providers (19%) followed by PDF documents (17%) and PowerPoint documents (14%). This reliance on Word and PDF documents is supported by the web assessment findings (Figure 4-17) whereby a majority of such files were found to be inaccessible. Microsoft Office and PDF formats were used across both the main university website and within the e-learning content pages (Table 5-15 and 5-16), leading to a widespread negative accessibility outcomes where such documents are not engineered in an accessible manner. Interestingly, social media such as Twitter, Facebook and Flickr are quite commonly used as university resources, though they also suffer a number of accessibility challenges and do not work very well with assistive technologies (Hollier, 2011).

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### 5.1.3 PART THREE: EXPERIENCE AND ATTITUDE TOWARDS ACCESSIBILITY

This section of the survey instrument(s) was designed to explore respondent experiences and attitudes towards accessible online materials and accessibility knowledge. Open and close-ended questions were provided in this section. Again, some close-ended questions include multiple responses, such as checklists, ranking questions and rating scales.

### 5.1.3.1 ACCESSIBLE ONLINE MATERIALS

Figure 5-5 demonstrates the understanding of university staff about people with disabilities. Overall, most respondents described themselves as having a clear understanding of the meaning of people with disabilities.

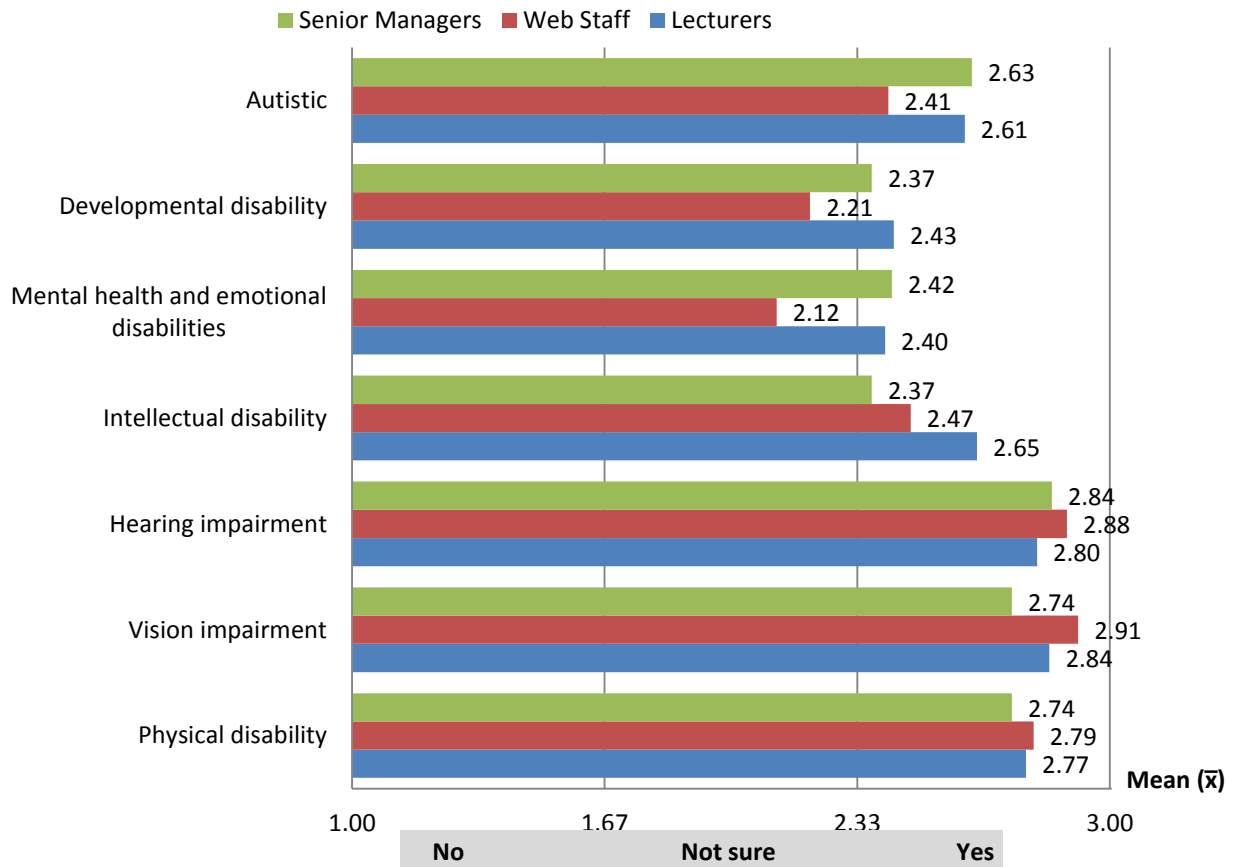


Figure 5-5: Mean scores for understanding the meaning of 'people with disabilities'

All respondents (Figure 5-5) understood the meaning of seven types of disabilities listed in Thai government (Ministry of Social Development and Human Security, 2012) definitions of such, with vision impairment being the most well understood type of disability by the web staff ( $M = 2.91$ ) and lecturers ( $M = 2.84$ ). However, most senior managers indicated an understanding of the meaning in relation to people with hearing impairments ( $M = 2.84$ ). Overall though, on the scale of No, Not Sure and Yes, most respondents showed a moderate degree of understanding of the concept of what defined a person with a disability, though the lowest average score of 2.12 being indicated for mental and emotional disabilities. It may be because a number of the listed disabilities are defined as 'hidden' disabilities that they are not clearly evident whereas physical impairments such as being a

wheelchair user or being legally blind and using a Kane seems to be something that most people in this study could relate to. However, WebAIM (n.d.-b) noted that the large scale of visual disability from vision impairment to total blindness impacts on developing websites, and for example, people with vision impairment can have some level of vision, whereas someone who is totally blind has no useable vision. Therefore, it is useful to be aware of specific needs of disability conditions when designing university websites, and how to test against such needs.

**Table 5-17 : Knowledge of the needs of students with disabilities**

<b>Knowledge of the needs of students with disabilities</b>	<b>I have a broad knowledge of the needs of students with a wide range of disabilities</b>	<b>I have some knowledge of the needs of students with certain specific disabilities</b>	<b>I have a little knowledge of some of the needs of students with disabilities</b>	<b>I have little or no understanding of the needs of students with disabilities.</b>
Lecturers	1	16	20	25
Percent within group	2%	26%	33%	40%
Web staff	0	7	9	18
Percent within group	0%	21%	26%	53%
Senior managers	0	4	9	6
Percent within group	0%	21%	47%	32%
<b>Total</b>	<b>1</b>	<b>27</b>	<b>38</b>	<b>49</b>

Table 5-17 reveals that respondents had low levels of knowledge about the specific needs of students with disabilities, hence indicating a gap between the recognition of a person with a disability and what specialised needs that person may have, especially in a university learning context. Specifically, 39% of lecturers and 53% of web staff respondents had little or no understanding of the needs of students with disabilities, whilst 47% of senior managers indicated they had a little knowledge of the needs of students with disabilities. This dataset implies that lack of knowledge of the needs of students with disabilities is a key issue relevant to issues surrounding web accessibility in Thai universities (or lack thereof). This data supports other research which indicates that academic staff are broadly unfamiliar with the needs of students with disabilities, however more faculty members express the need to support the necessary knowledge and skills in order to develop accessible accommodations for students with disabilities (Baggett, 1994; Leyser, Greenberger, Sharoni, & Vogel, 2011).



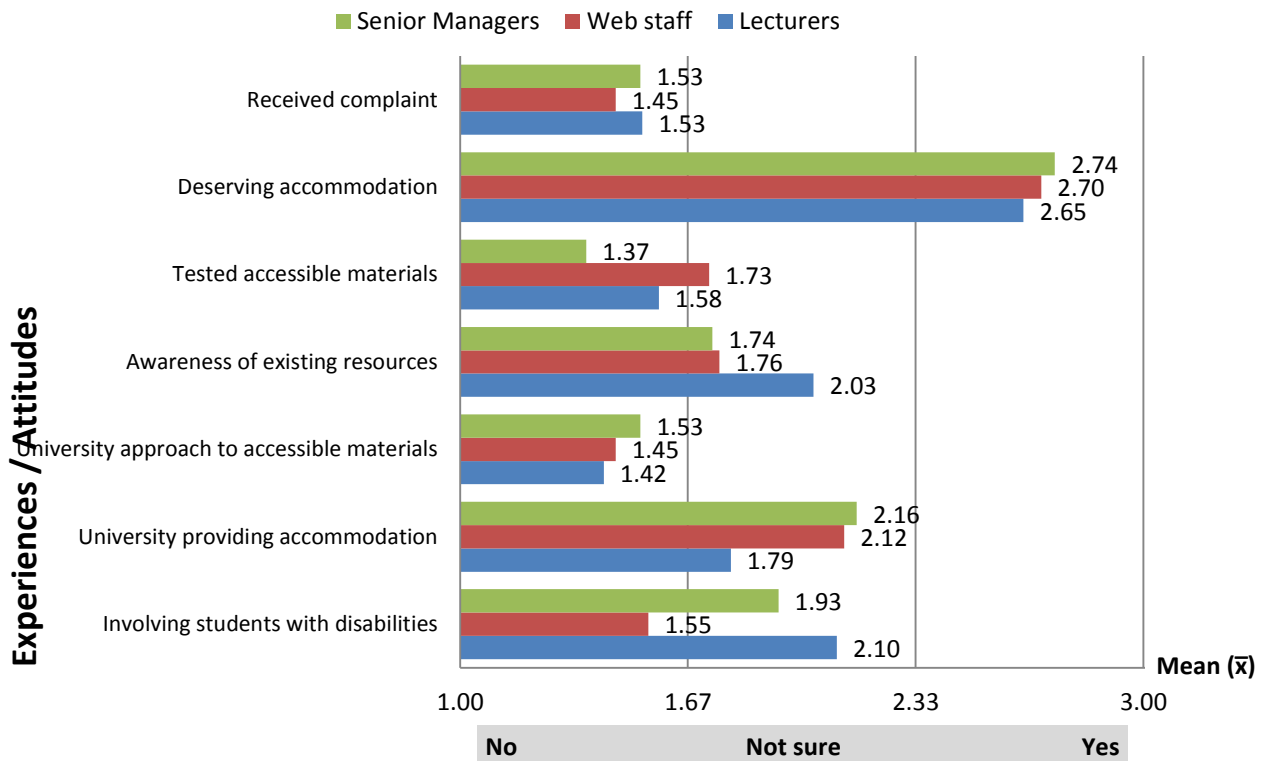


Figure 5-6: The average score of experiences/attitudes toward students with disabilities

Results in Figure 5-6 indicate that Thai academic staff had low levels of awareness of providing facilities and services for students with disabilities, though the same staff held positive attitudes towards providing these accommodations.

In terms of experience with students with disabilities, most respondents had little experience with students with disabilities, with average score for lecturers  $M = 2.10$ , senior managers  $M = 1.93$  and web staff  $M = 1.55$ . With respect to providing accommodation or assistance such as extra exam time, captioned videos and computers with speech output for students with disabilities, most respondents were uncertain that their university offers any accommodation for those students. In terms of making accessible online materials for students with disabilities, most respondents felt that their universities have not been approached about making those materials, with average scores for senior managers  $M = 1.53$ , web staff  $M = 1.45$  and lecturers  $M = 1.42$ . As regards awareness of existing resources, most respondents were unaware of existing resources that explained how to make accessible online materials for students with disabilities. When asked about any accessibility testing they may have

performed before uploading learning materials, senior managers and lecturers lacked awareness of such testing processes to meet the special needs of students with disabilities, while web staff reported a small level of awareness. In relation to deserving accommodation, the average score of each group reached the peak of 2.74 (senior managers), 2.70 (web staff) and 2.65 (lecturers) on the topic of students with disabilities deserving accommodation in the form of specialised support. None of the respondent groups had any experiences with complaints from students with special needs. This critical data set indicates that all respondents had positive attitudes towards the provision of facilities and services to support the needs learning of students with disabilities, however the same data found very low levels of awareness of what form those facilities and services might take, especially in terms of accessible online materials.

**Table 5-18 : opinions about developing online materials for students with disabilities**

Opinions	Senior Manager		Lecturer		Web staff	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Equal access for all including students with disabilities	84	16	98	2	100	0
Responsibility for developing accessible online materials	95	5	71	29	91	9

Table 5-18 illustrates university staff's views on developing online materials for students with disabilities. In terms of equal access, 98% of lecturers, 100% of web staff and 84% of senior managers felt that students with disabilities should have equal access to the same online materials as other students. Once again, this indicates that respondents have positive attitudes about disability equality, which is likely to be a key factor in any future improvement of accessible online/e-learning materials in Thai universities. According to responsibilities as to who should be developing these materials, at least 70% of all respondent groups believe that their role should be required to develop hands-on accessible online materials. The percentage of senior managers was very high at 95%, followed by web staff (91%) and lecturers (71%), that latter perhaps being a slightly lower figure from the lecturers as they would probably be the ones doing most of the work.

Table 5-19: Top five barriers to create accessible online materials for students with disabilities

Barriers	Lecturers				Web staff				Senior Managers			
	Rank	Mean	N	SD	Rank	Mean	N	SD	Rank	Mean	N	SD
Lack of knowledge of the needs of students with disabilities	1	8.75	57	1.479	1	8.43	28	2.617	1	8.38	16	1.455
Lack of knowledge of technologies to create accessible e-learning content	2	8.18	57	1.814	2	7.96	28	1.527	2	6.38	16	2.277
Lack of knowledge of assistive technologies	3	7.74	57	1.788	3	7.21	28	1.988	2	6.38	16	2.156
Lack of accessibility training and awareness	4	6.40	57	2.034	4	6.00	28	1.963	3	4.94	16	2.744
Lack of assistive technology equipment and software (e.g. screen readers)	5	6.19	57	1.941	5	5.64	28	1.569	4	4.31	16	2.152

Table 5-19 presents the top five barriers to creating accessible online materials for students with disabilities by ranking the importance of a number of factors. Overall, all respondent groups agree that a lack of knowledge of the needs of students with disabilities is the most critical barrier to the development of accessible online materials. The following comments below indicate that a lack of knowledge of the needs of students with disabilities appears to impact the lack of accessibility apparent in university online materials. Some lecturers echoed concerns of inadequate knowledge that may be a serious obstacle to future uptake of accessible practices. For example:

*The problems may arise when developing online materials for different types of disabilities; there are many different types of learning disabilities. Therefore, it is difficult to develop accessible online materials for some developers who have a lack of web accessibility skills and special needs knowledge.*

**Participant ID: L797. (Male, 18-35 yrs, Lecturer, Industrial Management, 1-5 exp. yrs)**

*Students with disability may have specific needs based on their impairment so they need practical things in order to support their learning. Universities are required to provide accommodations for students with disabilities.*

**Participant ID: L876. (Male, Lecturer, 36-50 yrs, Science-Physics, +15 yrs)**

The results indicate that there is not enough knowledge about the needs of students with disabilities among Thai staff at university. This is similar to a point made by Hartley (2010) and Faltis (2011), where appropriate knowledge

and skills about special needs allow teachers/lecturers to prepare tasks and materials throughout the academic course, resulting in improving the learning outcomes of students with disabilities.

#### 5.1.3.2 ACCESSIBILITY TECHNOLOGY

Table 5-20 demonstrates the awareness of Thai university staff members about accessibility technology: meaning of web accessibility, Thai government policy, web accessibility guidelines and assistive technology (AT).

**Table 5-20 : Awareness of accessibility technology**

Awareness	Senior Manager		Lecturer		Web staff	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Meaning of the term 'web accessibility'	68	32	50	50	58	42
Thai government web accessibility policy	26	74	20	80	33	67
Web accessibility guidelines	28	72	40	60	27	73
Assistive Technology	53	47	60	40	38	62

In terms of meaning of web accessibility, 50% of lecturers were unclear about the meaning of 'web accessibility' though 58% of web staff and 68% of senior managers indicated that they understood this term. This implies that respondents have some understanding of the meaning of 'web accessibility', though open-end questions below showed that this indicated understanding was not always correct:

*Ability to login to the system in order to use all available information.*

**Participant ID: L283. (Male, 36-50 yrs, Lecturer, 1-5 exp. yrs)**

*Open system which does not require registration.*

**Participant ID: L665 (Male, 18-35 yrs, Lecturer, 1-5 exp. yrs)**

*Access to the internet, social media e.g. Facebook, email, websites. Use and gain benefit from the internet.*

**Participant ID: L171 (Male, 36-50 yrs, Lecturer, Doctor's degree, Economics, 1-5 exp. yrs)**

*The web has the potential to provide equal access for all people and no need to use a password.*

**Participant ID: W576. (Female, 18-35 yrs, Web administrator, 1-5 exp. yrs)**

*My understanding is more of a user one and from trying out some of them. I'd say User Interface (UI) perspective.*

**Participant ID: S537 (Male, 36-50 yrs, Doctor's degree, IT, 6-10 exp. yrs)**

*A website that can be accessed by multiple modes for general use via voice and touch access.*

**Participant ID: S193. (Female, 36-50 yrs, Management information system, 6-10 exp. yrs)**

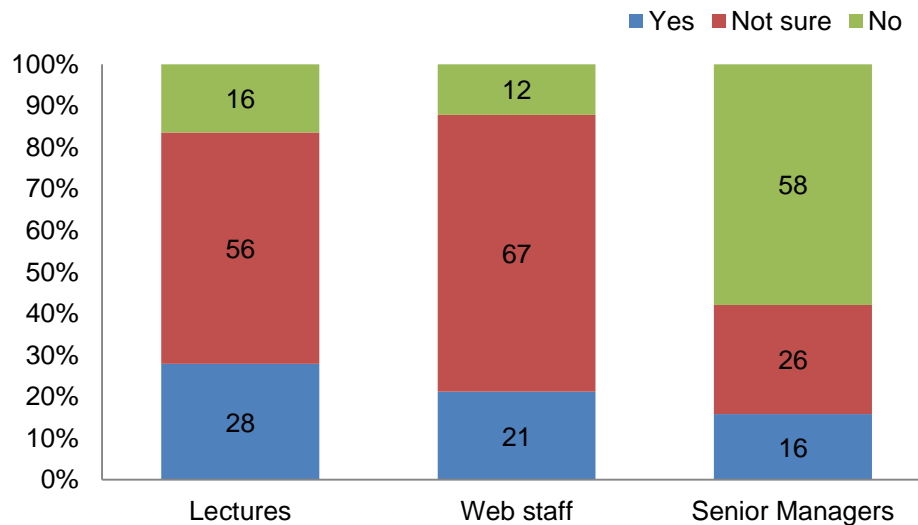
*It is easy to do. Accessible webpages should be a special section in the website. Web administrators can set permissions for users with disabilities to access those webpages.*

**Participant ID: W857. (Male, 36-50 yrs, E-learning developer, 11-15 exp. yrs)**

These responses indicate a basic misunderstanding of web accessibility from the participants and might be a problem for accessibility development at Thai universities where training resources are not first provided. Such responses are consistent with research indicating that web developers of UK academic websites seem to be under a misunderstanding about the requirements of web accessibility, resulting in poor levels of accessibility of the websites providing services to users (Witt & McDermott, 2004).

In terms of the Thai government web accessibility policy (Figure 5-20), 80% of lecturers, 67% of web staff and 74% of senior managers did not know that the Thai government has a policy on web accessibility. This is not necessarily an isolated finding, as research by Freire, Russo, & Fortes (2008) reported that most Brazil's web developers indicated that they had never heard of web accessibility in their national laws or policies. In term of web accessibility guidelines (Figure 5-20), 73% of web staff, 72% of senior managers and 60% of lecturers were unfamiliar with web accessibility guidelines which is consistent with other findings where almost 74.3% of academic staff had no or basic knowledge of WCAG guidelines whilst only 10.9% of those people identifying themselves as advanced and expert users understood the guidelines (A. P. Freire, C. M. Russo, & R. Fortes, 2008, p. 162). With respect to assistive technologies (Figure 5-20), a much lower level of awareness was demonstrated by the web staff participants with only 38% of respondents indicating that they knew what this technology was used for. The lack of AT knowledge by people who are in charge of maintaining university websites could does not bode well for accessibility outcomes for Thai university websites, a finding supported by the assessment values presented in the previous chapter. This finding is consistent with Lazar et al. (2004, p. 277) where one of the barriers to developing accessible website is that most webmasters (60%) did not test websites with screen readers.

It also should be noted that the results (Table 5-12) also showed that over 60% of e-learning content developers in the universities examined in this study were the lecturers and web staff, therefore unfamiliarity with accessibility knowledge and web accessibility policy could (and did) lead these content developers to producing inaccessible materials.

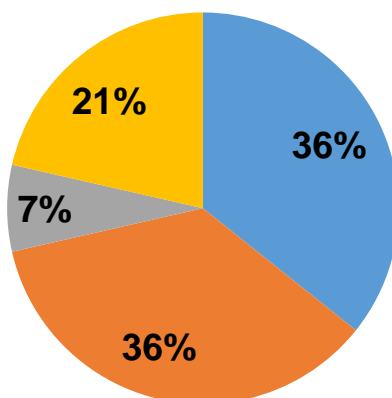


**Figure 5-7: Having a web accessibility policy at university**

Figures 5-7 indicates that most lecturers and web staff were uncertain if their university had a policy on web accessibility. Additionally, more than half of the senior managers indicated no such policy at all. Whilst most respondents indicated that they were unsure about whether their university had an accessibility policy, or in the case of the senior managers, stated that it did not, a small percentage of respondents indicated that their university did indeed have such a policy. This last finding seemed somewhat contradictory to the data collected in this thesis, as each of the 50 university websites were thoroughly searched for any evidence of a specific policy or statement regarding web accessibility, for which none were found. This contradictory result is likely to be related in part to a misinterpretation of the question, where respondents were thinking in terms of general accessibility policies (ie physical campus layout) and equal opportunity statements (which a number of the university websites did have). In fact, Thai universities provide disability policy and support students with disabilities through agency webpages such as the Disabilities Support Services Center or Disabled Student Services Center and therefore, the

lack of awareness among university staff about such disability services (and policies) might mean that the lack of web accessibility awareness is unsurprising. Current research in this area states that a lack of specific reference to web accessibility in organisational plan will lead to the failure of accessibility outcomes (Lazar et al., 2004; McAndrew, Farrow, & Cooper, 2012), which certainly seems apparent thus far in this study.

■ 2 years or less ■ 5 years or less ■ 5+ years ■ Not Sure



**Figure 5-8: Senior manager preferences - years to achieve a university web accessibility policy**

As evidenced by the results in Figure 5-8, most of the senior managers (72%) believed that web accessibility could be part of university policy within the next 5 years, however some senior managers were not sure how many years any such policies may have been in place. The general tone of responses from the senior admin staff was that such policy was ‘coming soon’, but never with specifics as to when.

Most of the participants speak of the importance of web accessibility policy, emphasising that they are expected to comply with university requirements, and that accessibility policy reflects the commitment of the university to providing accessible web content. As participants indicated via the open-ended questions in the survey instrument:

*The policy regarding web accessibility for people with disabilities should be raised by management. Then, the faculty and staff can comply with this policy. Otherwise, web accessibility cannot happen in the university.*

**Participant ID: S728. (Male, 36-50 yrs, Doctor's degree, IT, 6-10 exp. yrs)**

*The policy must be clear. University members can follow.*

**Participant ID: S537 (Male, 36-50 yrs, Doctor's degree, IT, 6-10 exp. yrs)**

*The university has a KPI (Key Performance Indicator) for e-learning as a supplementary indicator across all programs.*

**Participant ID: S537. (Male, 36-50 yrs, Doctor's degree, 6-10 exp. yrs)**

*1. It should start at university policy first. If web accessibility is not in any part of the policy, it will lead to a lack of commitment to follow-up. As you know, budgets, plans and strategy are included in a policy. Hence, university policy plays an important role in web accessibility.*

*2. The university should provide a campaign to raise awareness about disability, accessibility and web accessibility in order to motivate university members to create accessible materials.*

*3. Some lecturers have no experience in developing e-learning or web accessibility, therefore the university should provide staff to assist lecturers to create those materials.*

**Participant ID: S965. (Female, 51-60 yrs, Asst. Prof., Doctor's degree, 1-5 exp. yrs)**

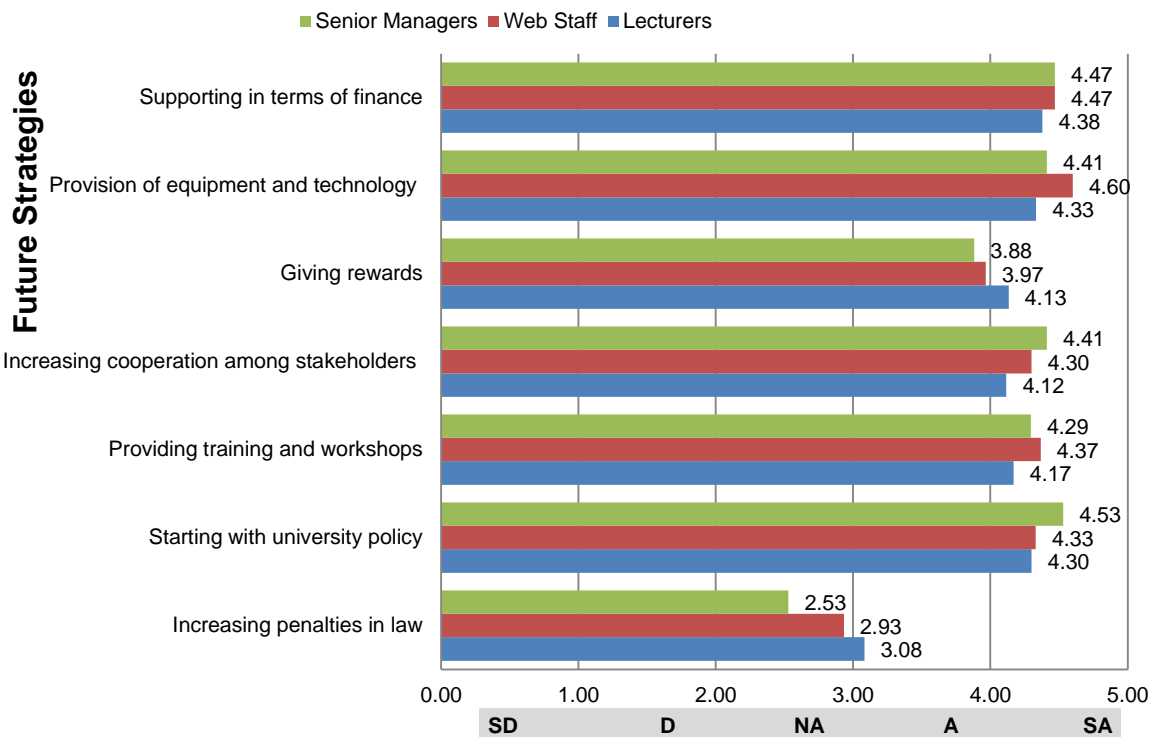
Bohman (2004) claims that ineffective university policies which do not include timeframes, specific technical standards, evaluation and monitoring processes can all lead to ongoing accessibility problems. The perception that accessibility policy is likely to become a priority at their university is shared by lecturers, web staff and senior manager participants. In terms of a call to action for the acceptance and implementation of web accessibility, the participants in this research seem to feel that policy is amongst the most important drivers.

**Table 5-21: Indicating the people mainly responsible for supporting web accessibility**

People responsible for supporting web accessibility	Senior managers	Lecturers	Web Staff	Others
Lecturers	55	54	53	1
Percent within group	34%	33%	33%	0%
Web Staff	30	25	27	2
Percent within group	36%	30%	32%	2%
Senior Managers	15	10	8	5
Percent within group	40%	26%	21%	13%
<b>Total</b>	<b>100</b>	<b>89</b>	<b>88</b>	<b>8</b>



The results in Table 5-21 indicate that all roles should take responsibility for encouraging web accessibility at university, especially senior managers, as they are responsible for the development of university policy in most cases. More than half of respondents felt that the senior manager role received the most support and endorsement (from all three groups) to be the main stakeholder supporting web accessibility at university, consistent with participants S965's statement that *"It should start at university policy first. If web accessibility is not in any part of the policy, it will lead to a lack of commitment to follow-up"*.



Note: SD=Strongly disagree, D=Disagree, NA=Neither agree nor disagree, A=Agree, SA=Strongly Agree

Figure 5-9: Potential strategies for increasing web accessibility at university

Figure 5-9 presents the potential strategies for improving web accessibility in Thai universities, with the three most important policies perceived as being: financial support, provision of equipment and technology, and development of university policy. Participants were uncertain of the effective use of increasing penalties in law for noncompliance with accessibility, with one senior manager (S779) stating that:

*Personally, web accessibility could not possibly happen in Thai universities yet because of a lack of software, tools and knowledge, however the university should be getting started on web accessibility temporarily. I think that web accessibility is coming in Thailand over the next ten years.*

**Participant ID: S779 (Male, 36-50 yrs, Asst. Prof., Doctor's degree, Mathematics, 1-5 exp. yrs).**

This is consistent with the suggestion of Harper and DeWaters (2008), Bradbard and Peters (2010) and, Maisak, Brown, and Utakrit (2014) which contends that an organization should consider providing policy, finance and developer tools to staff in order to support positive web accessibility outcomes. The concept is not dissimilar to that identified by Bualar (2013) whereby a lack of enforcement of accessible transport policy has led to ongoing problems with equitable bus-services for people with disabilities in Thailand. It would seem that policy creates the framework for compliance, but only effective enforcement brings about change, as examples from the literature review indicated for those countries that have managed to achieve least modest levels of web accessibility compliance through policy, law and occasionally, legal precedent.

Some participants specifically mentioned that the growth of web accessibility requires a range of university supports such as training, access to accessibility professionals and accessibility tools. The research literature also supports these results whereby adequate training, university commitment and management support are the three most important aspects for achieving e-learning development initiatives (Alhomod & Mohd Mudasir, 2013). Likewise, the development of web accessibility in Thai universities with support from the university administration is likely to be necessary for the uptake of accessibility practices, as evidenced through the following participant views:

*One thing to support web accessibility is that the university should provide training, software and hardware and public relations (PR) towards web accessibility.*

**Participant ID: W511. (Male, 36-50 yrs, Web administrator, 6-10 exp. yrs)**

*Personally, it's difficult to develop web accessibility in Thai universities, therefore professionals who have experience and skills are a key to success in this project. The university should provide policy, equipment and training.*

**Participant ID: W1552. (Male, 18-35 yrs, Web project manager, 6-10 exp. yrs)**

*Since there are some IT technicians in the Resources and IT Institute who are well-trained, they should be ready to help those lecturers who are not keen in IT or have little time to deal with it.*

**Participant ID: L268. (Male, 51-60, Asst. Prof., Computer Science, 15+ exp. yrs)**

*A university should increase the adaptation of e-learning for all courses because e-learning is able to motivate students. Moreover, the university should provide e-learning training for all stakeholders and make the e-learning courses attractive.*

**Participant ID: W264. (Female, 18-35 yrs, Web designer, 1-5 exp. yrs)**

*A university should raise investment in e-learning, such as by providing training, creating an e-learning department, and providing a free internet connection for lecturers, students and other people to access e-learning courses.*

**Participant ID: W511. (Male, 36-50 yrs, Web administrator, 6-10 exp. yrs)**

*There has been a decline in the number of lecturers who are interested in e-learning. It may be because of a lack of university support.*

**Participant ID: W590. (Female, 36-50 yrs, Information technologist, 11-15 exp. yrs)**

The last three quotes are particularly interesting, as they would seem to indicate that there has been a decline in university support for e-learning activity, which would not seem to bode well for the adoption of web accessibility practices in e-learning content development.

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#### 5.1.4 OPEN-ENDED QUESTIONS

The web survey provided a series of open-ended statements which allowed participants to share valuable further information against the questions they were being asked about accessibility, policy and students with disabilities.

Some of these responses have been presented above to support the survey findings. Below is a more comprehensive list of the direct questions ask via the open-ended response format.

**Question: What are your views on web accessibility?**

The comments below indicated that participants expressed generally positive attitudes towards web accessibility in terms of the concept of equality and corporate social responsibility. In particular, participants expressed a strong interest in web accessibility as an equal opportunity and human rights issue. In research conducted by Peters and Bradbard (2010), results showed that web accessibility is often related to ethical implications such as morals, equal access for all, legal problems, and as organisation's reputation, whereby a lack of focus on the accessibility of corporate websites leads to the risk of organisations attracting negative publicity. This theme is highlighted in the comments below:

*It is a good thing about virtue, ethics and humanity. Everyone should have equal rights and opportunities.*

**Participant ID: L174. (Male, 36-50 yrs, Assoc. Prof., Doctor's degree, IT, 15+ exp. yrs)**

*Web accessibility should include all learners.*

**Participant ID: L268. (Male, 51-60, Asst. Prof., Computer Science, 15+ exp. yrs)**

*Creating web accessibility is useful for all users including users with disabilities.*

**Participant ID: L797. (Male, 18-35 yrs, Lecturer, Industrial Management, 1-5 exp. yrs)**

*I think everyone should have equal accessible e-learning and web accessibility.*

**Participant ID: L171 (Male, 36-50 yrs, Lecturer, Doctor's degree, Economics, 1-5 exp. yrs)**

*Web accessibility is a good tool for encouraging all groups of users to gain knowledge and increase opportunity in education.*

**Participant ID: W264. (Female, 18-35 yrs, Web designer, 1-5 exp. yrs)**

*The accessibility to access websites is the resource for learning and pertaining knowledge. Everyone deserves the equal right and ability to do so.*

**Participant ID: W7499. (Female, 36-50 yrs, Web project manager, 6-10 exp. yrs)**

*Good because of equal opportunity for all.*

**Participant ID: W5537. (Male, 18-35, Database Administrator, 1-5 exp. yrs)**

*Government support is necessary for encouraging this project because web accessibility allows equal opportunity and education for all citizens.*

**Participant ID: S849. (Female, 36-50 yrs, Director of academic resource center, 6-10 exp. yrs)**

*I agree with web accessibility on university websites because students with disabilities should have equal access to the information as others, however there is the question of cybercrime, which is of concern to users with disabilities. Stakeholders should consider a plan to combat cybercrime and educate users with disabilities to protect themselves.*

**Participant ID: S965. (Female, 51-60 yrs, Asst. Prof., Doctor's degree, 1-5 exp. yrs)**

Moreover, several participants felt web accessibility was a form of corporate social responsibility. For example:

*Agree because we engage in corporate social responsibility in achieving equality for students with disabilities in education.*

**Participant ID: L797. (Male, 18-35 yrs, Lecturer, Industrial Management, 1-5 exp. yrs)**

*If the university can provide web accessibility, more recognition in terms of social responsibility will be increased. Providing those facilities leads the university to having no boundaries in terms of learning.*

**Participant ID: S728. (Male, 36-50 yrs, Doctor's degree, IT, 6-10 exp. yrs)**

*Web accessibility represents our social responsibility actions towards people with disabilities, however it requires that all stakeholders join hands and take concrete actions.*

**Participant ID: W1552. (Male, 18-35, Web project manager, 6-10 exp. yrs)**

These responses are consistent with findings that inclusion and ethics were the major motivating force for respondents in another study examining the development and uptake of web accessibility (Yeliz Yesilada, Giorgio Brajnik, Markel Vigo, and Simon Harper (2012). Thus, these responses seem to indicate that the concept of social responsibility is known to the participants in this study and that it has an inherent link with the tenets of web accessibility.

**Question: Please feel free to add any further comments of thoughts regarding any of the issues raised above.**

Another key issue raised by participants concerns the lack of demand for web accessibility at university. As some participants observed:

*It depends on the policy of the university and the number of students with disabilities.*

**Participant ID: L171 (Male, 36-50 yrs, Lecturer, Doctor's degree, Economics, 1-5 exp. yrs)**

*Web accessibility should be implemented at a large university and a special university for people with disabilities first because those institutions have a large number of students with disabilities.*

**Participant ID: W689, (Male, 18-35 yrs, Web programmer, 6-10 exp. yrs)**

*I agree on the web accessibility concept, however there is a small number of students with disabilities in university so web accessibility is not necessary for university now.*

**Participant ID: S884. (Female, 18-35 yrs, 6-10 exp. yrs)**

The results indicate that the small numbers of students with disabilities in Thai universities impacts on the respondent's attitude towards web accessibility, and that in the face of such small numbers, the university staff are likely to ignore the needs of such students, or at least reduce their priority. This is similar to the views about building home projects that Imrie (2003, p. 402) found in 'Housing Quality and the Provision of Accessible Homes', whereby some builders and property developer respondents commented that *"the market for disabled people is so small it's not worth it"* and *"the size of the market is such as to not warrant any focus. It is not a marketable asset to the properties"*. As the next chapter will highlight, this link between numbers and service not only flies in the face of views on corporate social responsibility, it is essentially a self-fulfilling prophecy in terms of enrolment restrictions placed on students with disabilities wishing to enter some Thai universities.

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#### 5.1.5 SUMMARY OF SURVEY RESULTS

The survey mechanism provided crucial data which, when triangulated with the results of the automated and manual assessments along with the interview responses presented below painted a picture why Thai university website fared so poorly in terms of web accessibility. In the end, if people are not aware that a set of technical

guidelines exists for creating accessible web content, it is perhaps not surprising they do not apply those guidelines in the development of their websites or e-learning content. Section 5.1 indicates that awareness of web accessibility and its associated technologies is low, as is participant awareness of students with disabilities and their specialised access and learning needs. It appears that attitudes towards supporting students with disabilities is strong, and that web accessibility might indeed be well received by participants, but only in the presence of enforceable university policy. Some initial indications of negative attitudes came late in the survey, where web accessibility action seemed linked to numbers of students with disabilities, a finding which is further explored below and in the following chapter.

## **5.2 INTERVIEW DATA**

This section presents the results from the semi-structured interviews, with the responses to the interview questions being extremely helpful in ascertaining participant's attitudes and experiences in relation to web accessibility concepts. Specific participants are referred to below by group and number (for example, L001 for a lecturer, or S002 for a senior manager). The following in-depth interviews were conducted face to face at each of the interview respondent's university campus. Participants were offered the opportunity to interview individually after completing the web survey (by providing their email address in the survey mechanism). Responses to the ten probing questions for each of the three groups of research participants (web staff, senior managers and lecturers) relate to the three supporting research questions of this study:

Supporting Question #1: What level of awareness is there for web accessibility in Thai universities?

Supporting Question #2: What are the barriers to web accessibility in Thai universities?

Supporting Question #3: What drivers exist for web accessibility within Thai universities?

The analysis of the responses to the interview questions follows the order of the questions.

Table 5-22: The relationship between research questions and outcomes

Themes	Question Probes	Findings
The awareness of students with disabilities at university	<b>Question:</b> Are there students with disabilities in the university? Do you know how those students use the internet?	A small number of students with disabilities are at Thai universities. Due to the limitation of some admissions requirements, this has resulted in an exposure to and lack of understanding of those students.
Attitude toward developing accessible online materials	<b>Question:</b> Would you agree to making the university's website or e-learning materials more 'web accessible'?	<b>Agree:</b> There are social benefits and ethical reasons. <b>Disagree:</b> There is a lack of perceived demand for web accessibility in the university and thus it is not worth excessive effort.
Web accessibility awareness	<b>Question:</b> Have you ever heard of the term 'web accessibility'? <b>Question:</b> In your view, what does 'web accessibility' mean? <b>Question:</b> From the survey conducted through automated and manual testing, it has been found that the university website and e-learning materials have the following deficiencies. As you are the web staff/ lecturer, which of these have you been involved in and why? 1. Lack of Alternative Text (the checkpoint 1.1.1 of WCAG 2.0) 2. Lack of purpose of links (the checkpoint 2.4.4 of WCAG 2.0) 3. Lack of language of page (the checkpoint 3.1.1 of WCAG 2.0) 4. Lack of parsing (the checkpoint 4.1.1 of WCAG 2.0) 5. Inaccessible documents such as using PDFs with no alternative options.	<ul style="list-style-type: none"> <li>• Poor awareness and misconception of web accessibility.</li> <li>• The awareness depends on personal background according to experience with 'usability' and 'assistive technology'.</li> <li>• The reason for making inaccessible online material is that participants lack specific accessibility knowledge.</li> <li>• Benefits of HTML5, Search Engine Optimization (SEO) on web accessibility.</li> </ul>
The lack of knowledge of the needs of students with disabilities: causes and solutions	<b>Question:</b> From the results of the survey, it has been found that the main obstacle for creating accessible online materials for students with disabilities is the lack of knowledge of the needs of students with disabilities. What do you make of this and what method would you propose in order to solve this problem?	<ul style="list-style-type: none"> <li>• The need for understanding user requirements, especially for people with special needs.</li> <li>• Solution: training, workshops and integrating web accessibility in university policies.</li> </ul>
Encouragement of web accessibility	<b>Question:</b> From the survey results, it has been found that in developing	<ul style="list-style-type: none"> <li>• Costs related to web accessibility projects such as assistive</li> </ul>



	<p>the university's website to become web accessible, "Support in terms of finance for accessibility projects is crucial", "Provision of equipment and technology is crucial" and "Starting with university policy" are required. What do you make of the above points?</p> <p><b>Question:</b> Who should be the driver any such accessibility projects?</p> <p><b>Question:</b> As an executive/a web staff member/senior manager, how do you stimulate/encourage/support the university's website to become more accessibility?</p> <p><b>Question:</b> Do you have anything further you would like to add on web accessibility and Thai universities?</p>	<p>technology devices.</p> <ul style="list-style-type: none"> <li>• Hierarchical organisational structure in Thai university management.</li> <li>• Stakeholder engagement is needed.</li> <li>• Raising awareness of web accessibility in the university.</li> <li>• Suggestion to embed web accessibility into the national Quality Assessment (QA) process.</li> <li>• Developing materials aligned to the TWAG guidelines.</li> </ul>
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Table 5-28 identifies and summarises the relationship between the themes of the interview questions and the key findings. The overall outcomes reveal that the obstacle of web accessibility were found in terms of poor awareness of web accessibility, lack of knowledge, some negative attitudes of stakeholder and, a lack of accessibility policy. However, web accessibility drivers were ascertained in terms of positive attitudes of university staff toward web accessibility, and while web accessibility in Thai university is likely to be slow to develop, possible solutions are available in the form of policy, training and high level university support. The themes and findings outlined above are explored in more depth in the following section where specific responses from participants are presented.

#### 5.2.1 THE AWARENESS OF STUDENTS WITH DISABILITIES AT UNIVERSITY

**Question: Are there students with disabilities in the university? Do you know how those students use the internet?**

It is evident from the participants' responses that there are students with disabilities studying at the Thai universities involved in this study, however the number of those students appears to be very small. Generally, the participants' perception was that students use the internet normally because most of them are people with physical disabilities. For example:

I have seen students with disability. They can use the internet normally/without a problem (W252).

Another lecturer participant states:

There are some in the subject of Information System. They are students who lost a leg or an arm. But the number is low. There are no problems reported with regards to their use of the internet (L101).

Likewise, one senior manager participant points out:

There are students with disability. The university provides them with the opportunity to study. However, they amount to less than 1%. Most of them are leg- or arm-handicapped. There are no blind or deaf students. Students with disabilities do not have any problem in using the internet (S865).

Some of these participants state that the limitation of admissions requirements is significant to the population of students with disabilities in Thai universities. One lecturer explains:

There are some but not many. There are very few students who have lost an arm or a leg. This is due to the requirements of the Faculty of Industrial Education, which only accepts those who are physical health. This is different from the Social Sciences such as Law or Political Sciences or Humanities that accept students with disabilities (L174).

Another senior manager commented:

Most students with disability are students with physical disabilities. There is only one student with low vision. The reason for the low number is because each faculty or subject department determines the requirements of a student. For Engineering, for instance, those who wish to become students are to be in perfect health (not disabled). Hence, people who are colour blind are not going to satisfy the requirements to study. As for students who have lost a leg or an arm, I have seen them using the internet normally (S165).

Thus, the problem is compounded by educational requirements that people with disabilities are not allowed to be admitted into the full range of academic courses, leading to the perceived small number of students with disabilities in Thai universities. This crucial point is expanded upon in the next chapter.

**Question: Would you agree to making the university's website or e-learning materials more 'web accessible'?**

Overall, most participants agreed that developing accessible online materials had benefits in terms of ethics and social responsibility, with only a minority offering suggestions concerning a lack of demand for these materials in the university and questioning the worthiness of accessibility. These following statements indicate that the idea of equality for students with disabilities is indeed a driver for making web content accessible for all users:

Agree because a university should promote equal opportunities for people with disabilities (S865).

And one web staff member stated:

Agree because students with disabilities should have equal rights as students without disability (W232).

Another lecturer echoed:

Students with disabilities should be able to participate in education on the same basis as students without disabilities. Moreover, various organisations do accept people with disabilities to work in the field of IT (L268).

Generally, participants have both positive and negative attitudes towards web accessibility. On the one hand, one of the possible advantages is knowledge sharing. For example, one lecturer stated:

Agree because in the university, there is a lot of beneficial information in various agencies and organisations of the university, for instance subject departments, faculties or research institutes. If the websites of those agencies or organisations can be made web accessible, those from outside and members of the university will be able to learn knowledge and materials in the university (L174).

This view was confirmed by one senior manager:

Agree because people with disabilities have equal rights. University websites should be available to all students including students with disabilities. Moreover, the university is able to serve

internal and external individuals who search for information on the website. Apart from the Research Department, the university also operates knowledge management which seeks to disseminate knowledge of the university to any interested parties that may include people with disabilities (S767).

Peters and Bradbard (2010) report that manager perspectives influence web accessibility projects for example, managers who think that accessible websites are expensive and costly may not support the project, while managers who think about negative publicity and Search Engine Optimisation (SEO) may encourage and support web accessibility projects. Thus, it is likely that if stakeholders in the university have positive attitudes toward web accessibility, then the university website could eventually become more accessible.

On the other hand, some participants expressed negative attitudes towards web accessibility, with the key issue being raised by participants including inadequate demand and, the worthiness of web accessibility in the university. For example:

It must be understood that the concept regarding people with disabilities in Thailand is that these people are mostly enrolled in special schools... Hence, personally, if we admit students with disabilities to study with others, there will be problems. Hence they need to study separately. That's why web accessibility is not widespread in universities nowadays (S865).

And:

It does not mean that we cannot create web accessibility. That is not a problem. The problem lies with the users. The target group (students with disabilities) is low in number thus it is not worthwhile to invest in this project. Personally, the project for people with disabilities is not worth the investment (L174).

And:

I wouldn't agree because it is not necessary for this university. From the usage statistics, the number of students with disabilities is still low. If the whole website needs to change to respond to the minority, I don't think it will be worth the investment. The main problem is that technology for people with disabilities, once developed, can be sold to a minority of people (W689).

This is confirmed by the report of the Thailand Office of the Higher Education Commission (2013), there were almost 4,500 students with disabilities compared to nearly 2,000,000 students without disabilities in higher education institutions in 2013. These findings seem to imply that the low number of students with disabilities in the university influences negative staff attitudes towards investment in web accessibility. Carey, cited in J. Seale (2006b), states that the issue of developing accessibility features in media was a negative for content producers who were concerned that accessibility is costly and has less potential benefits. These negative results which revolve around effort and return on investment are likely to be significant barriers for any future implementation of web accessibility in Thai universities, and could possibly hold more sway than those who do support web accessibility simply because it is perceived as being the right thing to do.

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### 5.2.3 WEB ACCESSIBILITY AWARENESS

**Question: Have you ever heard of the term 'web accessibility'?**

It is evident from the participants' responses that five from nine interviewees had poor awareness of web accessibility, with responses including:

I have never heard of it until I am doing this questionnaire. I have also just been made aware of web accessibility guidelines while being interviewed (S767).

And:

I haven't heard anything about it including the relevant guidelines (W252).

And:

I haven't heard of it before (L268).

However, some participants provided correct definitions because they had a background and experience in web accessibility and related fields, such as those working in the area of usability. As two lecturers stated:

I have heard of it for a long time because the Ratchasuda Foundation, in cooperation with the National Electronics and Computer Technology Center (NECTECH) held a training seminar a few years ago. The main agency directly responsible for IT projects in Thailand is NECTECH. The

department that is directly involved with this topic in particular is the Rehabilitation Engineering and Assistive Technology Institute (L174).

And:

I have heard of it because my Master's thesis was on the topic of usability (L101).

It would appear that participants have had limited exposure to web accessibility in any shape or form except where they worked in conceptually aligned fields.

**Question: In your view, what does 'web accessibility' mean?**

More than half the participants (five from nine people) stated that they have no idea about the meaning of web accessibility, which is hardly surprising given that the previous question asked them if they had heard of the term 'web accessibility', with most participants having never heard of this term. Consequently, participants could not explain web accessibility or elaborate their understanding more detail. For example:

I don't know (S865), (S767), (W232), (L268).

Sorry, I have no idea (W252).

However, one lecturer recognised this term and provided more details as below:

This is an ideal website. I teach web design. Hence web accessibility refers to the idea that a website needs to convey messages in a way that allows users to understand the information on the website. Another term related to this is Universal Design. It is a design that allows users to use the website with simplicity and in a way that is as good as possible (L174).

One lecturer mentioned that she understood the concept of web accessibility although she has never seen the WCAG guidelines.

Personally, I have never seen web accessibility standards before (L101).

This implies that the understanding of web accessibility among Thai university staff is a serious issue for any university's future adoption and implementation of web accessibility, as essentially the universities will be starting

from an almost zero base of accessibility awareness. Zeng and Parmanto (2003) found that none of the users of health websites were satisfied with its accessibility, and that the failure came from the web developer's lack of knowledge of the field of web accessibility, a finding later supported in a study conducted by Lopes, Van Isacker, and Carriço (2010). Before asking the question below, the researcher provided an explanation of:

- the definition of web accessibility
- the TWCAG guidelines which is based on WCAG 2.0 in Thai language
- the top 5 website accessibility failures identified in this study.

The purpose of the explanation was to remind participants of what web accessibility is and to ensure that participants have appropriate web accessibility knowledge.

**Question: From the survey conducted through automated and manual testing, it has been found that the university website and e-learning materials have the following deficiencies. As you are the web staff/ lecturer, which of these have you been involved in and why?**

1. Lack of Alternative Text (the checkpoint 1.1.1 of WCAG 2.0)
2. Lack of purpose of links (the checkpoint 2.4.4 of WCAG 2.0)
3. Lack of language of page (the checkpoint 3.1.1 of WCAG 2.0)
4. The webpage is coded correctly (the checkpoint 4.1.1 of WCAG 2.0)
5. Inaccessible documents such as using PDFs with no alternative options

Most participants indicated some familiarity with the failures of '2. Lack of link purpose' and '5 Inaccessible documents such as using PDF with no alternative' in particular. Importantly, they expressed that they did not know how to produce accessible e-documents for publication, with one web staff stating that:

I have done 2 and 5. The faculty's website has PDF files but I don't know how to make them accessible electronic documents (W232).

Another lecturer stated that *“Item 5 because I don’t know what applications to use or how to proceed with it”* (L268). Again, this almost total lack of knowledge became to be seen by this researcher as the ‘I don’t know’ syndrome.

It is interesting to note that HTML5 and Search Engine Optimization (SEO) methods were seen as possible benefits for improving the accessibility of websites. As two web staff members stated of the above list of most commonly found WCAG errors found from the automated and manual web assessments:

No. 1, 2 and 3 are already required by search engine optimization (SEO). This university is involved in SEO. Hence those topics are automatically consistent with the standard. Personally, when we develop a website, we do not put in alternative text for people who are blind but we mainly think about the SEO. Thus the alternative text involved results in benefits for people with disabilities as well. We also use HTML5 for developing the website. For 5, I have never known that there needs to be accessible documents. There are files in the forms of PDF, Word and Excel to be downloaded in the university but I have not heard of this (W689).

HTML5 offers a number of benefits that can make websites more accessible, with L. Moreno et al. (2011) indicating that the Accessible Rich Internet Applications (ARIA), the DOM (Document Object Model) and APIs (Application Programming Interface) are written by the HTML5 code that support assistive technology (AT) so as to more readily allow access to web content. Likewise, SEO and web accessibility have a number of overlaps which make websites more accessible and searchable (WebAIM, n.d.-c; World Wide Web Consortium, 2005c). It thus appears that developing university websites with HTML5 and SEO standards could contribute to its accessibility but only if done properly.

Some participants mentioned the accessibility feature in web development software. As one web staff stated:

I produce e-learning developed from Learning Management System (LMS). In that system, there is no feature to create content for people with disability. Hence if there is such a feature, I believe that most lecturers are ready to develop e-learning content for people with disability. There may be a plug-in in LMS by solving deficiencies following WCAG. Items 1, 2 and 3 (the



checkpoint 1.1.1, 2.4.4 and 3.1.1 of WCAG 2.0) are about programming on the website. In e-learning, most lecturers/tutors create their e-learning materials from LMS. It is in the form of combining several modules together for instance, Forum, Chat and Login. A lecturer does not have to write codes themselves. Hence if LMS has such features, I believe lecturers and tutors are able to develop accessible e-learning (L174).

The World Wide Web Consortium (2005a) has led the development of the Authoring Tool Accessibility Guidelines (ATAG) for developers and content authors to produce authoring tools which help to create accessible web content. The ‘Moodle-related accessibility coding guidelines’ was developed to encourage the providers of web content to create accessible courseware (Moodle Community, 2014). Again, it would appear that any accessibility benefits derived from using LMS tools is largely accidentally rather than deliberate, as with the accessibility benefits of using HTML and SEO techniques.

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#### 5.2.4 THE MAIN OBSTACLE OF ACCESSIBLE ONLINE MATERIALS

**Question: From the results of the survey, it has been found that the main obstacle for creating accessible online materials for students with disabilities is the lack of knowledge of the needs of students with disabilities. What do you make of this and what method would you propose in order to solve this problem?**

The results in the survey (Table 5-19) showed that all participant groups agree that the most serious barriers to web accessibility adoption is the lack of knowledge of the needs of students with disabilities, thus they were asked to provide more detail on this issue. The research outcomes indicated that the participants linked knowledge of the needs of students with disabilities to the user requirement in accessible online materials and web accessibility. For example, one lecturer participant stated:

I agree because if one does not understand how a person with disability perceives the world or the relevant persons do not have any experience with special needs, it will not be possible to develop web accessibility in the university. A programmer may try not to use hands when using a computer for a day or close one’s eyes so as not to see the monitor to understand what people with disabilities want. In the same vein, people with disabilities cannot pass on requirements to a

programmer. To sum up, the problem is that user requirements do not reflect the user's needs of web accessibility. In addition, users with disabilities cannot express their special needs to others. The solution is based on the perspective of system development, to adjust the 'gathering data' section. Staff who collect data to create user requirements or web staff need to have knowledge about the special needs of people with disabilities (S865).

These responses confirm that the analysis of user requirements is more likely an important factor for developing a website for people with special needs, and is addressed in part by the World Wide Web Consortium (2012d) materials dealing with 'How People with Disabilities Use the Web' in order to assist web developers develop more accessible websites. Moreover, another web staff member confirmed that:

I agree because if the knowledge about the special needs of students with disabilities is publicised and known to web staff, web accessibility is not difficult. Generally, web staff have the basic knowledge about creating websites. They only need some additional information, which is the special needs of students (W252).

Similarly, one senior manager participant points out:

I agree because if user requirements are not known, I wonder how the university's website can be more accessible. The method to solve the problem will need to start from the university issuing a policy regarding web accessibility. Then all relevant persons are to be trained, for instance the conduct of training for special needs students. At present, the university has not issued a policy with regards to this issue. Another problem is that the relevant persons need to have awareness regarding web accessibility and are ready to correct or develop the website (S165)

Several participants identified that 'providing web accessibility in the university policy' and 'training and workshops for stakeholders in the university about special needs' could offer key accessibility benefits. They suggest that 'providing policy and training' might encourage developers to better understand real user requirements, especially the needs of people with disabilities. Consequently, the developers would be more likely to create the university website to meet such needs. As one lecturer participant pointed out:

I agree. The solution is to conduct a workshop between people with disabilities and organisations related to people with disabilities and the university's web staff to produce a common experience. For instance, the Faculty of Communication Arts in the university has conducted a workshop between students and the Association of the Deaf. In the workshop, the participants were not allowed to speak. They had to use sign language all day to make students understand what it was like being deaf. Then the students produced the 'Deaf Channel' project which was a TV program for the deaf. In a similar situation perhaps, if one wants web accessibility to be realised, those relevant persons need to have knowledge about the special needs of people with disabilities (L101).

Such training could address the lack of knowledge that web staff and lecturers displayed in this study towards the needs of students with disabilities. WebAIM (2013, para. 2) stated that *"Developers often benefit from understanding design techniques from the user point of view. Placing accessibility issues in a macro structure, such as human factors, can facilitate the developer's ability to assimilate accessibility techniques into their practice"*. Furthermore, the accessibility policy of a university is provides empirical evidence of accessibility outcomes of that universities website, with Yu (2002) and, Bradbard, Peters, and Caneva (2010) suggesting that accessibility policy should be combined with the web development process to ensure that web accessibility goals are successful. This implies that "the understanding of developers about special needs" and "providing web accessibility in the university policy" are significant for the levels of accessibility of university website demonstrated in this study.

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#### 5.2.5 EXPLORING THE NEEDS OF SUPPORT

**Question: From the survey results, it has been found that in developing the university's website to become web accessible, "Support in terms of finance for accessibility projects is crucial", "Provision of equipment and technology is crucial" and "Starting with university policy" are required. What do you make of the above points?**

In terms of 'finance' and 'equipment and technology' supports, there appears to be potential to enhance facilities in developing accessible websites and its potential to motivate web content providers. When provided with a copy of the TWCAG document, most participants felt that web accessibility in the university might not be difficult to

implement because they already have experience and skills in developing websites and that applying the requirements of WCAG 2.0 (via the TWAG) would be no issue. For that reason they could develop accessible websites if they received equipment and technology support from their university. For example:

A device such as a screen reader is necessary for testing the website after improvement should the university want to proceed with the project of web accessibility. Hence the university should support both in terms of finances and tools in this project (W689).

And:

If finances, tools and the team are available, this project should be successful. We need to know what these students need. I have just skimmed through the TWAG [Thai Web Content Accessibility Guidelines] and it does not seem very difficult to develop (W232).

And:

I agree. In developing an accessible website, one needs to take into account future expenses. Hence the university should provide financial support and the provision of equipment and technology for this project (S165).

The identified need for adequate finance and supporting tools for website development and testing outlined by the participants is in line with a study by Lazar et al. (2004) which reported that webmasters require better resources such as funding, training and tools in order to improve the accessibility of a website. The World Wide Web Consortium (2012c) outlined that web accessibility projects come with potential initial capital expenditures such as purchasing accessibility evaluation tools, buying assistive technology and upgrading technologies and tools, however there is a list of free assistive technologies such as the NVDA screen reader. Therefore, it is more likely that web accessibility projects in Thai universities require finance and tools, though a wide variety of free and open source accessibility applications could reduce project costs. Whilst a number of participants felt they could translate the technical requirements of the TWAG guidelines into accessible university websites and materials, this current research was not convinced that such an outcome would be so readily achievable.

**Question: Who should be the driver any such accessibility projects?**

All participants emphasise the important role of universities, stating that staff should follow university policies, and that those policies should be developed in accordance with Thai government policies. Participants pointed out that since Thai public universities receive government subsidies, they have an obligation to contribute to national prosperity, which in theory, should include prosperity for people with disabilities. As stated in the literature review, most Thai universities are public so their websites fall under government policy. For example, participants stated:

The administrative system of the Thai civil service is top-down management. This means the government needs to have a policy before the ministry-level takes over. Hence, first of all, the government needs to have a policy then the university will be able to take over at a later stage. Within the university, all personnel in the university need to participate in producing web accessible resources. The Office of Academic Resources and Information Technology is responsible for the university's website. The Public Relations Department is responsible for the production and maintenance of the faculty's website corresponding to the university's policy. Lecturers and tutors are responsible for e-learning (S767).

And:

This should start from the government, the ministry, the Office of the Higher Education Commission (OHEC) as well as the university's management team. Following their policies, staff will be able to start working [on web accessibility]. The agency that is responsible for the university's website is the Office of Academic Resources and Information Technology. In the faculty, the relevant agency is the Public Relations Department. Those responsible for e-learning are lecturers and tutors in respective subjects (S165).

And:

The government needs to regard web accessibility as important. There needs to be policy and action plans. Then subordinate organisations and agencies will follow the government. At the level of the university, there needs to be a policy and the Office of Academic Resources and Information Technology should act as the main host/actor in the project of creating web accessibility. At the same time, lecturers and students should provide feedback after the project is completed (L628).

In particular, the Thai government agencies are more likely to be seen as external key actors, while the university executive teams are the inner key actors for effective interpretation and implementation of government policy. It is noted that most Thai universities are government agencies which are top-down in management and therefore in terms of the Thai government especially, OHEC (Office of the Higher Education Commission) should be the key stakeholder to promote wider adoption of accessible website design in both public and private sectors. The Thai government passed the *National Education Act 1999* in order to support the equality of educational opportunity for all Thais, including those with disabilities, though the requirements of this act does not seem to be met by a number of universities in this study that do not allow students with disabilities into some of their courses. Moreover, the Thai Web Content Accessibility Guidelines (TWAG) were launched in 2008 (Office of the Ministry of Education, 1999; Office of the Ministry of Information Communication Technology, 2008) though again, there seems to be little or no awareness of these guidelines and how they pertain to the development of Thai university websites and e-learning materials.

However, several participants believed that all staff in their university should work together in terms of accessibility projects, with one web staff member indicating that:

Staff and the executives should cooperate. Lecturers and tutors are not involved in the development of the university's website. Some tutors develop e-learning materials themselves but those are in a minority because normally there are staff who help tutors to produce e-learning materials. Thus I believe that the staff and executives should be the main people who are directly responsible for this project. In a university, the main department directly responsible is the Office of Academic Resources and Information Technology. However, the university needs

to have a policy to create accessible online materials first. Then the staff are ready to work in response to the policy. At present, there is no such policy (W689).

Several participants emphasised the need for effective stakeholder engagement in the university and that all university staff and agencies should work together to improve the level of accessibility of online materials. In particular, the Office of Academic Resource Center / the Office of Academic Resources and Information Technology in Thai universities should be highlighted as the key actor for within this process.

**Question: As an executive/a web staff member/senior manager, how do you stimulate/encourage/ support the university's website to become more accessibility?**

Participants highlighted the need to raise awareness about web accessibility in their institutions. Participants proposed a field trip and activities addressing web accessibility as solutions to raise awareness. For example:

It starts from the executive study visit. This kind of visit will make executives realise the importance of web accessibility. Then the executives will regard the issue as important and determine web accessibility in the university's policy. At present, such a thing has not happened. Afterwards, continuous promotion of the idea is to be conducted. Promoting the project is a way of spreading the concept to all members of the university. Other types of activities may also be conducted in the university, for instance, a university-wide faculty or department website contest with a prize. Various events may be used to remind and promote the project (S165).

And:

There should be a contest for the accessibility of university websites in Thailand, as nowadays, university websites are being ranked using backlinks as one of the indicators. Alternatively, relevant associations for people with disabilities should hold various contests, for example, the Association of the Blind might hold a web accessibility competition. I expect that there will be several interested parties participating in such a project (W689).

The proposals to develop awareness raising activities and drive home the importance of web accessibility to university staff members is likely to be positive for the development of web accessibility in Thai universities, or at

least create a starting point. This is consistent with the findings of Yeliz Yesilada et al. (2012), where the lack of proper promotion of the benefits of accessibility in the web community was identified as one of the challenges of accessibility uptake. The authors also found that one of the motivations was to inform stakeholders how web accessibility benefits everyone.

Another suggestion made by all participants was the integration of web accessibility into educational policies, especially the National Quality Assessment (the Office for National Education Standards and Quality Assessment, 2014). The passage below encapsulates the views on web accessibility and educational policies of one senior manager:

All universities are required to be certified 'Excellent' in the external quality assessment by The Office for National Education and Quality Standards Assessment (ONESQA). The ONESQA has a set of Key Performance Indicators (KPIs). If the ONESQA included web accessibility as one of their KPIs, the university will then be required to create web accessibility in order to pass the assessment (L268).

And:

The university needs to have a policy on web accessibility first. At this time, the university still lacks policies and facilities for students with disabilities, such as walkways, ramps and lifts. Once the policy has been determined, web accessibility is to be one of the KPIs for internal quality inspection within the university. Hence, all departments and agencies in the university need to have web accessibility in order to pass the quality assessment...If the executives of the university regard web accessibility as important, web accessibility can be included in the KPI for the internal quality assessment of the university. This is the easiest way for the project to emerge (S865).

Thus, an attempt to introduce web accessibility in the National Quality Assessment of ONESQA is likely to raise the accessibility of university websites, or at the very least, to spur the development of processes to start working on accessibility outcomes. This is supported by Sections 47-51 in the National Education Act (1999), which requires all Thai educational institutions to include internal and external quality assurance (Office of the Ministry of Education,



1999). If web accessibility is part of the KPIs of those assessments, universities will be committed to deliver accessible web content.

However, some participants were concerned with the lack of demand for web accessibility in the university, so they suggested other solutions, such as an alternative version or placing web accessibility into the remit of special institutions. For example:

The concept rather contrasts web accessibility against website attractiveness. It is rather difficult to balance the two. Hence I suggest creating web accessibility in an alternative version, similar to a website having two languages (English and Thai). In this case, a website is to have two versions, an ordinary version and another version for people with disabilities. This will, arguably, combine the two harmoniously (S767).

And:

From another perspective, web accessibility should be done in certain areas/places such as schools for people with disabilities. These are schools that are built especially for students with disabilities. If web accessibility is created in such institutions, I believe that is worth the investment (L174).

Some participants believed that web accessibility is costly and not worthwhile so that they suggest developing accessible websites in an alternative version or specific place, a view that is not really in keeping with the concept of the web for all.

Whilst some participants earlier reported that they would have no issue implementing the requirements of the TWAG, others indicated that the TWAG 2010 seemed difficult to understand and the requirements were likely to be confusing in practice. They then suggested that editors should rewrite it to include more explanations and provide illustrations within a new, revised version. As one senior manager commented:

Moreover, the guideline is also important. WCAG is in English, which is difficult for Thais to understand. Looking at TWAG, which is in Thai, there are some technical terms that make it even harder to understand. I would like to suggest that a guideline should be in Thai. It should

have illustrations and English terms in brackets. This would make readers able to study web accessibility by themselves. This is one of the ways that can help reduce the training budget of the university (S767).

Similarly, one lecturer points out:

The Thai version of WCAG is TWAG which is very difficult to understand as it has been translated from its English version. For instance the word 'Auto-update' does not give an instantly-understandable translation. It is like reading a legal document that needs interpretation. Personally, I don't think a guideline needs to be written in a very legal or technical form. A guideline with texts and illustrations will make readers understand the concept of web accessibility and they can find more information at a later stage (L268).

Some participants reported difficulty in understanding or interpreting the TWAG guidelines which could result in a poor compliance rate. It is implied that some accessibility requirements do not always translate into other languages very well. To address issues with interpretation of accessibility guidelines, some organisations provide accessibility documents which are simplified and easier to understand for developers who have little experience and background in accessibility, such as the example of Easy Checks (World Wide Web Consortium, 2014a) and the New Zealand Government Web Toolkit (Department of Internal Affairs New Zealand, 2013). Hence, making the TWAG more understandable could possibly elicit greater attention of Thai web developers and lead to increasing their knowledge of accessibility practices.

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#### 5.2.7 SUMMARY

This chapter has analysed and presented the research outcomes of the Thai university staff web surveys and follow up interviews, which include lecturers, senior managers and web staff.

To conclude this chapter it must be said that while web accessibility has been embedded in Thai government policy for more than over decade, the analysis in this chapter indicates that most Thai university staff have low levels of web accessibility awareness. It would seem that this lack of awareness largely contributes to the poor accessibility outcomes demonstrated in chapter four. The key findings around these issues of awareness, attitudes and gaps in university policy will be explored in greater detail in the following chapter.

The focus of this research project concerns the accessibility of Thai university websites along with e-learning materials in Thai universities. The topic is embedded in the research question *'Is web accessibility conformance inherent in Thai university websites?'* This discussion chapter comprises three main sections regarding the supporting research questions. As previously stated in Chapter 3, there were three data collection approaches used in this study: website evaluation, web questionnaires and interviews. The follow sections will discuss the findings of the thesis based around the thesis's supporting research questions.

## 6.1 SUPPORTING QUESTIONS

### 6.1.1 SUPPORTING QUESTION ONE: WHAT LEVEL OF AWARENESS IS THERE FOR WEB ACCESSIBILITY IN THAI UNIVERSITIES?

The findings of this study indicate that there is little in the way of awareness of WCAG 2.0 guidelines in the Thai universities examined in this study, both in terms of the university websites and e-learning content contained within. This outcome appeared to be driven by an almost total unfamiliarity by university staff with web accessibility guidelines and concepts. The discussion will commence with an examination of three major areas of technical problems with the Thai university websites, followed by a look at policy issues and finally the role of staff attitudes towards accessibility and disability.

#### 6.1.1.1 ACCESSIBILITY PROBLEMS ON UNIVERSITY WEBSITES

The results of the web evaluation (through automated and manual testing) as outlined in chapter 4 indicate that Thai university webpages have accessibility problems in nearly all aspects of their design and implementation. The university websites had serious accessibility problems related to providing inappropriate web content in multi-formats, resulting in information on those websites being inaccessible to assistive technologies (AT). The most glaring accessibility problems involved 'no alternatives for non-text information' (the checkpoint 1.1.1 of WCAG 2.0 guidelines), with an average of almost 42 such errors being reported for each of the university's homepages.

People with visual impairments use screen readers and use a keyboard to access a computer rather than a mouse. Screen readers convert text into synthesised speech by reading the text linearly from left to right, line by line, so that users can listen to the content from the beginning to end. Screen readers will read the alternative text (ALT TEXT) of images, if ALT TEXT is provided at the same time, and may ignore images without ALT TEXT and read nothing. Providing ALT TEXT for images is important for people with disabilities (i.e. people with visual impairments) to read the content. WebAIM (n.d.-a) stated that:

Alternative text can be presented in two ways:

- Within the alt attribute of the img element.
- Within the context or surroundings of the image itself.

Determining appropriate alternative text for an image is to decide if the image presents **content** and if the image has a **function**. In most cases, an image will only have a function if it is contained within a link (or is an image map hotspot or a button). Determining if the image presents content and what that content is can be much more difficult. If the content that the image conveys is presented within text in the surrounding context of the image, then an empty alt attribute may suffice (para. 3).

In some cases, images (pure decoration) may be given an empty or null alt attribute (ALT="") however, the results in this study demonstrated that the errors around ALT TEXT were caused by an absence of descriptions, that is, the ALT="" element was left blank in many cases when in fact it should have contained descriptive text. Now, in the case decorative images this would not be deemed an error, however as Figure 6-1 below shows, in nearly all cases decorative images had no ALT TEXT descriptors and neither did meaningful content, such as the image below depicting a scene from Thai history. Both of these images were located on the same page, one directly after the other.



Figure 6-1: Example of violation of success criterion 1.1.1 Non-text content for Uni\_08

To follow up this finding in more detail, each of the 50 university homepages was examined to identify what type of 'generator' might have been used to create the page. A web page can typically be developed by hand using a text editing program, or via a WYSIWYG (What You See Is What You Get) such as Adobe Dreamweaver or Microsoft's Visual Studio. Alternatively, the framework of the page can be run out of a Web Content Management System (such as Moodle, Drupal or Joomla), whereby the user provides the content and the system generates the actual page. The issue of the generator is of interest as most Web CMS tools and modern WYSIWYG editors have varying degrees of support for accessible code generation, with ALT TEXT being a standard attribute to the html <img> element. Thus, in cases where one of these tools was in use but ALT TEXT errors occurred, it could be implied that the content author selected to leave the ALT attributes blank, either deliberately or because they did not know the purpose of the attribute. At the time of the study, of the 50 homepages examined, one was being hosted in Drupal, five in Wordpress, eight in Joomla with the remaining 36 being not specifically identifying the code generation tool. It would appear that even though the website development tools supported the use of ALT TEXT, the feature went largely unused by the Thai university homepages examined in this study. The most common issue relating to alternative text was the actual absence of an ALT attribute on IMG elements, followed by ALT attributes with blank content and finally alternative text that bore no relation to the content to which it was attached. From the staff questionnaire and interviews presented in the previous chapter, it appears that staff

would be willing to use accessibility features such as ALT TEXT, but that at the time of the research, they did not realise the purpose or benefit of the ALT element in the context of web accessibility.

For example one web staff member stated:

I have not been involved in 1 (the checkpoint 1.1.1 of WCAG 2.0 guidelines) because the website of this university uses Wordpress. The application requires one to put in Alternative Text after inserting photos on a webpage. With regards to the theme structure in Wordpress, there are already H1, H2 and H3 available (W689).

This quote came from a Web Admin participant working within university Uni\_29, a university which was amongst the best performers in terms of providing meaningful alternative text in their website. It would seem from this quote that the participant included alternative text because the Wordpress CMS prompted him to do so, but that he was unaware of the actual purpose of ALT TEXT and its relationship to accessibility. Another participant indicated that:

I produce e-learning developed from Learning Management System (LMS). In that system, there is no feature to create content for people with disability. Hence if there is such a feature, I believe that most lecturers are ready to develop e-learning content for people with disability. There may be a plug-in in LMS by solving deficiencies following WCAG. Items 1, 2 and 3 (the checkpoint 1.1.1, 2.4.4 and 3.1.1 of WCAG 2.0) are about programming on the website. In e-learning, most lecturers/tutors create their e-learning materials from LMS. It is in the form of combining several modules together for instance, Forum, Chat and Login. A lecturer does not have to write codes themselves. Hence if LMS has such features, I believe lecturers and tutors are able to develop accessible e-learning (L174).

This is a particularly interesting response in that it demonstrates a common theme across a number of the responses, that accessibility or creating content for 'people with disability' requires an add-on product or specialist piece of software. It would seem that this participant, like many, did not realise that by using the standard features of a Web CMS/LMS in an accessible way and by uploading documents in an accessible format, that they will in turn be inherently more accessible. Essentially, it is practise, not product that produces accessible websites and site content.

In terms of critical failures against WCAG 2.0, the results indicated that the most failures are found at Checkpoint 2.2.2 (Pause, Stop, Hide) of the WCAG 2.0 guidelines (Chapter 4, Figure 4-13). The WCAG 2.0 indicates the success criterion 2.2.2 as to provide a function to turn off moving, blinking, scrolling, or auto-updating information. Many of the university websites featured in this study made heavy use of slideshows, marquees, rotating image displays and animated GIFs on their homepages. In the case of slideshows and marquees most did not have labeled slides or the ability to Pause, Stop or Hide the content. Figure 6-2 and 6-3 shows the university's homepage, which contains a number of moving visual elements over which the user has no control. For both website visitors and students with low vision or cognitive disabilities such content would be very difficult to read or focus on.



Figure 6-2: Example of violation of success criterion 2.2.2 Pause, stop, hide due to “lack of control of marquee element” on the Uni\_05 page



Figure 6-3: Example of violation of success criterion 2.2.2 - Pause, Stop, Hide due to “lack of control of Slideshow” on the Uni\_02 page



Figure 6-4: Example of an accessible slideshow on the Uni\_16's homepage

Figure 6-4 presents the example of a slideshow which on face value looks to be more accessible, with Pause, Stop and direction controls embedded in the slides of the Uni\_16 homepage. However, these controls along with the slides themselves are not accessible via keyboard, essentially making the informational content of the slideshow opaque to visually impaired users. It would appear from the participant interviews that there is a belief that visually attractive web pages and content are at odds with the tenets of web accessibility. For example, a senior manager comments:

Apart from lacking the knowledge of the needs of people with disabilities, we need to think in another aspect that the number of disabled students when compared to the total number of students is still low. Hence, most students may want a website that is colorful equipped with multimedia to attract attention. The concept rather contrasts web accessibility and web's attractiveness. It is rather difficult to balance the two. Hence I suggest creating a web accessibility in an alternative version similar to a website having two languages (English and Thai). In this case a website is to have two versions, an ordinary version and another version for disabled persons. This will, arguably, combine the two harmoniously (S767).

The senior manager pointed out that web accessibility may lead to boring websites, a view not supported by Burgstahler (2006) who feels that a website can be equally appealing or unappealing in design regardless of its levels of accessibility. Moreover, Mbipom (2009) and Mbipom and Harper (2011) also support the view that designing a website to be visually appealing in terms of clean, clear and organised design can increase the level of



accessibility. Specifically, there is no inherent link between ‘boring’ websites and those with high levels of accessibility.

In terms of technical issues, another major problem identified in Thai university websites was that of an over reliance on inaccessible electronic documents, most of which were to be found within the e-learning content pages for each university site (Chapter 4, Figure 4-16). This finding was supported by the data from the automated and manual testing as well as the results of the web questionnaire in which lecturers indicated that they mostly uploaded lecture notes and assignments onto e-learning pages (Chapter 5, Figure 5-4), in Microsoft Word and Portable Document Format (PDF) formats (Chapter 5, Table 5-15). On the homepages for the e-learning section of each of the university websites, PDF was the prominent document format used, followed by Microsoft Word documents along with some embedded HTML. In no cases (at the time of writing at least) were accessible alternative documents made available in place of these PDF and Word documents, as required Conformance Requirement 4 of the WCAG 2.0 guidelines. Whilst it was not feasible to open and assess each of these documents individually, those that were examined manually showed no evidence of accessible design or structure. It could be argued that this is not a particularly surprising finding, and is an issue facing universities worldwide in the terms of the development and maintenance of online learning materials and public facing documents (Alsobhi & Abeysinghe; Calvo, Iglesias, & Moreno, 2014; Kelly et al., 2009; Mark van, 2009). In of themselves, PDF and other electronic documents such as word Powerpoint and Excel files are not necessarily inaccessible, although they do require some thought in terms of structure, content and layout in order to be usable by assistive technologies. In order to enhance document accessibility, a number of solutions have been put forward, such as ISO 14289-1:2012 (International Organization for Standardization, 2012), PDF Techniques for WCAG 2.0 (World Wide Web Consortium, 2012e) and tagged PDF files (Microsoft Corporation, 2014). Therefore, content developers and providers in Thai universities have the opportunity to make their electronic documents more accessible, however as with general website accessibility, it appears that there is a distinct lack of awareness of this issue and these possible solutions.

In summary, as evidenced by the findings in the web evaluation, Thai university websites appear to lack awareness of WCAG 2.0 guidelines regarding POUR violations, critical failures and inaccessible documents. Whilst this above has concentrated on the most common and prevalent issues encountered across the 50 homepage and e-learning sites examined in this study, it is fair to say, and supported by the data provided in Chapter 4, that the technical aspects of accessibility awareness are sorely lacking in the Thai university sector with accessibility errors crossing all aspects of the POUR guidelines in WCAG 2.0.

#### 6.1.1.2 UNFAMILIARITY WITH WEB ACCESSIBILITY GUIDELINES AND CONCEPT

According to the results of the web questionnaire, over half of the respondents had little or no knowledge about web accessibility guidelines (Chapter 5, Table 5-20). In addition, the results of the interviews confirmed that participants from across the various universities were unfamiliar with the WCAG 2.0 guidelines. In the words of Participant S767: *“I have never heard of it until I started this questionnaire. I have also just been made aware of web accessibility guidelines while being interviewed”*. This implies that Thai university staff have a reduced ability to cope with accessibility issues related to their websites due to a lack of knowledge about web accessibility guidelines.

Table 6-1: Summarise of awareness about web accessibility knowledge

Awareness	Senior Manager		Lecturer		Web staff	
	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)
Meaning of the term 'web accessibility'	68	32	50	50	58	42
Web accessibility guidelines	28	72	40	60	73	27

The results of the web questionnaire, summarized in the table 6-1, indicate that most participants have little or no knowledge in regards to web accessibility, and in particular web accessibility guidelines. At the actual implementation level, the web staff seem to indicate a better level of web accessibility awareness and an even better knowledge of accessibility guidelines. However, the further one moves from the web development coal face, the lower the level of guidelines awareness seems to be, a result that is perhaps not unreasonable given that web accessibility is more conceptual whilst guidelines are more practical. However, it must be stated that though a number of respondents indicated higher levels of awareness, in reality it seemed that some of them were unaware of the actual meaning of the term. Participants were asked to fill in a blank text field with an explanation

of their understanding of web accessibility and its meaning. Some surprising responses included that from Participant S193 who said, *“A website can be accessed by multi-modes for general use via voice and touch access”*. This response, if generously interpreted, could hint at the role of assistive technologies in web accessibility, though the role of disability and equity is not. Moreover, more than half of the participants in the interviews had no idea about web accessibility meaning as Participant W252 stated: *“Sorry, I have no idea”*. Secondly, the results of the web questionnaire presented that most senior managers (72%) and lecturers (60%) were unfamiliar with web accessibility guidelines in contrast to the 73% of web admin staff who were. In fact, some participants in the interviews were unaware of web accessibility guidelines, as Participant W252 echoed: *“I haven’t heard anything about it including the relevant guidelines”* and W689 commented: *“I know what web accessibility means but I don’t know the deeper details of it. For instance, I don’t know the details of each article in the guideline”*. It seems that participants appeared to have heard of the term ‘web accessibility’ and web accessibility guidelines, but once again, had little idea of its actual technical underpinnings and inherent link to assisting users with disabilities.

The theme of accessibility awareness, or lack thereof, will continue in the following sections of this chapter and in the conclusions of this thesis as it lies at the core of the problems found with the accessibility of Thai university websites and the content contained within. As we will see in the following sections, a lack of awareness in regards to website accessibility may not necessarily represent a lack of desire to address the issue, as some participant attitudes were quite positive, whilst others would appear to be socially outdated.

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#### 6.1.2 SUPPORTING QUESTION TWO: WHAT ARE THE BARRIERS TO WEB ACCESSIBILITY IN THAI UNIVERSITIES?

The examination of this question has been categorised according to four issues in Thai universities: the negative attitude of stakeholders, absence of accessibility knowledge, a lack of awareness of accessibility policies, and a lack of understanding of TWAG guidelines (Figure 6-5).

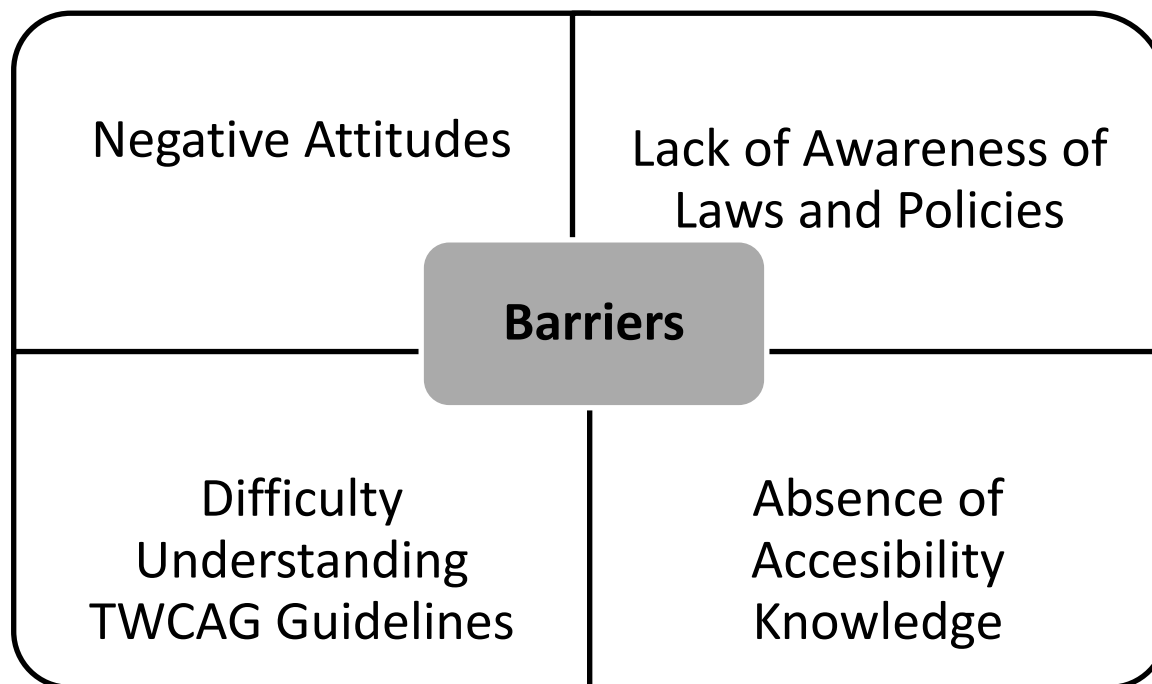


Figure 6-5: Barriers to WCAG adoption in Thai universities

#### 6.1.2.1 NEGATIVE ATTITUDES

This study found that some participants had negative attitudes towards web accessibility in Thai universities in terms of ‘inadequate demand’ and ‘not worthwhile’ given a perception of very small number of students with disabilities in Thai universities.

Interview participants believed that they are able to identify students with disabilities in their university, especially students with physical disabilities (Chapter 5, Section 5.2.1). They also explained that the numbers of such students appears to be very low because of a segregated approach to education for students with disabilities and the limitation of admissions requirements of universities. Some participants speak of disadvantages of integrating a student with a disability into a regular classroom. For example, one senior manager comments:

It must be understood that the concept regarding people with disabilities in Thailand is that these people are mostly enrolled in special schools... Hence, personally, if we admit students with disabilities to study with others, there will be problems. Hence they need to study separately. That’s why web accessibility is not widespread in universities nowadays (S865).

It appears, then, the attitude of university's staffs leans towards a segregated educational approach which is a significant factor in making little progress of web accessibility in the universities. This is consistent with Anthony F. Rotatori, Bakken, and Emerald (2014) claim the following:

Recently, scholars in the field of special education have articulated advantages of inclusive over segregated education, but a majority of people in the Thai society still believe that a standalone special education school is the best option for individuals with disabilities because of lack of school personnel's expertise in working with this population (p. 699).

In fact, Thai government promotes the rights of *"persons with disabilities to be able to access education services and other resources at all levels and to improve the Thai educational system to enhance their quality of life and independent living through empowerment"* in the Persons with Disabilities Education Act B.E. 2551 (2008) (Thailand Ministry of Foreign Affairs, 2011, para. 2).

The limitation of admissions requirements of university is also an obstacle to the adoption of web accessibility. Some participants pointed out that there low numbers of students with disabilities because of the limitation of admissions requirements, as pointed out by one lecturer who stated:

There are some but not many. There are very few students who lost an arm or a leg. This is due to the requirements of the Faculty of Industrial Education which only accepts those who are fully healthy. This is different from the Social Sciences such as Law or Political Sciences or Humanities that accept students with disability (L174).

In the 2014 Thai university admission, some universities present special requirements for undergraduate programs such medicine, engineering and, technical education. For example, the admission of Technical Education faculty of one university shows in their engineering course the following:

- Engineering

Candidates must have graduated from high school (m.6)... Candidates must not be people with visual impairment (totally blind) and people with a physical disability who lost an arm, a hand and both legs.

- Computer

Candidates must have graduated from high school (m.6) ... Candidates must not be people with visual impairment (totally blind) and people with a physical disability who lost an arm, a hand and both legs (Association of University Presidents of Thailand, 2014, p. 236).

Of the two examples presented above, the statement placing limitations on students with disabilities is particularly interesting as computing, as evidenced by the huge literature base available in the field of web accessibility, is replete with assistive technologies. These technologies allow computer users with a wide range of physical, visual, audio and cognitive disabilities to make productive use of computer systems, and in the case of this research focus, the web in particular.

It appears that such admission restrictions have influenced students with disabilities to choose university's programs and it is more likely that the admission policy has a significant impact on types and numbers of those students in the universities, in that numbers of students with disabilities will naturally remain low if they cannot gain admittance in the first instance. Kachondham (2010) also found similar, negative attitudes as those seen in this thesis:

However, attitudinal barriers still existed and some students with disabilities continued to encounter rejection by some universities. There was evidence that blind students were denied the opportunity to study in some universities because some university professors thought that university education would be of no use for them, since there would be no appropriate jobs after their graduation. The kind of jobs that blind persons could typically do would not require education at the university level, such as work as a telephone operator, Thai masseuse, or lottery ticket seller... Though many students with disabilities have successfully entered into the universities, they have had very little choice in choosing the subjects to study. Many of them had to study in the Arts, Social Sciences or in Special Education because these were the only available fields that were offered to them (p. 30).

A very small number of those students in the university are likely to be significant factors in the negative attitude towards web accessibility among Thai university staff. Some participants (S767, W689 and L174) believed that

there was 'inadequate demand' and 'not worthy of developing web accessibility', as W689 commented: *"From the usage statistics, the number of students with disabilities is still low. If the whole website needs to change to respond to the minority, I don't think it will be worth the investment"*. A comment such as this is consistent with the passivity of Thai education and is likely to result in the negative attitude of stakeholders in universities inhibiting the implementation of web accessibility today. Due to the lack of social inclusion, people with disabilities seem to have limited opportunity to participate in our society (United Nations Children's Fund, 2013). However, the Thai government's effort to improve education opportunities for all such as the Thailand Permanent Mission (2010) reported that:

As for education for persons with disabilities, the National Education Act B.E. 2542 (1999) and its amendment B.E 2545 (2002) and the Persons with Disabilities Education Act B.E. 2551 (2008), which mention the right of disabled persons to education, including cost free education, ability to choose schools and educational institutions that suit their capacities, as well as funds for special technologies and scholarships, are used as the fundamental guidelines for plans and policies with regard to education for persons with disabilities (p. 4).

This statement would not seem to be aligned with the findings and attitudes expressed in this thesis by participants from within the Thai university sector. In particular this statement would seem to be the most problematic *'ability to choose schools and educational institutions that suit their capacities'* in that it appears that the institutions make the determinations on the capacities of the students, not the students themselves. Thus, it is seems likely that working on accessibility in Thailand requires more time and focus in the grass roots issues of policy, law and broader social inclusion for students with disabilities.

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#### 6.1.2.2 LACK OF AWARENESS OF ACCESSIBILITY LAWS AND POLICIES

As noted in the literature review, the Thai government has promoted equality in the *National Education Act 1999*, and moreover, the Thai Web Content Accessibility Guidelines (TWCAG) as launched in 2005. However, the results of the web questionnaire indicated that only a few respondents recognised the Thai government accessibility policy and they were uncertain that their institution provided web accessibility policies (Chapter 5, Table 5-20), including accommodations for students with disabilities such as extra exam time, captioned videos, and computers

with speech output or other assistive technologies (Chapter 5, Figure 5-6). The results also confirm views expressed in the interviews, for example as Participant S865 commented: *“At this time, the university still lacks policy and facilities for students with disabilities, such as walkways, ramps and lift”*. By looking at the university's policy webpage, most policies pointed out to ‘University Social Responsibility’, ‘Social Responsibility’ and ‘Innovation’ areas however, no one university had a specific policy regarding accessibility on the webpage except the special institution for students with disabilities (Uni\_45). However, accessibility policy was found on Disabled Students Services (DSS) webpages in university websites. The Office of the Higher Education Commission (OHEC) have launched the National Policy on Education for Students with Disabilities in Higher Education Institutions since 2004 and issued the Regulation on the Promotion of Education for Person with Disabilities in 2010 (Thailand Bureau of Student Development, 2012). The regulation aims to ensure that an effective education from compulsory education to university level is provided for people with disabilities without charge. Moreover, the regulation provides action plans and a budget to support university activities for providing accommodations and facilities for students with disabilities, such as establishing the Disability Support Service (DSS). For example, one of the Thai universities presented DSS centre webpages, which provide services and resources for students with disabilities such as recorded class materials, e-audio books and disability-related advice, however the homepage of the centre contains moving content (a Flash logo and an inaccessible slide show) which failed to meet success criterion 2.2.2 - Pause, Stop, Hide of WCAG guidelines (Figure 6-6).

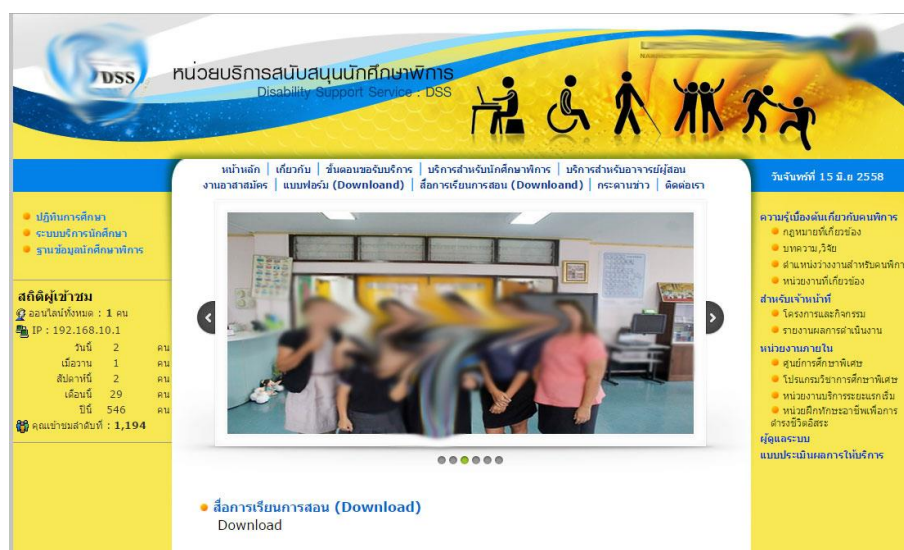


Figure 6-6 :: Example of violation of success criterion 2.2.2 Pause, stop, hide on the DSS center homepage



The OHEC reported that there were 31 DSS centres in Thai universities in 2012, however there were 173 higher education institutions in Thailand (Office of the Higher Education Commission, 2014; Thailand Bureau of Student Development, 2012). It means that there were 31 DSS centres across the 173 Thai universities (18%). Again, the Thai government has been involved to promote laws and policies to address anti-discrimination in society since the Thai Constitution, adopted in 1997. Thailand Information and Communication Technology Policy Framework (2011-2020) presents 'Smart Learning' and the context as following:

Encourage the creation and application of innovation and digital content for learning at all levels, including informal education....The creation of content, database, online content which promotes lifelong learning, the development of school websites and other digital content should follow the web accessibility standard (2011, p. 23).

However the finding of this study clearly shows that there is a lack of awareness of accessibility in university policy and unfamiliarity with TWCAG among academic staff. Thus, law enforcement and accessibility policy implementation in Thailand is still problematic. In a similar study, Cheausuwantavee and Cheausuwantavee (2012) found that ineffectiveness of law enforcement and negative attitudes of educators are the barriers for providing educational provisions and accommodations for students with disabilities in Thai institutions.

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#### 6.1.2.3 ABSENCE OF ACCESSIBILITY KNOWLEDGE

In this study, three significant areas of absence of knowledge were found: the needs of students with disabilities, assistive technology (AT), and web accessibility.

Firstly, in the research literature, most students with disabilities must be supported through appropriate accommodations and resources in the institutions. Thus, understanding the specific educational needs of individual students is a necessary element in implementing the support services and adjustments that they need. However, the research outcome of this study indicates that there is poor knowledge of the needs of students with disabilities among the university's staff. In particular, the results from the web questionnaire revealed that university staff felt that while they do understand well the types of disabilities and its meaning (Chapter 5, Figure

5-5), they have little or no understanding of the needs of students with disabilities (Chapter 5, Table 5-17). This goes hand in hand with their lack of awareness of any existing resources that explain how to make accessible online materials for students with disabilities, resulting in a lack of tested online materials being usable for students with disabilities (Chapter 5, Figure 5-6). Moreover, they believe that the biggest barrier is related to the lack of knowledge of the needs of students with disabilities (Chapter 5, Table 5-19). This is also supported by results from the interview, as one participant commented:

If one does not understand how a person with disabilities perceives the world or the relevant persons do not have any experience on special needs, it will not be possible to develop web accessibility in the university...Staff who collect data to create user requirements or web staff need to have knowledge on the special needs of people with disabilities (S865).

As stated previously, this participant indicated a link between knowledge of the needs of students with disabilities and user requirements that would contribute to increase the level of accessibility of university websites. Thus, providing training to university staff about the needs of students with disabilities could lead to more positive accessibility outcomes for Thai students with disabilities.

Secondly, another key issue raised by participants is that of unfamiliarity with assistive technology (AT). Evidence shows that most content providers (the web staff and lecturers) in the universities were not sufficiently aware of AT (Chapter 5, Table 5-20). The resulting situation where a single staff member emerges as the AT proponent in developing websites means that only the webpages under the care of this staff member will have been developed with AT in mind, while other pages under the care of other staff remain opaque to AT. It was thought that this was one of the many reasons why university websites failed to meet WCAG 2.0 assessment, as shown in the results from the web evaluation in this study. As highlighted by the World Wide Web Consortium (2005b), AT is one part of the implementation cycle which demonstrates the process and development of web accessibility. However, at the time of writing, this research could find little evidence of course referring to accessibility or assistive technologies in Thai universities. The Rehabilitation and Assistive Technologies Laboratory (RHA) under National Electronics and Computer Technology Center (NECTEC), the Ministry of Science and Technology was the sole example of a significant accessibility and assistive technology resource presented in the Thai language, and thus it

is perhaps not surprising that many Thai university staff are unfamiliar with the nature and role of AT in relation to assisting students with disabilities.

Thirdly, as stated in 6.1.1 (ii) section, most university staff members lack sufficient knowledge about accessibility such as WCAG guideline, the assistive technology and are therefore incapable of selecting the appropriate tools or methods to build or evaluate the level of accessibility of university websites. For example, some web staff indicated that if they have accessibility knowledge they would develop accessible website with one such staff member (W232) stating:

I do not know what special needs do students with disability want and how to make materials on the website respond to such special needs. However, if it's about having a video on a website with captions similar to the production of karaoke videos, I don't think it will be difficult to make.

Similarly, another web staff (W689) stated:

Personally, I think people can study by themselves if there is a Thai version of web accessibility guideline that is easy to understand for instance, there is an example of webpage that conforms to the principle of accessibility as well as an example of another webpage that does not for the benefit of comparison. If there is such a guideline, I think people can do it.

Thus, if university members are unfamiliar with accessibility terminology, methodologies and tools it is unsurprising that they would not be able to produce accessible websites and check them against relevant standards.

Interestingly, it should be noted that most information and software addressing web accessibility and related fields is primarily presented in English, thus creating a significant barrier to gaining knowledge and building experience in this area for Thai staff. One serious concern among Thais is the use of English (or lack of) as the common language. There are many ways to measure language proficiency, one of which is by using the English Proficiency Index (EPI) (EF Ltd., 2013). The EPI ranked countries by comparing the average English language ability of adults. There are five

levels of the EPI: 'Very High Proficiency', 'High Proficiency', 'Moderate Proficiency', 'Low Proficiency' and, 'Very Low Proficiency'. Thailand is among the group of countries which have "Low Proficiency" as of 2013. Moreover, Pitsuwan who was the ASEAN Secretary-General from 2008 to 2012, states that *"the universally low fluency in English of Thais in general and Thai students in particular is one result of the abnormally low quality of Thailand's higher education and should be urgently addressed"* ("Surin: Low English proficiency in Thailand 'urgent problem'," 2013, para. 1). This low level of English proficiency puts Thai university staff members in a very difficult situation, one in which they are solely reliant on gleaning accessibility knowledge from resources that are available in the Thai language. At the time of writing, the primary such resource was the Thai Web Content Accessibility Guidelines (TWCAG) itself.

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#### 6.1.2.4 DIFFICULTY UNDERSTANDING TWCAG GUIDELINES

The technical language found in the WCAG 2.0 guidelines and documentation can be difficult to comprehend and is overly technical in nature (Ribera et al., 2009b). As stated, this presents even more of an issue if the lecturer or web administrator is not fluent in English and thus cannot make use of the huge amount of WCAG resources available across the web that are written almost entirely in English. The Thai Web Content Accessibility Guidelines (TWCAG) are written in Thai and are based on WCAG 2.0 guidelines, though it is evident from all interview's participants responses that they found the TWCAG translations of the WCAG 2.0 guidelines to be unclear and difficult to understand. Content developers (web staff and lecturers) suggested that if the TWCAG content was clearer, they would be able to develop accessible content because they would have sufficient knowledge and skills in developing websites. For example, one lecturer commented:

The Thai version of WCAG is TWCAG, which is very difficult to understand as it has been translated from its English version. For instance, the word 'auto-update' does not give an instant-understandable translation. It is like reading a legal document that needs interpretation. Personally, I don't think a guideline needs to be written in a very legal or technical form. A guideline with texts and illustrations will make readers understand the concept of web accessibility and they can find more information at a later stage (L268).

As stated previously, it seems likely that the developers are concerned with the content of TWAG which requires interpretation, and if their interpretation of TWAG is incorrect this will in turn lead to lower accessibility outcomes. This researcher feels that the issues surrounding TWAG are crucial in terms of Thai universities and their ability to comprehend and comply with the accessibility mandates of the Thai government. The content needs to provide clear meaning and examples of satisfying success criteria in order to assist the university's content developers in producing accessible websites. In fact, many organisations and governments have done this. For example, the Hong Kong government provides a web accessibility handbook which offers illustrations of a 'before and after rectification' in order to facilitate understanding for each success criteria of WCAG 2.0 guidelines to web developers (Figure 6-7) (Office of the Government Chief Information Officer, 2012). The World Wide Web Consortium (W3C) also provides their Before and After (BAD) <http://www.w3.org/WAI/demos/bad/> site where developers can identify accessibility issues and then examples of solutions to these problems.



Figure 6-7: Example of WCAG failures in the Hong Kong web accessibility handbook

For those who are fluent in English there are the core WCAG 2.0 guidelines plus a wealth of other official and unofficial 'how-to' style resources which allow developers to interpret the technical WCAG materials and apply them in a practical way. However, at the time of writing, this research could find little in the way of Thai language accessibility materials which could be used to complement the existing TWAG documentation.

Of all the barriers identified in this section of the discussion, the researcher feels that availability of Thai language accessibility resources is perhaps the greatest barrier to the adoption of accessibility in the Thai university sector. On reflection, this issue was not considered at the commencement of this research, but in hindsight should have played a more central role, as the issues of awareness, policy and even attitudes can all be impacted to varying degrees on the ability of individuals to be informed as to the purpose and implementation of web accessibility concepts. If the learning resources are not available to them in their native language, then logically the awareness and understanding of web accessibility would be reflective of that found in this study.

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### 6.1.3 SUPPORTING QUESTION THREE: WHAT DRIVERS EXIST FOR WEB ACCESSIBILITY WITHIN THAI UNIVERSITIES?

Responses to the question four key components are included in this sector namely, maintaining a positive attitude, raising awareness and training, finance and other supports and, government agencies and policies (Figure 6-8).

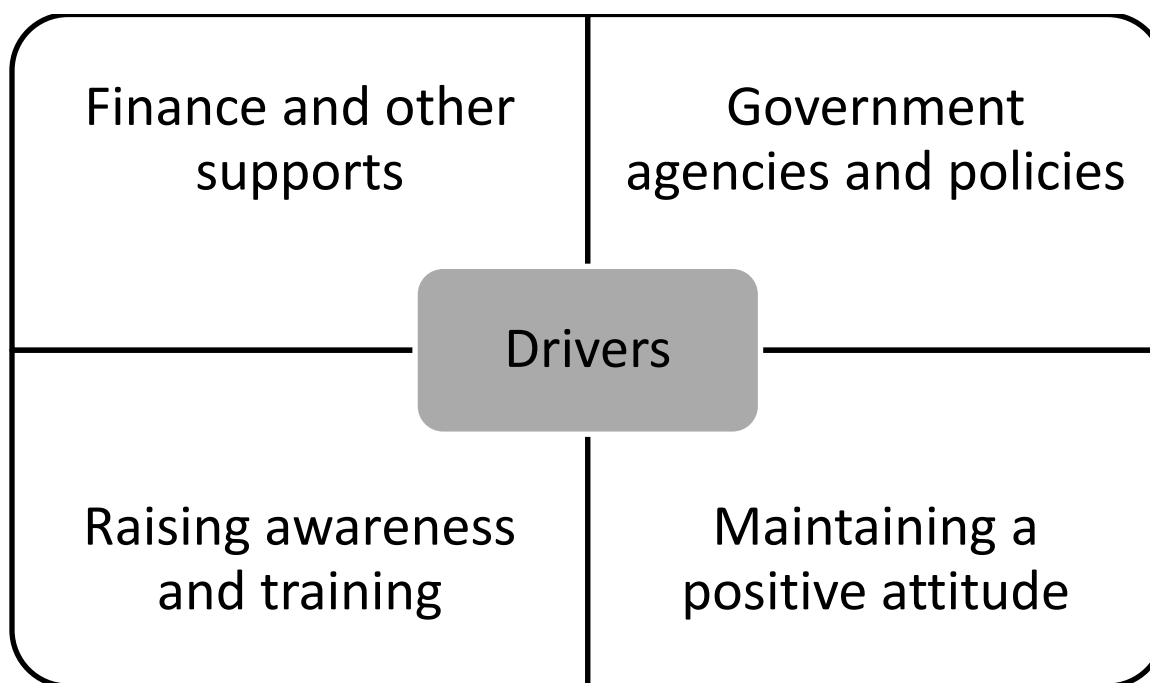


Figure 6-8: Drivers for conforming to WCAG within Thai universities

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#### 6.1.3.1 MAINTAINING A POSITIVE ATTITUDE

Whilst the previous section highlighted a number of negative attitudes as possible barriers to web accessibility in Thai universities, there was also evidence of positive attitudes towards the concepts of accessibility, as shown in

Chapter 5, Section 5.2. The results from both web questionnaire and interviews show that most participants had more positive than negative attitude towards web accessibility. For example, eight from nine interview participants agreed on that making the university's website or e-learning sections accessible was a worthwhile goal. There are three key components of positive attitude: ethics, sharing knowledge and resources and, corporate social responsibility (CSR). Firstly, the reason for developing accessible websites for participants was that of the 'ethics' involved. Participants provided keywords such as 'equal opportunities', 'equal rights' and 'the same basis as students without disabilities' (Chapter 5, Section 5.2.2). As two web staff point out "*Web accessibility is a good tool for encouraging all groups of users to gain knowledge and increase opportunity in education*", states (W264) whilst staff member (W7499) contends that "*The accessibility to access websites is the resource for learning and pertaining knowledge. Everyone deserves the equal right and ability to do so*". Secondly, some participants (L174 S165 and S767) felt that the advantage of web accessibility was 'sharing knowledge and resources'. They believed that university agencies such as the research department, knowledge management (KM) department or innovation centre contain a great deal of valuable information which should be shared with people and organisations external to the university. Therefore increasing the level of accessibility of university websites would benefit wider Thai society as it would provide more inclusive access to the knowledge outputs generated by university activities such one senior manager stated:

I would agree because in fact, not only students access the university's website but also those outside the university. They may access to obtain information from the University's Institute of Research and Development as there are several communities that the Institute gets involved in and such information may be a model for other communities. Hence everyone should be able to obtain information on the university's website (S165).

Thirdly, participants (L797, S728 and W1552) felt that universities should produce accessible websites because of corporate social responsibility (CSR), as participant W1552 commented: "*Web accessibility represents our social responsibility actions towards people with disabilities, however it requires that all stakeholders join hands and take concrete action*". This accords with World Wide Web Consortium (2012f), which encourages organisations to have an accessible website as one form of CSR.

Interestingly, some participants echoed both negative and positive views about web accessibility as one lecturer (L174) stated:

Agree because in the university, there is a lot of beneficial information in various agencies and organizations of the university for instance subject departments, faculties or research institutes. If websites of those agencies or organizations can be made to have web accessibility, those from outside and members of the university will be able to learn the knowledge materials in the university. However, because there is only a few students with disability or almost none at all, the university has not had a web accessibility. Thus when there is no web accessibility, those outside the university who are disabled cannot access such knowledge materials. I aim for 'publicisation' because everyone should be able to access the 'knowledge' in the university... It does not mean that we cannot create web accessibility. That is not a problem. The problem lies with the users. The target group which comprises students with disability is low in number thus it is not worth to invest in this project. Personally, I have cooperated with National Electronics and Computer Technology Center (NECTECH) in many projects and I think a project for people with disability is not worth the investment. However, this type of project needs to be done or developed. This is because the target group, people with disability in Thailand, are still not many. Most of the times, the government invests in projects related to the improvement of the country's competitive potentials or for the majority in the country. From another perspective, web accessibility should be done in certain areas/places such as schools for people with disability. These are schools that are built especially for students with disabilities. If web accessibility is created in such schools, I believe that is worth the investment.

This is a particularly telling statement, as although it is wrapped in a veneer of positivity, it actually contains a deeply seated set of negative attitudes towards students with disabilities, and again comes back to the recurring theme of 'numbers' and the invest in disability specific services as 'not worth it'. This is not unlike the views of Lewthwaite (2014, p. 1380) who feels that



Whilst web standards and web services retain their highly normative technical and social conditions, disability is confirmed as a deficit; a transgressive and abnormal condition, that remains unchallenged, discursively and resolutely embedded in the web. This relation, between normalcy and deviance, non-disabled and disabled, bears greater consideration.

This view of disability as an ‘abnormal condition’ aligns with the views of a number of this research’s participants who repeatedly come back to the concept of students with disabilities being taught at specialised institutions, rather than be included as part of the ‘normal’ student population.

In terms of attitudes towards responsibilities for developing accessible online materials, the finding is that most participants agree that everyone at university should have responsibility for developing accessible materials, across all roles but in particular, those responsible for content development and delivery (Chapter 5, Table 5-18). It should be noted that according to participants in this study, almost 70% of the e-learning content is produced by the lecturers and thus first line accessibility lies with them, followed by the web staff in the role of administrating the university’s learning management system (Chapter 5, Table 5-13 and Table 5-14).

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#### 6.1.3.2 RAISING AWARENESS, TRAINING AND TECHNOLOGY

As stated in 6.1.2 (iii) section, most university staff members are unfamiliar with the tenets of web accessibility, and as a consequence universities may need to find ways to raise awareness among their staff. One solution, identified by participants, is that web accessibility can be promoted within the university through activities such as contests, field trips (to see evidence of best practice), and providing information through the university’s media. In particular, most content providers (web staff and lecturers) preferred the idea of a contest because they felt that it would challenge them to be the winner in the contest, however senior managers expressed their views that a field trip would catch their interest with real examples on a national or international scale, instead of simply watching and listening to information regarding web accessibility in meeting rooms. These are certainly interesting proposals for raising awareness of accessibility within a university setting, though in terms of the wider literature and approaches used by government organisations around the world, would likely be seen as tokenistic and unsustainable. In most cases, accessibility awareness takes the form of ‘you should do it’ because it is the right

thing to do, or 'you must do it' because you are required to do so by law and or policy. So whilst a contest or some internal media within a Thai university might be an interesting mechanism to get the concept of accessibility onto the staff radar, it must be approached in a manner that is not a one-off event. Accessibility is ongoing, evolving and persistent, a message that staff would need to be made aware of on an ongoing basis, particular in the form of staff training and development.

A majority of participants in the web questionnaire and interviews expressed their lack of familiarity with web accessibility guidelines, the special needs of students with disabilities, and the role of assistive technology. Most content providers (web staff and lecturers) indicated that they would be able to develop accessible content if they had appropriate knowledge. As one web staff commented:

It's difficult to develop web accessibility in Thai universities, therefore professionals who have experience and skills are a key to success in this project. The university should provide policy, equipment and training (W1552).

Similarly, another web staff member stated:

Personally, I take care of all aspects of the university website. I believe I can make web accessibility a reality. It's simply that I don't know what the standards of web accessibility are and what the needs of students with disability with regards to their use of website are (W689).

This would seem to imply that if Thai universities were to invest appropriate levels of time and effort into the development of accessibility training materials for their staff, that staff in turn would respond positively to such training. The development of training materials could be quite challenging, for as the previous section highlighted, there would seem to be a notable lack of resource and training regarding web accessibility available in Thai language. This might require that the first stage of any training program would be to identify seminal accessibility resources, such as the W3C's Easy Checks and WCAG-EM and have these translated into Thai. Thai university staff could also attend training through regional corporate projects such as ASEAN4all <http://asean4all.org/>, or Thai government sponsored projects such as People With Disabilities (PWDs) project <http://www.pwdsthai.com/> and, the Equitable-Society project <http://www.equitable-society.com/>. These organisations provide training and

resources to those who work with people with disabilities, though it should be noted that the primary WCAG related resources they provide is that of the TWAG. The Thailand Ministry of ICT provides accessibility training in Thai language such 'The training of ASEAN Web Content Accessibility on HTML5 and CSS for Beginners and Intermediate' and 'Assistive Technology for Person with disabilities' under ASEAN4all project and, 'Advanced web accessibility for Programmers' under Equitable-Society project (Ministry of Information and Communication Technology, 2013).

Another finding of this study is the particular importance of Search Engine Optimization (SEO), HTML5, and Learning Management Systems (LMS). According to the interview with one web staff member who maintains a website in the list of the best university group (Chapter 5, section 5.2.3), this person explained that he did not know the benefits of web accessibility on SEO, however the site takes notice of SEO because of the university's policy. As he commented:

No. 1, 2 and 3 (the checkpoint 1.1.1, 1.3.1 and 2.4.4 of WCAG 2.0 guidelines) are already required by search engine optimization (SEO). This university is involved in SEO. Hence those topics are automatically consistent with the standard. Personally, when we develop a website, we do not put in alternative text for people who are blind but we mainly think about the SEO. Thus the alternative text involved results in benefits for people with disabilities as well. We also use HTML5 for developing the website (W689).

Essentially, this statement indicates that at least one Thai university website addressed some accessibility compliance criteria by accident as part of their SEO activities. Whilst the alignment between SEO and web accessibility appears to be lost on participant W689, it is readily discussed in the literature by Lourdes Moreno and Martinez (2013), J. Smith (2011), and World Wide Web Consortium (2012c) who all state that web accessibility can, and does, go hand in hand with SEO practices. For example, developing a website following SEO standards means building the site with a clear, navigable structure in a way that the search engines can crawl effectively. This implies that the university website that applies SEO concepts should not contain poor navigation, broken links or low quality content, which in turn, can result in improved accessibility outcomes.

Another web staff member (W689) pointed out that HTML5, if implemented correctly, can be particularly important for accessible websites. Confirming the contention of the World Wide Web Consortium (2014b), Fichter (2013) and Creative Commons Team (2014), HTML5 can improve the accessibility of websites for two main reasons: semantics and Accessible Rich Internet Applications (ARIA). There are many HTML5 elements which are machine-readable for modern web browsers and assistive technology (AT). Some people with disabilities also use AT to access information on websites, thus developing university websites with HTML5 can also lead to improved website accessibility.

A related idea was also raised by several lecturer participants. They suggested that developing web accessibility in the university might require the knowledge of accessibility features in LMS software. The results of the web questionnaire revealed that the most popular LMS software is Moodle followed by Joomla and then in-house developed solutions (Chapter 5, Figure 5-3). Some participants were concerned with the accessibility features available in LMS software, as Participant L174 commented:

I produce e-learning developed from Learning Management System (LMS). In that system, there is no feature to create content for people with disabilities. Hence if there is such a feature, I believe that most lecturers are ready to develop e-learning content for people with disabilities.

In fact, Moodle notes achieving accessibility requirements in this statement: *"Websites built with accessibility in mind are flexible in meeting different user needs, preferences and situations"* (Moodle Community, 2014). There are Moodle accessible themes, plugins and guidelines available on its website, such as Moodle-related accessibility coding guidelines, Moodlerooms and Accessibility Block in order to assist developers building accessible online classes for disabled students. Therefore, implementing web accessibility at Thai university may require LMS training specifically the accessibility features in LMS applications.

The three approaches outlined above, SEO, HTML 5 and the use of LMS environments, could, if viewed somewhat cynically, lead to 'accessibility by accident'. That is, if web staff apply the concepts of SEO and use modern web technologies such as HTML 5 as part of their site development practice, even if they are not cognizant of the goals

of web accessibility, they may actually develop somewhat more accessible sites as a result of their use. In turn, lecturing staff might create more accessible learning materials if they had access to LMS tools with in-built accessibility features. Whilst this research is in no way advocating that staff members within Thai universities should not be formally trained in the tenets of web accessibility and be obliged by policy to implement them, however, emphasising the right tools upon which to base the foundation of accessible design is certainly a concept that might be worth consideration in the sector. It seems likely that raising awareness of web accessibility and training has the potential to be a key driver in enabling Thai universities to avoid having inaccessible websites, as other organisations have done (Kurt, 2011; Lazar et al., 2004; Willson, Craven, & Eskins, 2010).

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#### 6.1.3.3 FINANCE AND OTHER SUPPORT

According to the results of the web questionnaire (Chapter 5, Figure 5-9), most participants agreed that three of the most effective future strategies were: 'Support in terms of finance', 'Provision of equipment and technology', and 'Starting with university policy'. In particular, the results indicated that there is a difference in perspective based on each of the participant groups. Senior managers agreed on 'Starting with university policy', while the web staff members preferred 'Provision of equipment and technology' and the lecturers indicated 'Support in terms of finance'. It may be because the web staff has a greater technology focus than the other groups and therefore they require equipment and technology to improve the accessibility of websites. At the same time, participants within the senior managers role would like to see stricter university policy, whilst financial supports are incentives for lecturers. However, most participants were sceptical about 'Increasing penalties in laws regarding noncompliance with accessibility'. This is not unlike the views of Hollier (2012) who feels that:

Thanks to Maguire, there will never be an Olympics or major sporting event's website again that isn't heavily scrutinised for its accessibility. The large numbers of people with disabilities who shop at target.com are able to do so thanks to that case, and the millions of Canadians who are currently unable to get access to their government's online materials will hopefully be able to do so soon. It seems clear to me that each case has provided specific benefits to the wider community... This is significant, as it then frames the accessibility argument similar to the ones around making a bicycle helmet: no one questions if a bicycle

helmet has to comply with the ISO standard, it just does. The legal challenges outlined here, and the many other smaller cases, continue to progress this type of thinking (para. 4).

A similar situation appears in Thailand. The first lawsuit is against state authorities concerning people with physical challenges. ("Court to rule on Thai disabilities' 20-year fight for lifts at all BTS' exits," 2015; Jitcharoenkul, 2015). People with disabilities, through the lower Administrative Court, sued the Bangkok Mass Transit System (BTS) for not providing equal access to transportation for physically challenged people. The lower Administrative Court dismissed the lawsuit in 2009 on the ground that the 2001 legislation protecting the rights of disabled citizens was enacted six years after the BTS system was built. However, the prosecutors appealed the verdict, and the Supreme Administrative Court overturned the ruling and ordered all BTS stations to install lifts within one year in 2015. Similarly, a large number of lawsuits demonstrate the effectiveness of the legal framework (particularly in terms of litigation) in compelling higher education institutions to make their online materials accessible for students with disabilities. For example, the number of inaccessible information technology lawsuits have increased in higher education in the United States in five years, including Penn State University in 2010, the University of Montana in 2012 and Florida State University in 2012 (University of Minnesota Duluth, 2013). Recently, Harvard University and the Massachusetts Institute of Technology (MIT) were being sued by the National Association for the Deaf for not providing adequate captions within their online courses and other materials (Milford, 2015). It would seem that whilst participants in this study were opposed to the concept of penalties for non-compliance to web accessibility requirements, some of the cases cited here would indicate that members of the affected community (including Thai citizens) are becoming more likely to use legalistic approaches to bring about desired accessibility outcomes.

Correspondingly in a follow-up interview finding, most participants believed that finance support from the university is an important part of improving accessibility (Chapter 5, Section 5.2.5). Participants felt that despite their experiences and skills, they could not develop accessible online materials with no funding from the university. For example:

Devices such as a screen reader is necessary for testing the website after improvements should the university want to proceed with the project of web accessibility. Hence the university should support both in terms of finances and tools in this project (W689)

It seems that coupled to the identified lack of accessibility awareness, a further lack of university support may inhibit web accessibility in Thai universities, thus those institutions may be required to provide 'Support in terms of finance', 'Provision of equipment and technology', and perhaps most importantly of all, 'Starting with university policy' in order to encourage progress towards accessibility.

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#### 6.1.3.4 GOVERNMENT AGENCIES AND POLICIES

As outlined in the literature review, the Thai government has laws and policies in order to ensure equal opportunity for all Thai citizens, however the results of this study indicate an ineffective implementation and enforcement of those laws and policies. This is evidenced by the near total lack of awareness of web accessibility demonstrated by Thai university websites and the people who manage them, along with some of the extremely restrictive university entrance policies that actively prevent students with disabilities studying in certain fields. Such outcomes should not be evident were these organisations working within an effective policy environment. Thus, most participants suggested that Thai government agencies should be in charge of accessibility projects, especially the Ministry of Information and Communication Technology (ICT), Ministry of Education, and Ministry of Social Development and Human Security as is demanded by law. In fact, the Thai government has made efforts in providing accommodation for people with disabilities through accessibility projects. For example, the Web Portal on Disability <http://www.pwdsthai.com/> is an organisation under the Ministry of Information and Communication Technology. The website aims to provide support information and services for people with disabilities, such as disability news, assistive technology lending, and disability assistance services (Office of Ministry of Information and Communication Technology, n.d.). In Thai education, Ratchasuda College at Mahidol University is placing accessibility at the foundation of university learning:

Ratchasuda College is a college of higher education for disabled adults in Thailand, providing education and academic services through research to develop knowledge concerning maximizing the potential for life for persons with disabilities based on equality cooperation (Ratchasuda College Mahidol University, n.d., para 3).

Ideally, the positive outcome of accessibility policies could lead to a significant increase in services and accommodations such as developing web accessibility for students with disabilities.

Results from the web questionnaire and interviews point out that accessibility policy can play an important role in web accessibility adoption in universities. If web accessibility is a high priority issue for Thai government, universities should be fully committed to ensuring its website and learning materials are accessible to everyone including students with disabilities. Consequently, university agencies and members are required to publish accessible content. As one lecturer stated:

The government needs to regard web accessibility as important. There need to be policy and action plans. Then subordinate organizations and agencies will follow the government. At the level of the university, there needs to be a policy and the Office of Academic Resources and Information Technology should act as the main host/actor in the project of creating web accessibility (L268).

The participant responses demonstrate a lack of awareness in regards to the Thai government having accessibility laws and policies in place for over a decade. The Thai government fully promote their policies (i.e. TWCAG guidelines) on accessibility and inclusion to all sectors of government and government related organisations, or whether those organisations are not keeping themselves abreast of Thai government policy developments. If perhaps there is no action plan and milestone in government policy regarding web accessibility, there is likely to be no outcomes as a result. The Thai government publication of the TWCAG guideline is not a guarantee that accessible websites will then come as a result. An action plan may be required to achieve the goals established by accessibility policy such other countries have attempted. For example, the Australian Government Information Management Office (2010a) has promoted WCAG 2.0 for all government websites and the Web Accessibility National Transition Strategy (NTS) provided policy as follows:

Agencies must update all government websites (as specified within scope under the NTS) to WCAG 2.0 conformance.

- Level A (Single A) by 31 December 2012
- Level AA (Double A) by 31 December 2014
- To claim conformance websites must meet all five WCAG 2.0 conformance requirements (para. 3).



All Australian government agencies were required to meet minimum (Level A) WCAG.20 requirement in 2012 and up to level AA by the end of 2014. Whilst the outcome of the NTS is still being evaluated, for the most part it was seen as producing some improvement in government related website accessibility as well as greater accessibility awareness in government agencies (Conway, 2014). Likewise in Thailand, embedding an action plan and date-specific milestones in government policy regarding web accessibility might bring about a similar increase in the level of web accessibility and accessibility awareness in the Thai university sector.

It should be noted that Thai cultural management (top-down management style) seemingly has influenced accessibility and university policies as participants echoed that:

The administrative system of the Thai civil service is top-down. This means the government needs to have a policy before the ministry-level takes over. Hence first of all, the government needs to have a policy then the university will be able to take over at a later stage (S767).

And:

This should start from the government, Ministry, the Office of the Higher Education Commission (OHEC) as well as the university's management team. Following their policies, staff will be able to start working (S165).

This implies that the high-level management is responsible for setting accessibility policies and making decisions ensuring coordination in administrative and management areas across the education sector. It includes Thai government agencies such as the ICT Ministry, the OHEC and the university executive board. This is consistent with the study of Thanasankit and Corbitt (2002, p. 1), which stated that:

The concepts of power and uncertainty in Thai culture contribute toward hierarchical forms of communication and decision-making processes in Thailand, especially during requirements engineering, where information systems requirements need to be established for further development... Decisions are passed up through organisational structures to top-level management. Lower level managers avoid taking decisions and prefer those higher up take that responsibility. This was further shown to be institutionalised within a hierarchical set of committee structures where decisions were again passed upwards to the top-most committee

for final validation. This continual avoidance of decision making at lower levels meant that the decision making process was slow and resulted in communications processes that were invariably one way, upwards.

It is more likely that providing clear policy from the high-level management is significant for achieving accessibility compliance and enables Thai universities to develop accessible websites. Specifically, accessibility should be mentioned in the university's mission and core values that will lead to create learning environment in which all students are treated equally.

Another specific concern about government policy, Section 508 of the Rehabilitation Act is a good example of an enforceable standard seen in the United States. Section 508 does not apply to the private sector, however Section 508 does require that:

...this part applies to electronic and information technology developed, procured, maintained, or used by agencies directly or used by a contractor under a contract with an agency which requires the use of such product, or requires the use, to a significant extent, of such product in the performance of a service or the furnishing of a product (United States Access Board, 2000, para. 3).

Section 508 also includes computer software, hardware and documents. This means that if US federal agencies require accessibility features in information technology (IT) products, then companies are committed to develop accessible features in their products before a federal agency can purchase them. This has the side-effect of industry developing accessible products in IT markets, as IBM, Microsoft, Apple and Ericson have done. Providing specific requirements in Thai government policy, tied to procurement as the United States has done, might be beneficial for the development of web accessibility in Thailand. However, enforcing the purchasing of accessible tools and software in terms of the Thai university sector would be unlikely to address the greater issues of web accessibility having almost no profile amongst Thai academics and support staff. Having the tools but not knowing how to use them, or that they even need to be used in the first place is not seen as a solution to the issues identified in this research.

Significantly, Quality Assurance (QA) in Thai Higher Education was introduced by the Ministry of University Affairs in 1996 (Pitiyanuwat, 2015). The policies encourage all higher education institutions to establish quality assurance systems towards achieving and maintaining quality of instruction and academic learning environments. According to the National Education Act 1999 as stated in the literature review, every Thai educational institution is mandated to conduct a Quality Assurance process: the Internal Quality Assurance (IQA) and the External Quality Assurance (EQA) in the National Education Act of B.E. 2542 (1999) (Office of the Ministry of Education, 1999). Most participants suggested that if web accessibility were to become a Key Performance Indicator (KPI) of one or both of these QA processes, all universities would need to implement and maintain acceptable levels of web accessibility in order to pass this auditing as one senior manager suggests:

Web accessibility should be included in the Key Performance Indicators (KPI) to assess the quality of educational service of the university. For a public university, relevant indicators include the KPIs of the Office of the Higher Education Commission (OHEC), and the Office for National Education Standards and Quality Assessment (ONESQA) (S165).

One of the EQA indicators concerns social responsibility (Office of National Education Standards and Quality Assessment, 2012), an area to which participants in this study have already responded to in a positive way (ie Corporate Social Responsibility). Thus, an argument could be made that web accessibility could quite readily become an EQA indicator, perhaps being extended beyond just web accessibility and to a wider assessment of the treatment of students with disabilities. On the other hand, participants suggested that if the university executive team focuses on web accessibility, they could set web accessibility to become one of the IQA indicators to assess the accessibility quality within university. Those participants also commented that the university executive team is in control of their university's IQA so it is relatively easy to implement and would produce effective outcomes in a short period as one senior manager described:

Once the policy has been determined, web accessibility is to be one of the Key Performance Indicators (KPI) for internal quality inspection within the university. Hence, all departments and agencies in the university need to have web accessibility in order to pass the quality assessment. The criteria for quality assessment of a private university in Thailand comprise 3 levels; the first level consists of internal criteria in which the university can set its own

standards; the second level consists of the criteria from the Office of the Higher Education Commission; and the third level consists of the criteria from Office of National Education Standards and Quality Assessment. If the executives of the university regard web accessibility as important, web accessibility can be included in the Key Performance Indicators (KPI) for the internal quality assessment of the university. This is the easiest way for the project to emerge (S865).

The concept of web accessibility integrating into an internal QA process is not a new idea in education, with the University of Houston-Clear Lake (UHCL) provide eight quality assurance strategies such accessibility, usability and, web development in order to review and improve the quality of university's e-learning courses (Kidney, Cummings, & Boehm, 2014). Specifically, the UHCL audited the e-learning courses by using WCAG guidelines. The results reveal that ALT tag is problematic (as in this study) in the e-learning courses thus, it requires an understanding usability and accessibility concepts as a fundamental part of design and development.

Of course the issue of using internal and external quality assurance processes raises yet another concern, which is how such auditing is to take place and using which methods. As the literature review and methodologies chapters indicated, effectively auditing a website in terms of accessibility compliance is a non trivial task, and requires a deep understanding of the WCAG 2.0 guidelines, accessibility testing tools (and their limitations) and repeatable methods by which manual assessments can be performed. Given the almost total lack of awareness of web accessibility concepts and application demonstrated by the Thai universities in this study, finding internal personnel with the appropriate skills to conduct systemic and actionable website evaluations would seem to be a significant challenge. Finding an external quality assurance body capable of performing similar assessments would seem to be an even greater challenge. The latter chapters of this thesis have not focussed heavily on the issues of website evaluation and testing due in large to the findings which indicate that few participants are even aware of accessibility as a concept, with even fewer showing technical knowledge of its implementation. Without having a framework upon which to base accessibility concepts, in—depth discussions of website evaluation and testing seemed moot.

## 6.2 PRINCIPAL RESEARCH QUESTION

### ***Primary Research Question: Is Web Accessibility Conformance inherent in Thai university websites?***

The literature review provided initial evidence that web accessibility in Thai universities and e-learning settings was not well developed as a focus for research. After testing the university websites through automated and manual methods against WCAG 2.0 guidelines, the data showed that the Thai university websites included in this study do not demonstrate any meaningful conformance to the tenets of website accessibility. The evidence shows that errors were present across all aspects of the Perceivable, Operable, Understandable and Robust principles of the WCAG 2.0 guidelines, with Perceivable being particularly problematic. As the W3C (2008c) states, failure to meet any of the POUR principles can lead people with disabilities being unable to use parts or all of an organisations website. This implies that the content of the Thai university websites included in this study is largely opaque to people with disabilities. Whilst the Thai government makes efforts to ensure that *“The creation of content, database, online content which promotes lifelong learning, the development of school websites and other digital content should follow the web accessibility standard.”* (Office of Ministry of Information and Communication Technology, 2011, p. 23), it would seem that awareness of this policy and its application within university processes is limited to say the least.

In terms of web questionnaire and interview responses, this research found that Thai university staff (lecturers, senior managers and web staff) seemed unclear about what constitutes web accessibility. Most participants did not seem to understand even the basic principles of web accessibility. Specifically, there was little or no understanding of the WCAG 2.0 guidelines, or even the Thai version available through the TWCAG. It is perhaps not surprising that the Thai university websites included in this study performed so poorly in the accessibility testing, when the staff who developed the sites, the lecturers who contributed the content and those who managed the universities did not even realise that there was such a thing as website accessibility and that its primary purpose is to assist users with a variety of disabilities. This finding of a lack of awareness aligned with a further lack of awareness of the special needs of students with disabilities by the Thai university staff featured in

this study. Participants appeared to understand the various types of disabilities people may present with, however they did not know about the special needs of these people. They were also unsure of how to develop materials for supporting those specialists needs, particular through the use of assistive technology (AT). Additionally, findings revealed that most participants could not make improvements in web accessibility outcomes due to lack of awareness of accessibility laws and policies. Some participants had never heard about the equal opportunity laws and web accessibility policies although even though these have been embedded in Thai laws and policies for over a decade. The Thai Constitution, adopted in 1997 and amended in 2007 guarantees anti-discrimination provisions and guarantees access to social welfare and services for persons with disabilities (Skills and Emloyability Department, 2009). This indicates that there is ineffective law enforcement and the oversight of policies and procedures governing the development of web accessibility in Thai universities and even the routine acceptance of students with disabilities.

Examining the obstacles to web accessibility conformance in Thai universities, this research found that a number negative attitudes existed within the participant population of this study. Some participants commented that web accessibility is essentially 'worthless' due to low numbers of students with disabilities in the mainstream Thai university sector. However, it may be that those expressing these attitudes were not aware of the restrictions some Thai universities impose on students with disabilities and the barriers to enrolment that are placed in the path of such students. Of course, this is not a problem limited to entirely to the Thai university sector, with ignorance of students with disabilities in institutions appearing across the globe (Hall, Healey, & Harrison, 2002; J. K. Seale, 2013). Part of the attitudes identified in this study seem to go back to the notion that Thai university staff do not want to participate in developing accessible online materials if they believe that web accessibility is not a high priority. These attitudes, and the enrolment practices of some Thai universities seem at odds with the equality mandates promoted in the Thai National Education Act (Office of the Ministry of Education, 1999). Therefore, it is essential for Thai universities to train and educate their staff about the legal requirements and social responsibility benefits of web accessibility for students with disabilities in order to motivate said staff to create better accessibility outcomes.

By looking at the drivers that exist for web accessibility in Thai universities, the results indicate that most participants have positive attitudes towards developing accessible materials for students with disabilities, as long as accessibility is recognised as a university priority. They seemed cognisant of the benefits of web accessibility, especially social benefits, inclusive education, ethical implications and sharing knowledge. Most participants also felt that if they had appropriate knowledge (through training and financial support) about web accessibility and related fields, they could improve the level of accessibility of their institutional websites. This would require improved level of university support, such as financial support for training, equipment and technology. It may also behove Thai universities to develop internal quality assurances processes with an eventual view to establishing relationships with external quality assurance bodies. Finally, participants pointed out that the Ministry of ICT and the Ministry of Education, and Ministry of Social Development and Human Security should be the primary drivers for website accessibility in Thailand's university sector using 'top-down' legislative and policy initiatives in order to promote equal opportunity for Thai citizens with disabilities seeking to further themselves with university level education. Participants in this study believed that university policy, alongside government policy, was a crucial requirement for providing a framework against which Thai university staff members could understand and act upon their responsibilities to all students, not just those defined as being able-bodied.

## 7 CONCLUSION AND RECOMMENDATIONS

### 7.1 CONTRIBUTION OF THIS RESEARCH

As with most thesis studies, this research grew to be larger than initially expected. As the data began to be collected and analysed a number of key findings began to emerge. The following summarises the key contributions this work makes to the field of web accessibility, specifically in the Thai context, but more broadly, to any country where citizens view educational equality as a right, not a privilege.

**Awareness:** this research identified a complete lack of awareness of web accessibility concepts in the Thai university sector. A near total absence of accessible practice in Thai university websites alongside almost complete bemusement by staff in these institutions as to the concept of web accessibility was a key finding of this research. This finding, amongst others, indicates a significant failure of Thai government policy on web accessibility to filter down through the university organisations that receive government funding. Though this research identified numerous references to web accessibility in Thai government policies, it would seem that these policies and their inherent requirements were almost totally opaque to the administrators, lecturers and technical staff in the Thai university sector.

**Attitudes:** attitudes towards web accessibility (once explained to participants) was generally positive, though views ranged from participants feeling that web accessibility should be done as it was the right thing to do, through to accessibility being done on a reward for effort basis, such as staff members or universities winning prizes. Some more negative attitudes emerged from the study participants, such as the view that students with disabilities should go to 'special' institutions, or that certain courses and fields of study were off limits for people with disabilities. The ever present issue of numbers was expressed by some participants, that effort should only be put into accessibility work if there were sufficient numbers of students with disabilities to warrant the level of effort required. None of the attitudes expressed appeared to be malicious in nature, but seemed more reflective of a general ignorance of both the needs of students with disabilities and the potential that such students could



achieve. The researcher feels that some lingering cultural norms regarding the perception of people with disabilities may have also informed some of the more negative attitudes identified.

**Guidelines in Isolation:** a critical finding of this work is that web accessibility guidelines on their own are not sufficient to drive accessibility outcomes. Whilst the Thai government deserves recognition for its efforts in creating the Thai Web Content Accessibility Guidelines, a total lack of other Thai language accessibility resources means that even were the universities in this study pushing towards accessible web content, they would have but a single point of reference. The English language version of the WCAG 2.0 guidelines have numerous links to exemplars and how-to explanations for implementing each section of the guidelines, guidelines which most practitioners agree are technical and complex to comprehend. Not having this resource puts a significant burden on those without English language competencies.

**Language barrier:** the issue of the TWAG and the availability (or lack thereof) Thai accessibility resources is part of a larger issue of accessibility and language. The work done on the data collection phases of this research has shown that assistive technologies, web assessment tools and websites featuring Thai language all create problems for accessing, testing and implementing accessible web content. Having access to accessibility resources is vital, which at the time of writing, means having staff members who are fluent in English, as this research almost a complete dearth of such resources in languages other than English. This work found that if the accessibility message is to be adopted on a worldwide basis, that message needs to be available in more than one language.

**Extension of Thailand's ICT Policy Framework to integrate accessible practice:** based on the core findings of this research, an extended model of Thailand's ICT Policy Framework, the Smart Thailand : Accessible Learning model has been developed in which accessible practice is reflected the identification of key accessibility stakeholders and how they can drive accessibility policy. The provision of accessibility knowledge and resources should in turn lead to an understanding of the benefits of accessibility, particularly in terms of inclusive national education and the acceptance of corporate social responsibility as part of core business for how large institutions interact with the communities they serve. The Smart Thailand : Accessible Learning model encompasses the core criteria identified as being required in the Thai context to ensure that all students, including those with disabilities, can participate equally in tertiary level education. Looking at the model, a number of the key aspects are already in place, particularly policy developed at the government level. However, at the time of writing this policy work has little or

no recognition within the university sector, and in turn, accessibility goals, practice and perceived benefits remain completely unknown.

## **7.2 SMART THAILAND : ACCESSIBLE LEARNING – A MODEL FOR WEB ACCESSIBILITY IN THE THAI UNIVERSITY SECTOR**

As this research has demonstrated this far, at the time of writing staff members within Thai universities had little or no concept of web accessibility, accessibility guidelines or assistive technologies which could aid students with disabilities with their studies. This thesis proposes that in order for Thai universities to become aware of the benefits of web accessibility and adopt its driving principles, a number of key factors will need to be addressed over the coming years. Figure 7-1 proposes A Model for Web Accessibility Adoption in Thai Universities, centred on the five key components of adhering to Thai law and ICT policies, identifying accessibility stakeholders, developing accessibility policy, developing knowledge of web accessibility and its impact on students with disabilities, the provision of accessibility resources and understanding the benefits of web accessibility.

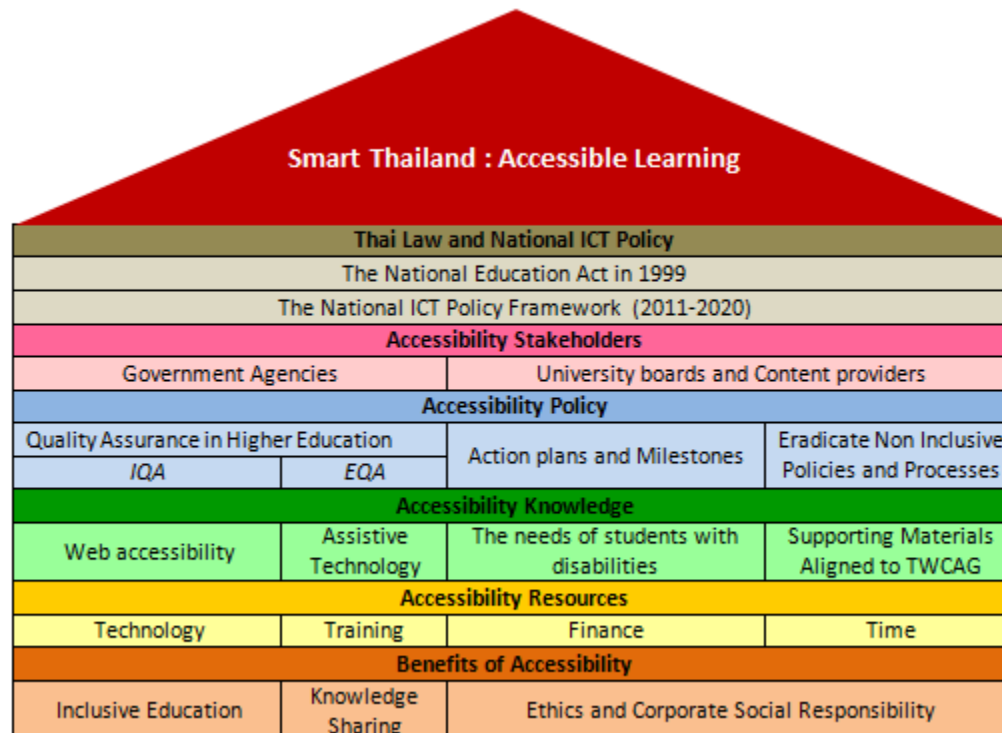


Figure 7-1: A Model for Web Accessibility Adoption in Thai Universities

The Smart Thailand: Accessible Learning structure is based in part on the Thailand ICT Policy Framework (2011-2020) (Ministry of Information and Communication Technology & The National Electronics and Computer Technology Centre, 2011, p. 8) and the National ICT Accessibility and Assistive Technology Framework (2008-2010) (Ministry of Information and Communication Technology, 2008, p. 16). The Thailand ICT Policy Framework is a very broad model as it is looking at ICT as applied to all of Thailand, whilst the National ICT Accessibility and Assistive Technology Framework is more detailed, with more components given its specific focus on ICT and accessibility.

This study provides a model which is drawn from the results of this study and based on the Thai higher education environment as it existed at the time of writing. A Model for Web Accessibility Adoption in Thai Universities (Figure 7-1) is even more detailed and multifaceted as its focus is even more tightly constrained, focussing only on the Thai university sector and the core components required in order to see web accessibility adopted in that sector. Specifically, the embedding of web accessibility in the Quality Assurance (QA) of Thai higher education, and the provision of materials aligned to web accessibility guideline, are seen as key drivers for improving the accessibility of Thai university websites. The following outlines each component of the model and its supporting requirements.

### Thai Law and National ICT Policy

According to the Thai National Education Act BE 2542 (1999) and amendments in BE 2550 (2002), Thailand has promoted the principle of '*lifelong learning*' (in Section 4) which reflects the intention of the Thai government to reform education and ICT framework and therefore deliver a '*Smart Learning*' strategy as promoted in the National ICT Policy Framework (2011-2020). One of the stated goals of the National ICT Policy Framework was to enhance accessible digital content for learning aligned with web accessibility standards. Thus, it is the view of this research, as well as that of some of the research participants, that accessibility adoption and compliance has to begin with Thai universities aligning their own policy and practices to the stated goals of the Thai government.

### Accessibility Stakeholders

The Thai government, as owners and developers of national laws and policy need to take a more active role in the promotion these instruments and legal requirement organisations have to adhere to them. Given the near total lack of recognition these laws and policies had with the research participants in this study, it would seem that the Thai government is taking a more passive approach, whereby the government authors a law or policy, and assumes the target population will simply locate and apply the requirements of said law or policy. It would seem that a more active approach from the Thai government is needed, with education and outreach programs going out to Thai universities and engaging with the executive level of these institutions and making their legal and social responsibilities clear and unequivocal. From here, it would then become the responsibility of each university executive to develop an accessibility policy and associated implementation plan for their specific university, expanding the stakeholder membership to all affected university staff. It should be noted that strong disability networks would be a key component in order to promote equality for people with a disability in Thailand. Thai private organisations and not-for-profits who work with disabled clients should join projects and promote web accessibility more heavily at a governmental and educational level. For example, the National Science and Technology Development Agency was working with others such as the Thailand Association of the Blind, Ratchasuda College at Mahidol University and the Thai Industrial Standards Institute in order to develop the Thai Web Content Accessibility Guidelines (TWAG) (Ministry of Information and Communication Technology, 2011). In a similar vein, it might be that Thai universities could work cooperatively with organisations such as the Thailand

Association for the Blind in order to more fully understand the needs of people with visual disabilities and to ensure that any accessibility work is developed hand in hand with those who would be the beneficiaries of such efforts.

#### Accessibility Policy

A policy is a formal organizational rule or principle to guide decisions, processes and to achieve outcomes. The Thai government has had policy and law in place for some time which outlines, in broad terms, the requirement for web accessibility and inclusive university education. Thai universities, in the absence of their own policies, need to interpret the Thai government requirements and use them as a base for their own accessibility policies. These policies should define what the university intends to do in achieving its accessibility goals, such as developing action plans and setting accessibility milestones (similar in approach to the Australia NTS (2010c) in Figure 7-2), developing supporting materials aligned with the TWAG and integrating web accessibility into internal and external quality assurance (QA) processes. The work plan aspect of the Australian NTS is a good example of how to implement web accessibility because it provides an action plan and timeline. Work plans such as those used as part of the Australia NTS could assist in implementing web accessibility in Thai universities by identifying important tasks and timeframes, including the resources necessary to complete the tasks. It must be stated that whilst aspects of the Australian NTS would provide a useful mode to replicate, such as the work plans, the long-term accessibility benefits of the NTS still remain to be seen. In terms of accessibility policy, Thai universities should ensure that they do not have any outdated admission requirements or constrictive policy which details which courses students with disabilities can and cannot enter, as the examples seen in this research would seem to fly in the face of Thai government laws governing students with disabilities and their participation in mainstream tertiary education.

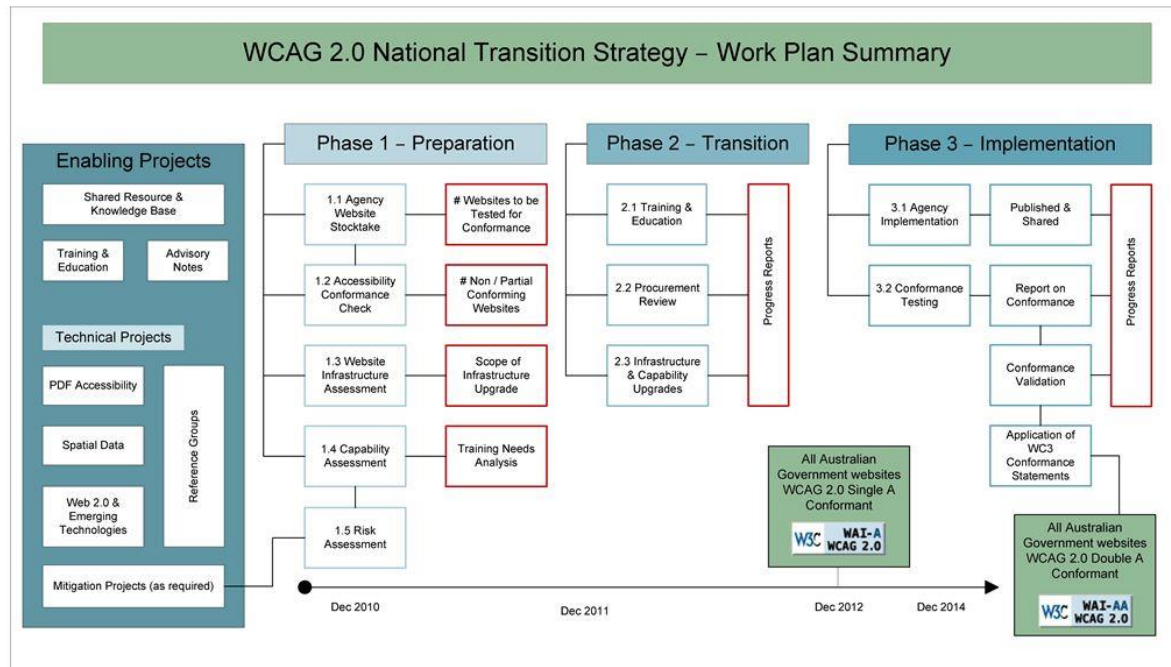


Figure 7-2: WCAG 2.0 National Transition Strategy – Work Plan

### Accessibility Knowledge

The results in this study clearly show that most university staff members, especially content providers and developers (lecturers and web staff) have a distinct lack of accessibility knowledge. If these coal face content providers lack the knowledge about how to develop accessible materials and evaluate for site accessibility, they in-turn will not be able to apply government and university policy surrounding web accessibility. Therefore, training and education for university staff members should be provided in order to ensure that they have appropriate knowledge to deal with accessibility issues. This training would make clear to staff the concept of web accessibility and how it can be of assistance to students with disabilities, including the current standards (outlined in the TWCAG document), the types and roles of assistive technologies and how they interact with accessibility standards and the development of supporting materials aligned with the TWCAG documentation. In fact, universities in a number of countries offer (or require) web accessibility training to their staff such as Cornell University (United States), the University of Melbourne (Australia) and, Queen's University (Canada) (Cornell University, 2013; Queen's University, n.d.; University of Melbourne, 2015). As this research has found, language is a critical barrier to Thai university staff recognising and understanding the requirements of web accessibility, and that the TWCAG alone is not sufficient as a resource by which such staff can learn and apply accessibility standards. To this end it would

be necessary for Thai universities, maybe even in cooperation with each other, to translate seminal English language accessibility resources (of the How-To variety) into Thai so that Thai university staff have a mechanism by which they could more readily interpret the TWAG in the development of their websites and content.

### Accessibility Resources

In order to achieve organisational change, such as bring about web accessibility thinking and conformance, resources need to be made available so that institutions and the staff within them can adequately plan and implement the process required to bring about the desired outcome. In terms of the Smart Thailand : Accessible Learning model the critical resources would include technology, training, financial support and allocation of appropriate time. The technology component would include access to assistive technologies so that university staff members would be able to conduct some level of manual testing as they developed web materials. It would also include software, such as screen readers with Thai language pack add-ons and software tools that are able to create and edit accessible documents, such as PDF's and captioned videos. These technology tools along with the WCAG 2.0 knowledge tools would need to be aligned with appropriate training resources and opportunities so that Thai university staff knew how to make best use of the resources that had been provided. As the previous chapter has outlined, there is some limited amount of Thai language accessibility training available in Thailand, however each university would most likely need to implement their own training materials and schedules to make such a process sustainable. In order to ensure maximum staff engagement with such training, it might need to be a mandatory professional development activity undertaken at least once a year by staff in student related roles, such as lecturers and web admins. The development and implementation of such training, along with the purchase and deployment of technology tools would have a substantial financial impact on a university, and would thus likely require top level support from the university executive in order to fund such initiatives. Whilst financial support of accessibility training and compliance would be necessary to get the accessibility process up and running, time is another critical factor that a university executive would need to provide its staff. As the Australian NTS model demonstrated, even with five years of lead time for government agencies to meet WCAG 2.0 AA compliance, whilst some improvement was identified, it is safe to say that most agencies are falling well short of their required targets. Whilst it is not for this thesis to set timelines and targets for the Thai university sector in

terms of web accessibility compliance, it would not seem unreasonable that a majority of Thailand's universities could have web accessibility compliance statements, targets, training and awareness programs fully instituted into core business by 2020.

### Accessibility Benefits

The Smart Thailand : Accessible Learning model is based primarily on the benefits of accessible websites as identified by the university staff participants in this study. Most such staff had positive attitudes towards the concepts of accessibility, with knowledge sharing and the ethical and corporate social responsibility aspects being of greatest benefit to the university as an organisation. Whilst these are laudable views, they are more about the benefit to the institution and those who work within it, rather than for actual students with disabilities attempting to study within Thai universities. The previous chapter clearly identified a gap in the attitudes of Thai university staff when it came to including students within disabilities into their normal university teaching processes, with many being supportive of the concept, but at specialised institutions rather than in mainstream classes. This issue was further compounded by a number of highly restrictive course entrance requirements which specified which fields of study were open to students with disabilities and those that were not. It is the contention of this research that Thai university staff need to recognise the benefits that students with disabilities can bring to university campuses and courses, rather than the drawbacks. To that end this thesis sees inclusive education, which is after all aligned with the goals of the Thai government's educational policy, as a core benefit of accessibility and modern educational thinking.

The discussion above has presented the core components of a model for accessible learning in Thailand which might be achieved over the next five to ten years. Some aspects of the model will be easier to implement than others, and certainly changes to attitudes by Thai university staff and university executives will likely be more challenging than the allocation of resources and the development of policy instruments. This research recognises that such a model cannot simply be proposed with the assumption that it will happen organically and without intervention at a national, university and staff level. To that end, Figure 7-3 presents an implementation framework for the proposed Smart Thailand : Accessible Learning model, with this framework outlining four areas



which need to be addressed in order for the Smart Thailand model to have any chance of adoption in the Thai university sector.

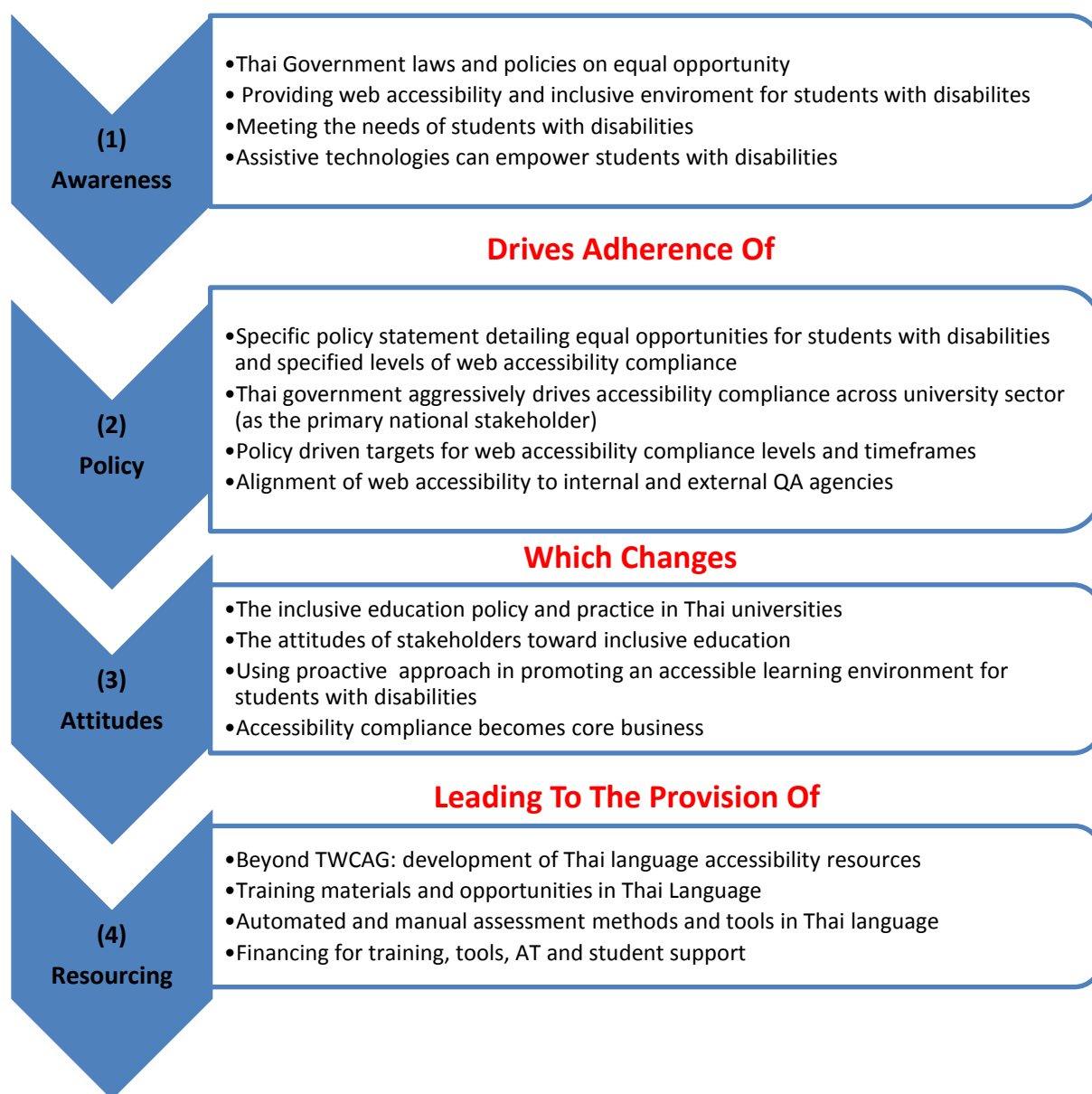


Figure 7-3: Implementation Framework for the Smart Thailand : Accessible Online Materials Model

1. Awareness - Inclusion is a strategic imperative, partnering equity and diversity

The first part of the implementation process would be to raise awareness of stakeholders in Thai universities about students with disabilities, and the importance of creating accessible websites and learning resources for them in order to support their studies. The rights of persons with disabilities is recognised by the international community

(United Nations, 2006), as are the benefits of developing accessible websites for individuals and organization (World Wide Web Consortium, 2012b). Whilst some Thai university staff did not see web accessibility as being a priority for their university, they did recognise the role it could play in allowing students with disabilities to study at the tertiary level. Thus, raising the awareness of Thai university staff to the needs of students with disabilities in order to encourage a shift in attitudes would seem a critical first step in the accessibility adoption process. Alongside this awareness raising process of the needs of students with disabilities, making Thai university staff as well as the university executive aware of the Thai government laws and policy regarding web accessibility and inclusive education would also need to take place. This should ensure that Thai universities recognised not just the social and ethical imperatives of web accessibility, but also the policy and legal requirements expected of them by the Thai government. Essentially, accessibility should not be considered optional, or that it should be put in place in order to garner reward or recognition, but rather as a mandatory requirement of core university business.

## 2. Policy – Equality, diversity and inclusive policy

A strong policy environment would be required in order to bring about the changes outlined in Smart Thailand : Accessible learning model. The Thai government has developed a number of laws and policies which embed disability equality into the higher education and ICT fields; however it seems to have had little or no impact on web accessibility in the Thai university sector. It is perhaps a lack of specific policy dealing with accessibility compliance in the Thai university sector which has resulted in these policies being largely unknown to the participants in this study, or a lack of policy enforcement by the Thai government. The results of this study reveal that Thai university staff see policy as a crucial driver for web accessibility uptake and compliance, and that at the time of this study these staff were essentially operating in an accessibility policy vacuum. Therefore, providing specific, actionable policy regarding web accessibility to deal with equal educational opportunities for students with disabilities should be seen as critical instruments for change in these higher education institutions. To be successful in web accessibility adoption and compliance, university executives must begin by creating accessibility policies that promote change throughout the institution, with policies that mandate accessibility being built into core processes university-wide, becoming a part of the university's mission. Policies can encompass areas such as accessibility

conformance guidelines, procurement requirements, and a code of conduct designed to ensure the provision of support services and equitable outcomes for all students. With respect to providing such equitable educational policy, inclusive education is a challenging issue for Thai universities in terms of some restrictive admission policies and a tendency towards segregated educational thinking, i.e. students with disabilities are better off at ‘special’ universities. Obviously, university policies governing the treatment of students with disabilities should be reflective of the Thai government’s policy and regulation that *“ensure that all persons with disabilities will be able to receive compulsory education and higher up to university level free of charge. The Ministry will coordinator with both the public and private universities to work out the requirements for enrolling persons with disabilities starting from the 2010 academic year”* (Thailand Permanent Mission, 2010, p. 4). It would seem that this coordination effort between the Thai government and the Thai university sector has yet to demonstrate meaningful outcomes, at least in terms of the university staff participating in this study. Again, this is why policy and regulatory mechanism need to be supported by internal and external quality assurance processes, so that statements like these are not just calls to action, but statements of actions against which outcomes will be checked and audited. One possible solution is for the Thai government to provide a timeframe as other countries have done, such as *WCAG 2.0 National Transition Strategy – Work Plan* (Australian Government Information Management Office, 2010c). Particularly, Thai universities would introduce action plans in order to drive accessibility adoption, implementation and monitoring of web accessibility within the institution (Table 7-1).

**Table 7-1: Example of accessibility action plan in the university**

<b>Target</b>	<b>Actions</b>	<b>Outcomes</b>	<b>Timeframe</b>
<u>Diversity Awareness:</u> Build inclusive education and thinking into the university by encouraging awareness of students with disabilities to all staff.	Measure levels of staff awareness of the needs of students with disabilities	Raise staff awareness of students with disabilities and the specialized learning needs	6 months – 1 year
	Measure levels of staff knowledge of web accessibility and assistive technologies	Current our staff level of accessibility knowledge	6 months – 1 year
	Develop disability awareness by promoting ethics, knowledge sharing and CSR through accessibility activities	Educate staff as to the benefits of accessibility and supporting students with disabilities	Ongoing
<u>Learning and Teaching</u>	Audit university facilities and online materials in	Upgrade facilities and online materials to meet minimum	1 – 2 years

<u>Development:</u> Ensure campus facilities and online materials are accessible for students with disabilities.	terms of appropriateness for students with disabilities.	accessibility standards.	
	Developing accessible online materials training program for lecturer and web admin staff.	All students facing websites and learning materials TWCAG compliant.	2 years
<u>Audit and Compliance</u>	Establish audit plans and schedules for TWCAG compliance.	Ensure that once accessibility targets have been implemented, they are maintained	Ongoing

Whilst the example action plan above is relatively simple in content, its application would require significant time and effort and a university wide commitment to the designated outcomes. However, as Figure 7-4 illustrates, similar action publically available actions plans seen in Australian universities can be equally general in what they aim to achieve and how.

<p>The University will achieve this by:</p> <ol style="list-style-type: none"> <li>1. Establishing and publishing clear guidelines for best practice accessible website design on our <a href="#">Accessibility Website</a>. This is based on conformity to Web Content Accessibility Guidelines V2 (WCAG 2.0), minimum AA compliance.</li> <li>2. Expecting all Website Coordinators monitor conformity regularly within their areas of responsibility.</li> <li>3. Ensuring all staff with web authoring responsibilities have an awareness of these guidelines and know how to apply them to everyday website editing.</li> <li>4. Promoting these guidelines throughout the University and community.</li> </ol>
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Figure 7-4: Example of University Website Accessibility Guidelines (Charles Sturt University, n.d.)

Moreover, some Thai university staff members suggest that web accessibility should form university Quality Assurance (QA) KPI's, whereby web accessibility is embedded in QA processes and linked to appropriate work plans such audit procedures and expected levels of accessibility compliance.

### 3. Attitudes – Positive attitude towards inclusive education and students with disabilities

Results of this study demonstrate that most Thai university staff members recognized students with disabilities in their universities however, and that overall the staff were supportive of people with disabilities studying at

university level. However, the positive attitudes of Thai university staff to students with disabilities were offset by some more negative views, including that service levels to such students should be provided in direct relation to the numbers of such students, or that such students would be better off at specialised institutions that could more adequately cater for their needs. Participants in this study pointed to inadequate demand and, the perceived value of web accessibility in the university, where levels of inclusion seemed to be treated as a numbers game. Thai universities should provide accommodations and services for all students including students with disabilities and therefore, e-learning should be accessible by everyone, regardless of ability or disability. This research also revealed that some universities have entrance requirements which specify which courses students could and could not do, with examples that include students with visual disabilities being excluded from computing related courses. Attitudes such as these are in need of modernisation, and need to acknowledge students with disabilities as equal participants in higher education. The issues of inclusive education are difficult ones, and some of the views identified in this thesis are ones which higher education systems have struggled with over the last 20-30 years (Allan, 2010; Bolt, 2004; Gilmore, 2004), however as Allan (2010, p. 604) states “*The sociology of disability emerged in the 1980’s as a direct challenge to the weighty paradigm of special education, with its fixation on individual deficits and remedies*”. In the case of this study, it would seem that the deficits are the courses that students can and cannot study whilst the common remedy is ‘specialised’ educational institutions. Just as these issues are being addressed (if not solved) on the international level by the introduction of strong policy and law, so can more inclusive education initiatives in Thailand through the raising of awareness and adherence to the laws that already exist. If attitudes towards students with disabilities can be improved through policy reform and awareness raising, a proactive approach to accessibility can help the institutions extend the effectiveness of their websites and online learning materials for everyone. Thai universities should look at their web presence and ask themselves, ‘*How can we make this more accessible – how can we better support our students with disabilities?*’. This part of the implementation framework is perhaps the most challenging, as changing attitudes and raising awareness can be very difficult, especially in the area of disability which has traditionally been associated with a certain level of social stigma and a “*tragedy discourse that surrounds disabled peoples and that depicts disability as a deficit, a tragedy and ‘abnormal’, and something to be avoided at all costs*” (Oliver & Barnes, 1998, p. 66).

#### 4. Resourcing – Tools, technology and training

In term of Thai accessibility resources, the development of accessibility knowledge in Thai the language will boost understanding of web accessibility among university's content providers and site developers. Specifically, the Thai Web Content Accessibility Guidelines (TWCAG), which is the official Thai government document regarding WCAG 2.0 requirements, should be modified and rewritten with clearer language with examples of best practise that Thai university staff can see how the guidelines are actually meant to be applied. In addition, the Ministry of ICT, the organisation which is responsible for the TWCAG, should consult web practitioners to provide Thai language versions of resources such as Easy Checks and equivalents of the web accessibility handbook of the Hong Kong government and the Australian government's NTS Work Plan. The benefit of this is would seem clear for web developers who might have minimal experience with web accessibility and require clear guidance in resources developed in their native language. Alongside the written resources, efforts should be made at both the government and university level to identify and recommend accessibility and assistive technology tools that can be used in conjunction with accessibility requirements. This might include recommended automated assessment tools and assistive technologies like screen readers which are readily usable in the Thai language. At the time of writing, the Electronic Government Agency which is a Thai government organisation concerned with e-government standards recommends on their website that government agencies use the TAW (<http://www.tawdis.net>) automated web accessibility assessment tool (Electronic Government Agency, 2012). This example highlights the issue of we accessibility and language in Thailand, as the TAW product supports a number of languages, but not Thai. A review of a number of mainstream assessment tools, including AChecker, SortSite, Webaim's WAVE and Deque did not reveal any support for the Thai language. This creates a significant problem for accessibility uptake in Thai universities as accessibility and assessment go hand in hand, certainly in terms of compliance to guidelines. Any Thai university staff member wishing to implement accessibility practices will have difficult checking their work unless they are fluent in English. Whilst manual assessment techniques are not reliant on automated tools, though one typically informs the other, manual techniques are extremely time consuming and require significant understanding of accessibility, usability and markup language coding techniques. In all cases, training will be central to the raising of accessibility awareness leading into accessibility compliance, which in turn will require financial commitments from Thai university managers in order to bring their staff, policy and process up to speed

in the accessibility context. As Wood and Hollier recommend in the case of Australian government departments meeting the requirements set out in the NTS that these departments should be

Focusing their efforts in training and the provision of support materials around the issues that are of most importance to their major stakeholders; in this case, the staff employed in government departments responsible for meeting NTS targets (2014, p. 4).

Once awareness has been raised, policies developed and attitudes have hopefully improved, training and the financial support which will drive them will be key factors in the ability of Thai universities to achieve both the expectations the Thai government already have for the sector and hopefully, the goals laid out in this research's Smart Thailand : Accessible Learning model.

In summary of the proposed Smart Thailand : Accessible Learning model and its associated implementation model, the accessibility of university websites is not just for the benefit of disabled students, but for the broader Thai community and university sector. All individuals and institutions can benefit from good web design, as it promotes knowledge sharing, collaboration and more importantly, equality of inclusion. The unanswerable question raised by the findings of this thesis is *how many potential Thai students lost the opportunity to participate in higher education because of inaccessible information on the university's website and inequitable processes for entering said university*. The model proposed as a result of this research's findings incorporates existing models, existing ideas, existing problems in web accessibility and creates a contextualised target for Thai university websites to achieve accessibility compliance in the next 5 – 10 years. Though this model is contextualised for the Thai university sector given the identified issues with attitudes, awareness and Thai language tools and resources, most aspects of the model could readily be adapted to any higher education provider, particularly those operating in nations where English is not the native language. Whilst the model proposed here is largely generalizable to different national contexts, it is the implementation framework that would most likely require significant adjustment depending on the educational and social factors apparent within the nation wishing to achieve accessibility from a low starting base.

### 7.3 RESEARCH LIMITATIONS

As with any research, this research was subject to a number of limitations. Firstly, as a result of the limited resources and time, the sample size was not representative of every university within Thailand, but rather those deemed to be in the 'top 46' plus those universities dealing in different modes of delivery, including online only and those dealing specifically with disabled students. Due to the vagaries of both survey and interview research approaches, not every university was represented in the survey results, and fewer still saw interview respondents. Whilst the researcher feels that the depth of response to the survey and interview data provided some extremely interesting and unexpected outcomes, the results cannot be considered generalizable to the entire university sector. A second limitation could be considered to be the selection of tools and methods used during the automated and manual website evaluation process. This research used the SortSite automated assessment tool and the NVDA screen reader assistive technology product for a number of reasons as outlined in the research methods chapter, however it might be argued that a wider variety of assessment and assistive technology tools might have given a clearer picture of the state of website accessibility in the Thai university sector. It is also notable that this study did not seek out participant students with disabilities studying in Thai universities. The reason for this is twofold, the first being that this research was essentially seen as establishing if web accessibility was even on the radar of Thai universities and their staff, and if not, why not. The second reason was that involving the difficulty in identifying and contacting students with disabilities in the participating universities in the time available to this research. Finally, whilst perhaps not a limitation of this study but more of a finding, the issue of language (Thai versus English) turned out to be a significant barrier to accessibility awareness and compliance in Thai universities, and perhaps should have been identified as such in the earlier stages of the research planning.



## 7.4 FUTURE RESEARCH

The findings of this research suggest a number of future research opportunities, especially in terms of the availability of Thai language resources and tools, exploration of university administrations and their understanding of Thai equality and education laws and finally, the perspectives of Thai university students with disabilities and their experience of accessible access to online resources. In terms of the Thai language, a study which sees the development of Thai language versions of some of the most useful web accessibility resources, aligned with Thai language training, should go some way to addressing the issue of whether resource availability influences accessibility acceptance and uptake. In a similar vein, the development of Thai language translations or equivalents of some of the automated assessment tools discussed earlier could come at the same time or after work on the Thai language resources, as once Thai university staff start developing accessible materials, they will need to assess and test soon after. With respect to university staff, the TWAG is more likely harder for beginners to understand because the guidelines seem very complex and have specific techniques, made more difficult by a lack of Thai language examples of the guidelines in action. Multimedia principles and visual content such as infographics should be integrated in the strategic planning for web accessibility as *“people learn better from words and pictures than from words alone”* (Mayer, 2014, p. 4). For example, infographics can help organisations more effectively explain information regarding web accessibility to stakeholders.

Future research into the alignment of organisational policy against government legal and policy requirements could provide a rich selection of topics, as has been seen in research conducted in Australia in terms of NTS compliance, the U.S. for Section 508 and other nations such as Canada, the U.K. and Europe. Finally, the primary stakeholders in accessibility research of any kind, the person with a disability, would need research focussed specially on their needs and context. In terms of this study and its findings, there seems to be little in the way of accessible university websites, online learning materials or even on-campus support for equity of access. Research into these areas, and the challenges faced by Thai university students with disabilities would be essential to completing the understanding of the accessibility space in relation to Thai universities.

## 7.5 CONCLUDING REMARKS

Thailand as a nation has a vibrant and rapidly growing higher education system, evidenced by a large number of university level institutions (173) for a population of around 70 million people. Of those universities, only 73 institutions report having students with disabilities in their courses, and of those 73, a number place restrictions on which fields can be studied by such students. Whilst this is not meant to be an indictment of the Thai university system or the people who work within, it perhaps places some of the findings of this thesis into the context of why web accessibility, an inherently disability oriented concept, appears to have such minimal traction in this sector. As discussed throughout this and previous chapters, there are a number of other critical barriers to the uptake of accessible thinking, including the dearth of accessibility resources available to Thai language speakers as well as attitudes that are at the same time both supportive and outdated.

As the Thai government, and no doubt the Thai people, place a great deal of merit in higher education and the outcomes it can achieve for individuals and the nation as a whole, it is the hope of this researcher that in the future some or all of the components of the proposed Smart Thailand: Accessible Learning model and its associated implementation framework will be adopted by Thai university sector. The ultimate aim is to commence the web accessibility journey in Thailand's universities, the people who work in it, and most importantly of all, students with disabilities striving to learn in an environment of equal access. The quote below from former president of the United States Bill Clinton is as true today as it was nearly two decades ago and is likely to be in decades to come:

New information and communications technologies can improve the quality of life for people with disabilities, but only if such technologies are designed from the beginning so that everyone can use them. Given the explosive growth in the use of the World Wide Web for publishing, electronic commerce, lifelong learning and the delivery of government services, it is vital that the Web be accessible to everyone.

(World Wide Web Consortium, 1994).

- Abou-Zahra, S., & Henry, S. L. (2010). *Exploring web accessibility solutions in developing regions as innovations for the benefit of all*. Paper presented at the Proceedings of the 2010 International Cross Disciplinary Conference on Web Accessibility (W4A), Raleigh, North Carolina.
- Adobe Systems Incorporated. (2012). Dreamweaver and accessibility. from <https://helpx.adobe.com/dreamweaver/using/dreamweaver-accessibility.html>
- Adobe Systems Incorporated. (2011). Acrobat X Pro Retrieved from <http://www.adobe.com/products/acrobat.html>
- Aizpurua, A., Arrue, M., Vigo, M., & Abascal, J. (2011). Validating the effectiveness of EvalAccess when deploying WCAG 2.0 tests. *Universal Access in the Information Society*, 10(4), 425-441. doi: 10.1007/s10209-011-0226-z
- Alhomod, S., & Mohd Mudasir, S. (2013). Success Factors of E-Learning Projects: A Technical Perspective. *TOJET : The Turkish Online Journal of Educational Technology*, 12(2).
- Alina-Mihaela, I. (2012). Compared Analysis of Representative Learning and Content Management Systems used in Education. *Informatica Economica*, 16(1), 123.
- Allan, J. (2010). The sociology of disability and the struggle for inclusive education. *British Journal of Sociology of Education*, 31(5), 603-619. doi: 10.1080/01425692.2010.500093
- Allen, I. E., & Seaman, J. (2011). Going the Distance: Online Education in the United States, 2011. from <http://www.onlinelearningsurvey.com/reports/goingthedistance.pdf>
- Allen, I. E., Seaman, J., & Garrett, R. (2007). *Blending in: The extent and promise of blended education in the United States*: ERIC.
- Alliance for Inclusive Education. (n.d.). Integration is not Inclusion. from <http://www.allfie.org.uk/pages/useful%20info/integration.html>
- Alsobhi, A., & Abeyasinghe, G. (2013). *An evaluation of accessibility of e-learning for dyslexic students*.
- Annex, A. (2008). Enhancing learning and teaching through the use of technology. *Policy*, 20.
- Armstrong, H. (2009). Advanced IT education for the vision impaired via e-learning. *Journal of Information Technology Education: Research*, 8(1), 243-256.
- Armstrong, M., Brown, D., & Reilly, P. (2011). Increasing the effectiveness of reward management: an evidence-based approach. *Employee Relations*, 33(2), 106-120.
- Arrue, M., Vigo, M., & Abascal, J. (2008). Web accessibility awareness in search engine results. *Universal Access in the Information Society*, 7(1), 103-116. doi: 10.1007/s10209-007-0106-8
- Association of University Presidents of Thailand. (2014). *Central University Admissions System*. Retrieved from [http://admission.cuas.or.th/download/01/admbook57\\_all\\_web.rar](http://admission.cuas.or.th/download/01/admbook57_all_web.rar).
- AudioEye Inc. (n.d.). Web Accessibility & Section 508 Highlights. from <https://www.audioeye.com/accessibility/>
- Australian Government Information Management Office. (2010a). Australian Government web accessibility national transition strategy. from <http://www.finance.gov.au/publications/wcag-2-implementation/docs/wcag-transition-strategy.pdf>
- Australian Government Information Management Office. (2010b). National Transition Strategy. from <http://www.finance.gov.au/publications/wcag-2-implementation/>
- Australian Government Information Management Office. (2010c). Web Accessibility National Transition Strategy: Work Plan. from <http://www.finance.gov.au/policy-guides-procurement/web-accessibility-national-transition-strategy/wcag-work-plan/>
- Australian Human Rights Commission. (2010a). World Wide Web Access: Disability Discrimination Act Advisory Notes ver 4.0 (2010). from <https://www.humanrights.gov.au/our-work/disability-rights/standards/world-wide-web-access-disability-discrimination-act-advisory>
- Australian Human Rights Commission. (2010b). *World Wide Web Access: Disability Discrimination Act Advisory Notes ver 4.0 (2010)*. Retrieved from <https://www.humanrights.gov.au/our-work/disability-rights/standards/world-wide-web-access-disability-discrimination-act-advisory>.

- Australian Human Rights Commission. (2010c). *World wide web access: Disability Discrimination Act advisory notes: version 4.0*. Canberra: Australian Human Rights Commission Retrieved from [http://www.hreoc.gov.au/disability\\_rights/standards/www\\_3/www\\_3.html](http://www.hreoc.gov.au/disability_rights/standards/www_3/www_3.html).
- Australian Human Rights Commission. (n.d.). Maguire v SOCOG from <https://www.humanrights.gov.au/maguire-v-socog>
- Ayres, L. (2008). *Semi-Structured Interview*. *The SAGE Encyclopedia of Qualitative Research Methods*. SAGE Publications, Inc. Thousand Oaks, CA: SAGE Publications, Inc.
- Babu, R. (2011). *Developing an understanding of the nature of accessibility and usability problems blind students face in web-enhanced instruction environments*. (Dissertation/Thesis), ProQuest, UMI Dissertations Publishing. Retrieved from [http://ecu.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwnV1LS8QwEA7qgoiCro\\_6hPyBdjePNunJg-sqyN72IF6WpElRWLou3T34J\\_zNTtJmrYgXoYcODaUk7czXyXzzORow40JncmiYdL1FqGKFtobx3MhUEp\\_r-E6ZB43TQcvRTOJH9G7aLAqXIR\\_IHHBLCuJ-9n0Z08kot7Xa6mdso56L--6Vfuhin82vOkAKgOUyS1nb4ynY9JcD9lFfijCxn-oJmmLCQMz50e3xv8-9xHaH3X23Ptov1bHTqy5Lew4QZ-JDXEKqwqv3QXvCgxQETc9P90lvIKi01N7QeMN3jddOkFq1WnqbEG8Gpw3fTNRHGpCovfKgwuO7bVqy86AHvTuxZ36XanaDq-n949xq1MQ2whuMcA6DihtFBaSeVEROEWnAhmKDMCzuEPWAgIYITrXQ8AQVNBKf4QUuZ5CejmDB0oV81frTzrz0SoV8KnZyMXDiNYkgjtPudPcvJCJ43ZD2ZSe2paslxFEH39rMZpws8RHvLSZJQSw3XGUyaULoaKilyprNRaiQsUhQWbmfl8RrmgmQA8SS7\\_vHKF9pqMsjuu0Q5Mkr3xlldfbvfBQ](http://ecu.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwnV1LS8QwEA7qgoiCro_6hPyBdjePNunJg-sqyN72IF6WpElRWLou3T34J_zNTtJmrYgXoYcODaUk7czXyXzzORow40JncmiYdL1FqGKFtobx3MhUEp_r-E6ZB43TQcvRTOJH9G7aLAqXIR_IHHBLCuJ-9n0Z08kot7Xa6mdso56L--6Vfuhin82vOkAKgOUyS1nb4ynY9JcD9lFfijCxn-oJmmLCQMz50e3xv8-9xHaH3X23Ptov1bHTqy5Lew4QZ-JDXEKqwqv3QXvCgxQETc9P90lvIKi01N7QeMN3jddOkFq1WnqbEG8Gpw3fTNRHGpCovfKgwuO7bVqy86AHvTuxZ36XanaDq-n949xq1MQ2whuMcA6DihtFBaSeVEROEWnAhmKDMCzuEPWAgIYITrXQ8AQVNBKf4QUuZ5CejmDB0oV81frTzrz0SoV8KnZyMXDiNYkgjtPudPcvJCJ43ZD2ZSe2paslxFEH39rMZpws8RHvLSZJQSw3XGUyaULoaKilyprNRaiQsUhQWbmfl8RrmgmQA8SS7_vHKF9pqMsjuu0Q5Mkr3xlldfbvfBQ)
- Baggett, D. (1994). A Study of Faculty Awareness of Students with Disabilities.
- Baker, S. C. (2014). Making It Work for Everyone: HTML5 and CSS Level 3 for Responsive, Accessible Design on Your Library's Web Site. *Journal of Library & Information Services in Distance Learning*, 8(3), 118-136. doi: 10.1080/1533290X.2014.945825
- Basdekis, I., Klironomos, I., Metaxas, I., & Stephanidis, C. (2010). An overview of web accessibility in Greece: a comparative study 2004–2008. *Universal Access in the Information Society*, 9(2), 185-190. doi: 10.1007/s10209-009-0166-z
- Benjamin, A. (2010). *Making Conformance Work: Constructing Accessibility Standards Compliance*. (Dissertation/Thesis), ProQuest, UMI Dissertations Publishing. Retrieved from [http://ecu.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwnV09T8MwELWASgiBBBVgPqX8gaRx4k8\\_WhAqLEupEB8RSJbEjhqPQtQv\\_njvHFkWIhfHiZMg58Tuf791DGnDJVS11bkuNvUWKqmxqZ0turBaa-VzHd8o8apwOAc7iyuiX6bte4MZ8oFGxT6l7M3txzJfYsg8Wg36Gdukh7iPn\\_TjZuzTbdWjDXFHbnlPCvdcAW4rnnswBPTXwuyR5nRIYmFALG6JBQXRqbOj-6N\\_32PI7J\\_v3EG3ydbbnFMxhOvSpUgATDwCBLMo9\\_gldBjFobvvLxiV1D7mTyHNMQgGfrCdHzqhExHD9Ph\\_OAOiC-kbFwyCa-lyXgumGq5L62CyuGxJFW2rnQXg4i7XrpDKGVYVMIFcN6bmCu5VFnm8p-Sgwlr8xdpz9iwlvrZ-HEcRzCg4kJLdF\\_OkJ6\\_FpDP70cxWnliWLdcUsNP7IBUZPyOJfJbB3hyc1SpeF6VpnAKlraxjsq2ZOyc0undm5\\_NZATAM-zjN2MWfI5dkrzv5x\\_TJFdkB17lrL1H1BfeBwxc](http://ecu.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwnV09T8MwELWASgiBBBVgPqX8gaRx4k8_WhAqLEupEB8RSJbEjhqPQtQv_njvHFkWIhfHiZMg58Tuf791DGnDJVS11bkuNvUWKqmxqZ0turBaa-VzHd8o8apwOAc7iyuiX6bte4MZ8oFGxT6l7M3txzJfYsg8Wg36Gdukh7iPn_TjZuzTbdWjDXFHbnlPCvdcAW4rnnswBPTXwuyR5nRIYmFALG6JBQXRqbOj-6N_32PI7J_v3EG3ydbbnFMxhOvSpUgATDwCBLMo9_gldBjFobvvLxiV1D7mTyHNMQgGfrCdHzqhExHD9Ph_OAOiC-kbFwyCa-lyXgumGq5L62CyuGxJFW2rnQXg4i7XrpDKGVYVMIFcN6bmCu5VFnm8p-Sgwlr8xdpz9iwlvrZ-HEcRzCg4kJLdF_OkJ6_FpDP70cxWnliWLdcUsNP7IBUZPyOJfJbB3hyc1SpeF6VpnAKlraxjsq2ZOyc0undm5_NZATAM-zjN2MWfI5dkrzv5x_TJFdkB17lrL1H1BfeBwxc)
- Bhattacharya, C. B., & Sen, S. (2004). Doing better at doing good. *California Management Review*, 47(1), 10.
- Bianchetti, R., Erle, M., & Hofer, S. (2012). *Mainstreaming the creation of accessible PDF documents by a rule-based transformation from word to PDF*.
- Bitzer, D., Braunfeld, P., & Lichtenberger, W. (1961). PLATO: An automatic teaching device. *Education, IRE Transactions on*, 4(4), 157-161.
- Blackboard Inc. (2012). Commitment to accessibility. Retrieved from <http://www.blackboard.com/Platforms/Learn/Resources/Accessibility.aspx>
- Blackhurst, A. E., & Morse, T. E. (1996). Using anchored instruction to teach about assistive technology. *Focus on Autism and Other Developmental Disabilities*, 11(3), 131-141.
- Bohman, P. (2004). *University web accessibility policies: a bridge not quite far enough*. Paper presented at the World Conference on Educational Multimedia, Hypermedia and Telecommunications.
- Bolt, D. (2004). Disability and the Rhetoric of Inclusive Higher Education. *Journal of Further and Higher Education*, 28(4), 353-358. doi: 10.1080/0309877042000298849
- Bookshare. (2012). An Accessible Online Library. from <https://www.bookshare.org/>
- Boondao, S., Komlayut, S., & Punnakan, W. (2009). Factors in E-Learning in Universities in Thailand. *International Journal of the Computer, the Internet and Management*, 17.

- Bradbard, D. A., & Peters, C. (2010). Web Accessibility Theory and Practice: An Introduction for University Faculty. *Journal of Educators Online*, 7(1), n1.
- Bradbard, D. A., Peters, C., & Caneva, Y. (2010). Web accessibility policies at land-grant universities. *The Internet and Higher Education*, 13(4), 258-266. doi: 10.1016/j.iheduc.2010.05.007
- Brajnik, G. (2006). Automatic Monitoring of Web Accessibility: the Validity Issues. from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.214.1200&rep=rep1&type=pdf>
- Brajnik, G., Mulas, A., & Pitton, C. (2007). *Effects of sampling methods on web accessibility evaluations*. Paper presented at the Proceedings of the 9th international ACM SIGACCESS conference on Computers and accessibility, Tempe, Arizona, USA.
- Brajnik, G., Yesilada, Y., & Harper, S. (2010). *Testability and validity of WCAG 2.0: the expertise effect*. Special Needs Students Order Act § 75 and 168 (2) (1989).
- Brophy, P., & Craven, J. (2007). Web Accessibility. *Library Trends*, 55(4), 950-972.
- Browne, T., Hewitt, R., Jenkins, M., Voce, J., Walker, R., & Yip, H. (2010). 2010 Survey of Technology Enhanced Learning for higher education in the UK.
- Browne, T., Hewitt, R., Jenkins, M., & Walker, R. (2008). 2008 Survey of Technology Enhanced Learning for higher education in the UK.
- Bualar, T. (2013). Commuting Challenges in Bangkok, Thailand: Voices of Blind Students that Public Administrators should Hear. *European Journal of Social Sciences*, 38(3), 400-409.
- Bunch, G. (1994). An interpretation of full inclusion. *American Annals of the Deaf*, 139(2), 150-152.
- Burgstahler, S. (2006). Web accessibility: guidelines for busy administrators. *Handbook of Business Strategy*, 7(1), 313-318. doi: 10.1108/10775730610618990
- Caldwell, B., Cooper, M., Reid, L. G., & Vanderheiden, G. (2008, 11 December 2008). Web Content Accessibility Guidelines (WCAG) 2.0. from <http://www.w3.org/TR/WCAG20/>
- Calvo, R., Iglesias, A., & Moreno, L. (2014). Accessibility barriers for users of screen readers in the Moodle learning content management system. *Universal Access in the Information Society*, 13(3), 315-327. doi: 10.1007/s10209-013-0314-3
- Carlton, L. W. (2011). *Illinois high school principals' perceptions of alternative learning environments*. ILLINOIS STATE UNIVERSITY.
- Casado Martínez, C., Martínez-Normand, L., & Olsen, M. (2009). Is It Possible to Predict the Manual Web Accessibility Result Using the Automatic Result? *Universal Access in Human-Computer Interaction. Applications and Services*, 645-653.
- Cavender, A. C., & Bigham, J. P. (2011). Toward web accessibility for older users. *Universal Access in the Information Society*, 10(4), 357-358. doi: 10.1007/s10209-011-0219-y
- Centre for Internet Society, & Global Initiative for Inclusive Information and Communication Technologies. (2012). *Web Accessibility Policy Making : An International Perspective*.
- Chao, K., Hung, I., & Chen, N. (2012). On the design of online synchronous assessments in a synchronous cyber classroom. *Journal of Computer Assisted Learning*, 28(4), 379-395. doi: 10.1111/j.1365-2729.2011.00463.x
- Charles Sturt University. (n.d.). Charles Sturt University Website Accessibility Guidelines. from [http://www.csu.edu.au/webpublishing/docs/disability\\_access.doc](http://www.csu.edu.au/webpublishing/docs/disability_access.doc).
- Chatelier, G. V. (2009). Asian Computer Man, Father of Thai Internet and Father of Thai eLearning.
- Cheausuwantavee, T. (2014). Social policy and law regarding education and equal social integration of persons with disabilities: model and lessons learned. *International Journal of Disability Management*, 9, e45.
- Cheausuwantavee, T., & Cheausuwantavee, C. (2012). Rights, Equality, Educational Provisions and Facilities for Students with Disabilities in Thailand: Legal and Practical Perspectives over the Past Decade. *Disability, CBR & Inclusive Development*, 23(1), 70-91.
- Cheek, G., Shehab, M., Ung, T., & Williams, E. (2011). *iLayer: Toward an Application Access Control Framework for Content Management Systems*. Paper presented at the Policies for Distributed Systems and Networks (POLICY), 2011 IEEE International Symposium on.
- Chulalongkorn University. (n.d.). Course Syllabus - 2110513 Assistive Technology. from [http://course.sls-atl.com/coursefiles/assistive/2011\\_1/2011-syllabus.pdf](http://course.sls-atl.com/coursefiles/assistive/2011_1/2011-syllabus.pdf)
- Conway, V. (2014). *Website accessibility in Australia and the national transition strategy: Outcomes and findings*. (Degree of Doctor of Philosophy), Edith Cowan University, Western Australia. Retrieved from <http://ro.ecu.edu.au/theses/1405>

- Cook, K. (2008). *In-Depth Interview*: Sage Publications.
- Cooper, M., Sloan, D., Kelly, B., & Lewthwaite, S. (2012). *A challenge to web accessibility metrics and guidelines: putting people and processes first*. Paper presented at the Proceedings of the International Cross-Disciplinary Conference on Web Accessibility, Lyon, France.
- Cornell University. (2013). Web Accessibility Training. Retrieved 27/2/2015, 2015, from <http://www.it.cornell.edu/policies/accessibility/training.cfm>
- Costin, P., Ruxandra-Dora, M., Paul, F., & Maria, G. (2012). Web Accessibility in Romania: The Conformance of Municipal Web Sites to Web Content Accessibility Guidelines. *Informatica Economica*, 16(1), 28-36.
- Court to rule on Thai disabilities' 20-year fight for lifts at all BTS' exits. (2015). *Prachatai*. Retrieved from <http://www.prachatai.com/english/node/4695>
- Craven, J., & Klaus, J. (2008). Accessibility: Education for Web Design and E-Learning Introduction to the Special Thematic Session. *Computers Helping People with Special Needs*, 178-181.
- Creative Commons Team. (2014). Windows Browsers Summary - Firefox has the best HTML5 Accessibility Support Score. from <http://html5accessibility.com/>
- Creswell, J. W. (2009). *Research design: qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, Calif: Sage Publications.
- Creswell, J. W. (2014). *Research design: qualitative, quantitative, and mixed methods approaches*. Thousand Oaks, California: SAGE Publications, Inc.
- Creswell, J. W., & Plano Clark, V. L. (2007). *Designing and conducting mixed methods research*.
- Cybermetrics Lab. (2013). Ranking of World Universities: Thailand. Retrieved 17 July, 2013, from <http://www.webometrics.info/en/Asia/Thailand>
- Daisuke, S., Hironobu, T., Masatomo, K., Shinya, K., & Chieko, A. (2010). Exploratory Analysis of Collaborative Web Accessibility Improvement. *ACM Trans. Access. Comput.*, 3(2), 1-30. doi: 10.1145/1857920.1857922
- Darvishy, A., Hutter, H. P., Horvath, A., & Dorigo, M. (2010a). A flexible software architecture concept for the creation of accessible PDF documents. *Computers Helping People with Special Needs*, 47-52.
- Darvishy, A., Hutter, H. P., Horvath, A., & Dorigo, M. (2010b). A Flexible Software Architecture Concept for the Creation of Accessible PDF Documents (Vol. 6179, pp. 47-52). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Darvishy, A., Hutter, H. P., & Mannhart, O. (2011). Web Application for Analysis, Manipulation and Generation of Accessible PDF Documents (Vol. 6768, pp. 121-128). Berlin, Heidelberg: Springer Berlin Heidelberg.
- De Freitas, S., & Oliver, M. (2005). Does E-learning Policy Drive Change in Higher Education?: A case study relating models of organisational change to e-learning implementation. *Journal of Higher Education Policy and Management*, 27(1), 81-96.
- de Souza, E. R., & Mont'Alvão, C. (2012). Web accessibility: evaluation of a website with different semi-automatic evaluation tools. *Work: A Journal of Prevention, Assessment and Rehabilitation*, 41, 1567-1571.
- Debevc, M., Kosec, P., Rotovnik, M., & Holzinger, A. (2009, Aug. 31 2009-Sept. 4 2009). *Accessible Multimodal Web Pages with Sign Language Translations for Deaf and Hard of Hearing Users*. Paper presented at the Database and Expert Systems Application, 2009. DEXA '09. 20th International Workshop on.
- Department of Internal Affairs New Zealand. (2013). *Guidance*. Retrieved from <https://webtoolkit.govt.nz/guidance/>.
- Disability Rights California. (2010). Employment Rights Under the Americans with Disabilities Act (and other related laws). from [http://www.disabilityrightsca.org/pubs/506801.htm#\\_ednref83](http://www.disabilityrightsca.org/pubs/506801.htm#_ednref83)
- Draffan, E. A. (2009). Web Accessibility and Usability-Can It Happen with Flash? *Journal of Access Services*, 6(1-2), 303-311. doi: 10.1080/15367960802301002
- Du, S., Bhattacharya, C., & Sen, S. (2010). Maximizing business returns to corporate social responsibility (CSR): the role of CSR communication. *International Journal of Management Reviews*, 12(1), 8-19.
- Dunn, L. (1968). Special education for the mildly retarded: Is much of it justifiable? *Exceptional children*.
- Ebner, M. (2007). *E-Learning 2.0= e-Learning 1.0+ Web 2.0?*
- EF Ltd. (2013). EF English Proficiency Index. from <http://www.ef-australia.com.au/epi/>
- Electronic Government Agency. (2012). *Government Website Standard*. Retrieved from <http://www.ega.or.th/Files/20120823061245.pdf>.
- Ellis, K. (2012). It means inclusion: a creative approach to disability and telecommunications policy in Australia. *Telecommunications Journal of Australia*, 62(2).



- Erpenbeck, J., & Sauter, W. (2007). *Kompetenzentwicklung im Netz: New Blended Learning mit Web 2.0*. European Commission. (2012). European Disability Strategy 2010-2020. from [http://ec.europa.eu/justice/discrimination/disabilities/disability-strategy/index\\_en.htm](http://ec.europa.eu/justice/discrimination/disabilities/disability-strategy/index_en.htm)
- Faltis, C. (2011). Introduction: preparing special education teachers and learning to teach. *Teacher Education Quarterly*, 38(2), 3.
- Farrelly, G. (2010). *Access denied: Overcoming barriers to adoption and implementation of web accessibility*. (Dissertation/Thesis). Retrieved from <http://ecu.summon.serialssolutions.com/link/0/eLvHCXMwY2BQAHaqUizNLZOTEi2B1XtqarJFclqypYFxnmgcYoZ-MwCxJA5UmnUJoQ4uYa4uyhC70HQDfDxBTYwzEDNq0sE80sjQxSDFNMzEzTUImsk40tDS1TzMEbP5NSU9JSTE2TzM3Tks0TUywtU1OSDFMMk8xBx6WbGRuKMfAmgpaL55WAt5WI8LEnuG7J3-nwdUriV PHro0OAHbMZc>
- Feilzer, M. Y. (2010). Doing mixed methods research pragmatically: Implications for the rediscovery of pragmatism as a research paradigm. *Journal of mixed methods research*, 4(1), 6-16.
- Fernández, J. M., Roig, J., & Soler, V. (2010, 2010). *Web Accessibility on Spanish Universities*.
- Ferretti, S., Mirri, S., Muratori, L. A., Rocchetti, M., & Salomoni, P. (2008). *E-learning 2.0: you are We-LCoME!*
- Fichten, C. S., Ferraro, V., Asuncion, J. V., Chwojka, C., Barile, M., Nguyen, M. N., . . . Wolforth, J. (2009). Disabilities and e-learning problems and solutions: An exploratory study. *Educational Technology & Society*, 12(4), 241-256.
- Fichter, D. (2013). Making Your Website Accessible. *Online Searcher*, 37(4), 73-76.
- Frank, J. (2008). *Web accessibility for the blind: Corporate social responsibility or litigation Avoidance?* Paper presented at the Hawaii International Conference on System Sciences, Proceedings of the 41st Annual.
- Franklin, T., & Harmelen, M. (2007). Web 2.0 for content for learning and teaching in higher education.
- Freire, Russo, & Fortes. (2008). *A survey on the accessibility awareness of people involved in web development projects in Brazil*. Paper presented at the Proceedings of the 2008 international cross-disciplinary conference on Web accessibility (W4A), Beijing, China.
- Freire, A. P., Russo, C. M., & Fortes, R. (2008). The perception of accessibility in web development by academy, industry and government: a survey of the brazilian scenario. *New Review of Hypermedia and Multimedia*, 14(2), 149-175.
- Fryia, G. D., Wachowiak-Smolikova, R., & Wachowiak, M. P. (2009, 28-31 July 2009). *Web accessibility in the development of an e-Learning system for individuals with cognitive and learning disabilities*. Paper presented at the Networked Digital Technologies, 2009. NDT '09. First International Conference on.
- Fuller, M., Bradley, A., & Healey, M. (2004). Incorporating disabled students within an inclusive higher education environment. *Disability & Society*, 19(5), 455-468.
- Gaigg, M. (2008). Web Content Accessibility Guidelines (WCAG) 2.0: Overview and Structure. Retrieved from <http://www.michaelgaigg.com/blog/2008/12/19/web-content-accessibility-guidelines-wcag-20-overview-and-structure/>
- Gaiser, T., & Schreiner, A. E. (2009). *A guide to conducting online research*. Los Angeles: SAGE.
- Garrison, D. R. (2011). *E-learning in the 21st century: A framework for research and practice*: Taylor & Francis.
- Gilmore, L. (2004). Community attitudes towards disability and inclusive education. *JOURNAL OF INTELLECTUAL DISABILITY RESEARCH*, 48, 391-391.
- Glenn, M., & D'Agostino, D. (2008). The Future of Higher Education: How Technology Will Shape Learning. *New Media Consortium*.
- Global Initiative for Inclusive Information and Communication Technologies (G3ict). (2013). 2013 ICT Accessibility Progress Report.
- Golafshani, N. (2003). Understanding reliability and validity in qualitative research. *The qualitative report*, 8(4), 597-607.
- Gonzlez-Garc, M., Moreno, M., & Martnez, P. (2014). *Adaptation rules for Accessible Media Player Interface*. Paper presented at the Proceedings of the XV International Conference on Human Computer Interaction, Puerto de la Cruz, Tenerife, Spain.
- Google. (2015). Captions. from [https://support.google.com/youtube/topic/3014331?hl=en&ref\\_topic=4355241](https://support.google.com/youtube/topic/3014331?hl=en&ref_topic=4355241)
- Gornitsky, M. (2011). Distance education: accessibility for students with disabilities. *Distance Learning*, 8(3), 47.

- Granić, A., & Ćukušić, M. (2007). Universal Design within the Context of e-Learning. *Universal Access in Human-Computer Interaction. Applications and Services*, 617-626.
- Grauer, R. T. (2011). *Microsoft Office 2010*: Prentice Hall.
- Green, R. A., & Huprich, J. (2009). Web accessibility and accessibility instruction. *Journal of Access Services*, 6(1-2), 116-136.
- Guercio, A., Stirbens, K. A., Williams, J., & Haiber, C. (2011). Addressing challenges in web accessibility for the blind and visually impaired. *International Journal of Distance Education Technologies*, 9(4), 1.
- Hackett, S., & Parmanto, B. (2009). Homepage not enough when evaluating web site accessibility. *Internet Research*, 19(1), 78-87.
- Hadley, W. M. (2011). College students with disabilities: A student development perspective. *New Directions for Higher Education*, 2011(154), 77-81. doi: 10.1002/he.436
- Hall, T., Healey, M., & Harrison, M. (2002). Fieldwork and disabled students: discourses of exclusion and inclusion. *Transactions of the Institute of British Geographers*, 27(2), 213-231.
- Hanafizadeh, P., Khodabakhshi, M., & Hanafizadeh, M. R. (2011). Recommendations for Promoting E-learning in Higher Education Institutions: A Case Study of Iran. *Higher Education Policy*, 24(1), 103-126. doi: <http://dx.doi.org/10.1057/hep.2010.27>
- Handicap International France, C. P. (2008). How to build an accessible environment in developing countries : Based on the Cambodia Program's experience. [http://www.handicap-international.org.uk/Resources/Handicap%20International/PDF%20Documents/HI%20Associations/AccessibleEnvironmentDev1\\_2008.pdf](http://www.handicap-international.org.uk/Resources/Handicap%20International/PDF%20Documents/HI%20Associations/AccessibleEnvironmentDev1_2008.pdf)
- Harper, K. A., & DeWaters, J. (2008). A quest for website accessibility in higher education institutions. *The Internet and Higher Education*, 11(3), 160-164.
- Hartley, R. (2010). Teacher Expertise for Special Educational Needs.
- Hassanzadeh, M., & Navidi, F. (2010). Web site accessibility evaluation methods in action: A comparative approach for ministerial web sites in Iran. *The Electronic Library*, 28(6), 789-803.
- Hayes, M. (1989). Integration: A Review Of Current Literature. from <http://www.saskschoolboards.ca/old/ResearchAndDevelopment/ResearchReports/StudentsDiverseNeeds/185.htm#TERMINOLOGY>
- Hend, S. A. (2012). WCAG 2.0 Semi-automatic Accessibility Evaluation System: Design and Implementation. *Computer and Information Science*, 5(6), 73. doi: 10.5539/cis.v5n6p73
- Henry, S. L., Abou-Zahra, S., & Arch, A. (2010). Involving Users in Web Projects for Better, Easier Accessibility. from <http://www.w3.org/WAI/users/involving>
- Henry, S. L., & May, M. (2008). Authoring Tool Accessibility Guidelines (ATAG) Overview. from <http://www.w3.org/WAI/intro/atag.php>
- Hinton, P. (2010). Mann-Whitney U Test. *Encyclopedia of Research Design*. SAGE Publications, Inc (Vol. 2, pp. 747-750). Thousand Oaks, CA: Sage Publications, Inc.
- Hollier, S. (2011). The Sociability: social media for people with a disability. from <http://www.mediaaccess.org.au/sites/default/files/files/MAA2657-%20Report-OnlineVersion.pdf>
- Hollier, S. (2012). Do legal precedents help the accessibility cause? , from <http://www.accessiq.org/news/w3c-column/2012/09/do-legal-precedents-help-the-accessibility-cause>
- Hong Kong the Government Chief Information Officer. (2012). *Web Accessibility Handbook*. Retrieved from [http://www.ogcio.gov.hk/en/community/web\\_accessibility/handbook/doc/Web\\_Accessibility\\_Handbook.pdf](http://www.ogcio.gov.hk/en/community/web_accessibility/handbook/doc/Web_Accessibility_Handbook.pdf).
- Hong, S., Katerattanakul, P., & Lee, D. (2007a). Evaluating government website accessibility. *Management Research News*, 31(1), 27-40. doi: 10.1108/01409170810845930
- Hong, S., Katerattanakul, P., & Lee, D. (2007b). Evaluating government website accessibility: Software tool vs human experts. *Management Research News*, 31(1), 27-40.
- Hoover, N. J. (2009, 10/14/2009). White House Confronts Barriers To Gov 2.0; Regulatory and technical requirements, including accessibility and electronic archiving, present unique challenges to bringing open government to the Web, *InformationWeek*. Retrieved from <http://www.informationweek.com/software/information-management/white-house-confronts-barriers-to-gov-20/d/d-id/1083980?>



- Hrastinski, S. (2008). Asynchronous and Synchronous E-Learning Asynchronous and Synchronous E-Learning. *Educause quarterly*, 31(4).
- Hussin, H., Bunyarit, F., & Hussein, R. (2009). Instructional design and e-learning: Examining learners' perspective in Malaysian institutions of higher learning. *Campus-Wide Information Systems*, 26(1), 4-19.
- Hyder, K., Kwinn, A., Miazga, R., & Murphy, R. (2007). *The eLearning Guild's Handbook on Synchronous eLearning*
- Hyun, J., Moon, J., & Hong, K. (2008, 2008). *Longitudinal Study on Web Accessibility Compliance of Government Websites in Korea*, Berlin, Heidelberg.
- IBM. (n.d.). IBM Web Accessibility Checklist, W3C Web Content Accessibility Guidelines (WCAG) and US Section 508. from <http://www-03.ibm.com/able/guidelines/web/ibm508wcag.html>
- Imrie, R. (2003). Housing quality and the provision of accessible homes. *Housing Studies*, 18(3), 402.
- International Organization for Standardization. (2012). Document management applications. from [http://www.iso.org/iso/catalogue\\_detail.htm?csnumber=54564](http://www.iso.org/iso/catalogue_detail.htm?csnumber=54564)
- Ishtaiwa, F. F., & Abulibdeh, E. S. (2012). The impact of asynchronous e-learning tools on interaction and learning in a blended course. *International Journal of Instructional Media*, 39(2), 141.
- James, A., Kelly, F., & Jaeanne, S. (2011). User Agent Accessibility Guidelines (UAAG) 2.0. from <http://www.w3.org/TR/UAAG20/>
- Jenkinson, J. (1997). *Mainstream or special?: educating students with disabilities*. New York: Routledge.
- Jitcharoenkul, P. (2015). Disabled rejoice over BTS ruling *Bangkok Post*. Retrieved from <http://www.bangkokpost.com/news/general/458889/disabled-rejoice-over-bts-ruling>
- Jun, & Faulkner, S. (n.d.). Colour Contrast Analyser (Version 2). Retrieved from <http://www.visionaustralia.org/digital-access-cca>
- Jun, Faulkner, S., Atkinson, M., & Novak, M. (2012). the Web Accessibility Toolbar (Version 2012). Retrieved from <http://www.visionaustralia.org/business-and-professionals/digital-accessibility-services/resources/tools-to-download/web-accessibility-toolbar-for-ie---2012>
- Kachondham, P. (2010). Disabled Students Services (DSS) in Higher Education in Thailand. *NTUT Education of Disabilities*, 8, 30.
- Kane, S. K., Shulman, J. A., Shockley, T. J., & Ladner, R. E. (2007). *A web accessibility report card for top international university web sites*. Paper presented at the ACM International Conference Proceeding Series.
- Kaye, H. S., Yeager, P., & Reed, M. (2008). Disparities in usage of assistive technology among people with disabilities. *Assistive Technology*, 20(4), 194-203.
- Keeler, C. G., & Horney, M. (2007). Online Course Designs: Are Special Needs Being Met? *American Journal of Distance Education*, 21(2), 61-75. doi: 10.1080/08923640701298985
- Kelly, B., Nevile, L., Sloan, D., Fanou, S., Ellison, R., & Herrod, L. (2009). From Web accessibility to Web adaptability. *Disability & Rehabilitation: Assistive Technology*, 4(4), 212-226. doi: 10.1080/17483100902903408
- Kidney, G., Cummings, L., & Boehm, A. (2014). Toward a quality assurance approach to e-learning courses.
- Kittitouch, S. (2010). Inclusive Education: Facilitating Language Learning in Students with Disabilities.
- Kock, N. F., & Gale. (2009). *E-collaboration: concepts, methodologies, tools, and applications*. Hershey, PA: Information Science Reference.
- Kode, K. (2002). *Elizabeth Farrell and the History of Special Education*: Council for Exceptional Children.
- Kovacs Burns, K., & Gordon, G. L. (2010). Analyzing the impact of disability legislation in Canada and the United States. *Journal of Disability Policy Studies*, 20(4), 205.
- Kozaris, I. A. (2010). Platforms for e-learning. *Analytical and bioanalytical chemistry*, 397(3), 893-898. doi: 10.1007/s00216-010-3587-x
- Kuakiatwong, S. (2010). *Evaluating Web Accessibility and Usability at Thailand Cyber University for Totally Blind Users*. Paper presented at the World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education.
- Kuakiatwong, S. (2012). *Evaluating web accessibility and usability for totally blind users at Thailand Cyber University*. BOSTON UNIVERSITY.
- Kurt, S. (2011). The accessibility of university web sites: the case of Turkish universities. *Universal Access in the Information Society*, 10(1), 101-110.
- Kuzma, J., Yen, D., & Oestreicher, K. (2009). Global e-government Web accessibility: An empirical examination of EU, Asian and African Sites.

- Laohajaratsang, T. (2009). E-Learning Readiness in the Academic Sector of Thailand. *International Journal on ELearning*, 8(4), 539.
- Laohajaratsang, T. (2010). *E-education in Thailand: Equity, quality and sensitivity for learners and teachers*. Paper presented at the Global Learn.
- Law, C., Jacko, J., & Edwards, P. (2005). *Programmer-focused website accessibility evaluations*.
- Law, C., & McKay, E. (2007). Taking account of the needs of software developers/programmers in universal access evaluations. *Universal Access in Human Computer Interaction. Coping with Diversity*, 420-427.
- Layton, T. (2009). Should Public Schools be required to offer online K-12 education? *International Society for Technology in Education*. doi: 1.800.336.5191
- Lazar, J., Dudley-Sponaugle, A., & Greenidge, K. (2004). Improving web accessibility: a study of webmaster perceptions. *Computers in Human Behavior*, 20(2), 269-288.
- Lee, B. (2006). *PARADIGM. The SAGE Dictionary of Social Research Methods*. SAGE Publications, Ltd. London, England: SAGE Publications, Ltd.
- Leitner, M. L., & Strauss, C. (2008). Exploratory Case Study Research on Web Accessibility (Vol. 5105, pp. 490-497). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Lewthwaite, S. (2014). Web accessibility standards and disability: developing critical perspectives on accessibility. *Disability & Rehabilitation*, 36(16), 1375-1383.
- Leyser, Y., Greenberger, L., Sharoni, V., & Vogel, G. (2011). Students with Disabilities in Teacher Education: Changes in Faculty Attitudes toward Accommodations over Ten Years. *International Journal of Special Education*, 26(1), 162-174.
- Li, S., Yen, D. C., Lu, W., & Lin, T. (2012). Migrating from WCAG 1.0 to WCAG 2.0—A comparative study based on Web Content Accessibility Guidelines in Taiwan. *Computers in Human Behavior*, 28(1), 87-96.
- Lindgreen, A., & Swaen, V. (2010). Corporate social responsibility. *International Journal of Management Reviews*, 12(1), 1-7.
- Littlejohn, A., Margaryan, A., & Vojt, G. (2010). Exploring students' use of ICT and expectations of learning methods. *Electronic Journal of e-learning*, 8(1), 13-20.
- Littlejohn, A., & Pegler, C. (2014). *Preparing for blended e-learning*: Routledge.
- Litwin, M. (1995). *How to Measure Survey Reliability and Validity: Vol. 7* (Vol. 7.). Thousand Oaks: SAGE Publications, Incorporated.
- Lo, J. (2012). *RES5115 Lecture notes*. Edith Cowan University, School of Engineering Website.
- Lopes, R., & Gomes, D. (2010). *Web not for all: a large scale study of web accessibility*. Paper presented at the Proceedings of the 2010 International Cross Disciplinary Conference on Web Accessibility (W4A), Raleigh, North Carolina.
- Lopes, R., Van Isacker, K., & Carriço, L. (2010). Redefining assumptions: accessibility and its stakeholders *Computers Helping People with Special Needs* (pp. 561-568): Springer.
- López, J. M., Pascual, A., Masip, L., Granollers, T., & Cardet, X. (2011). Influence of Web Content Management Systems in Web Content Accessibility (Vol. 6949, pp. 548-551). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Luján-Mora, S. (2013). A comparison of common web accessibility problems. from <http://desarrolloweb.dlsi.ua.es/web-accessibility/comparison-common-web-accessibility-problems>
- Lund, A., Lazar, J., & Wulf, V. (2011). *Standards and policy SIG*.
- Machado, M., & Tao, E. (2007). *Blackboard vs. moodle: Comparing user experience of learning management systems*. Paper presented at the Frontiers In Education Conference-Global Engineering: Knowledge Without Borders, Opportunities Without Passports, 2007. FIE'07. 37th Annual.
- Maisak, R., Brown, J., & Utakrit, N. (2014). *Accessible online materials in Thai universities: awareness, attitudes and barriers to effective development*. Paper presented at the The 2nd International Conference on Technical Education (ICTechEd2014), Bangkok.
- Marcelle, G. (2011). Distance Education: Accessibility for Students With Disabilities. *Distance Learning*, 8(3), 47.
- Mark van, H. (2009). Analysing the parameters of the duty of reasonable adjustment to facilitate access to e-learning resources. *Multicultural Education & Technology Journal*, 3(3), 227. doi: 10.1108/17504970910984899
- Marshall, N. M. (1996). Sampling for qualitative research. *Oxford University Press*, 13(6), 522.

- Mason, J. (2006). Six strategies for mixing methods and linking data in social science research.
- Mason, R., & Rennie, F. (2008). *E-learning and social networking handbook: resources for higher education*. New York: Routledge.
- Mayer, R. E. (2014). Principles for multimedia learning with from <http://hilt.harvard.edu/blog/principles-multimedia-learning-richard-e-mayer>
- Mbipom, G. (2009). Good visual aesthetics equals good web accessibility. *SIGACCESS Access. Comput.*(93), 75-83. doi: 10.1145/1531930.1531939
- Mbipom, G., & Harper, S. (2011). *The interplay between web aesthetics and accessibility*. Paper presented at the The proceedings of the 13th international ACM SIGACCESS conference on Computers and accessibility, Dundee, Scotland, UK.
- McAndrew, P., Farrow, R., & Cooper, M. (2012). Adapting online learning resources for all: planning for professionalism in accessibility. *Research in Learning Technology*, 20.
- McCaslin, M. L. (2008). *Pragmatism. The SAGE Encyclopedia of Qualitative Research Methods*. SAGE Publications, Inc. Thousand Oaks, CA: SAGE Publications, Inc.
- McHale, N. (2011). Browser-Based Accessibility Evaluation Tools for Beginners. *Journal of Web Librarianship*, 5(4), 334-343.
- McLellan, P. A. (2011). *Web Accessibility*. (Dissertation/Thesis). Retrieved from [http://ecu.summon.serialssolutions.com/link/0/eLvHCXMwQ7QykcsDIyLKA2DVBaZrCr6iDDGijlTYu4kyyLm5hjh76MIKzfiUnJx4I2Ng787UwszC0JDvSutXrm5Fp6r5FbO\\_vYo31AQAm00q9Q](http://ecu.summon.serialssolutions.com/link/0/eLvHCXMwQ7QykcsDIyLKA2DVBaZrCr6iDDGijlTYu4kyyLm5hjh76MIKzfiUnJx4I2Ng787UwszC0JDvSutXrm5Fp6r5FbO_vYo31AQAm00q9Q)
- Microsoft Corporation. (2014). Creating accessible PDFs. from <http://office.microsoft.com/en-au/word-help/create-accessible-pdfs-HA102478227.aspx>
- Milford, P. (2015). Harvard, MIT Sued Over Captioning for Deaf in Online Courses, *Bloomberg Business*. Retrieved from <http://www.bloomberg.com/news/articles/2015-02-12/harvard-mit-sued-over-captioning-for-deaf-in-online-courses>
- Ministry of Information and Communication Technology. (2008). *National ICT Accessibility & Assitive Technology Framework*. Retrieved from <http://www.equitable-society.com/downloadFile/file000022.pdf>.
- Ministry of Information and Communication Technology. (2011). *Draft of Thai Web Content Accessibility Guidelines* Retrieved from <https://thwcag.files.wordpress.com/2011/01/thwcag-fdns1-120110325.pdf>.
- Ministry of Information and Communication Technology. (2013). *The training of ASEAN Web Content Accessibility on HTML5 and CSS for Beginners and Intermediate, Assistive Technology for Person with disabilities*. Retrieved from <http://asean4all.org/wp-content/uploads/2013/10/02-HTML5-and-CSS-Th-2013-10-13.pdf>  
<http://asean4all.org/wp-content/uploads/2013/10/04-Assistive-Technology-Th-2013-10-21.pdf>.
- Ministry of Information and Communication Technology, & The National Electronics and Computer Technology Centre. (2011). *Thailand Information and Communication Technology Policy Framework (2011-2020)*. Retrieved from <http://unpan1.un.org/intradoc/groups/public/documents/ungc/unpan048145~1.pdf>.
- Ministry of Social Development and Human Security. (2012). *Types of disabilities*. Retrieved from <http://www.lampang.m-society.go.th/wb53/dis/form1.PDF>.
- Mitsamarn, N., Gestubtim, W., & Junnatas, S. (2007). *Web accessibility: a government's effort to promote e-accessibility in Thailand*. Paper presented at the Proceedings of the 1st international convention on Rehabilitation engineering & assistive technology: in conjunction with 1st Tan Tock Seng Hospital Neurorehabilitation Meeting.
- Molinero, A. M. (2004). *Standards compliance: Reliability in automated evaluation tools for accessibility*. (Dissertation/Thesis), ProQuest, UMI Dissertations Publishing. Retrieved from [http://ecu.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwnV3JTsMwEB2xXBCVylZRaCX\\_QGLiZ3G4cIAWrgjUlV3HEIKUAEkP\\_Xs8XpQi4MLNdIRLIYz4\\_Gb97ANmCW5zHikGEduESrYWpaKJYXIKY9traMvmQeN07nv0b4JHTG6adWssUI-N1aJzOBfcvf-MUPJKHxa9foZ-3CICR9N-nE393FX9d44GcvTOLNd6UWGLDRRGhh4\\_Jz-cMg2yiyHEIAAAV3iwYWhU-cbe-N\\_z3ECxw87b\\_CnsFfWZzD02Sjx\\_3prlQgQ1g7h-cXX3hoiY0io8ncEoQ1O7rvLXmrldhOjcmDzWY9ITjpmqZqicmQibASjQ6Uu72A6XLxev80C-dYqapacSQoNCITzEYwEljBrzvbg6cugWgqzf1H5tSEvIRqUWitmYikGdNISjGG0e-bXf314RqOHFIGSx4TOOG-N-XUYkp9AcFJtt8](http://ecu.summon.serialssolutions.com/2.0.0/link/0/eLvHCXMwnV3JTsMwEB2xXBCVylZRaCX_QGLiZ3G4cIAWrgjUlV3HEIKUAEkP_Xs8XpQi4MLNdIRLIYz4_Gb97ANmCW5zHikGEduESrYWpaKJYXIKY9traMvmQeN07nv0b4JHTG6adWssUI-N1aJzOBfcvf-MUPJKHxa9foZ-3CICR9N-nE393FX9d44GcvTOLNd6UWGLDRRGhh4_Jz-cMg2yiyHEIAAAV3iwYWhU-cbe-N_z3ECxw87b_CnsFfWZzD02Sjx_3prlQgQ1g7h-cXX3hoiY0io8ncEoQ1O7rvLXmrldhOjcmDzWY9ITjpmqZqicmQibASjQ6Uu72A6XLxev80C-dYqapacSQoNCITzEYwEljBrzvbg6cugWgqzf1H5tSEvIRqUWitmYikGdNISjGG0e-bXf314RqOHFIGSx4TOOG-N-XUYkp9AcFJtt8)
- Moodle Community. (2014). Accessibility:MoodleDocs. from <http://docs.moodle.org/dev/Accessibility>

- Moore, J. L., Dickson-Deane, C., & Galyen, K. (2011). e-Learning, online learning, and distance learning environments: Are they the same? *The Internet and Higher Education*, 14(2), 129-135.
- Moreno, L., & Martinez, P. (2013). Overlapping factors in search engine optimization and web accessibility. *Online Information Review*, 37(4), 564-580.
- Moreno, L., Martínez, P., Iglesias, A., & Gonzalez, M. (2011). HTML 5 support for an accessible user-video-interaction on the web. *Human-Computer Interaction–INTERACT 2011*, 535-539.
- Moreno, L., Martinez, P., & Ruiz-Mezcua, B. (2008). Disability Standards for Multimedia on the Web. *IEEE Multimedia*, 15(4), 52-54. doi: 10.1109/mmul.2008.85
- Munro, M., & McMullin, B. (2009). E-Learning for All? Maximizing the Impact of Multimedia Resources for Learners with Disabilities *Applied e-learning and e-teaching in higher education*: Information Science Reference (an imprint of IGI Global).
- National Electronics and Computer Technology Center, National Science and Technology Development Agency, & Technology, M. o. S. a. (2011). *Executive Summary. Thailand Information and Communication Technology Policy Framework (2011-2020)*. Bangkok: Retrieved from <http://unpan1.un.org/intradoc/groups/public/documents/ungc/unpan048145~1.pdf>.
- Nedbal, D., & Petz, G. (2010). Implementation Concept for an Accessible Web CMS (Vol. 6179, pp. 456-463). Berlin, Heidelberg: Springer Berlin Heidelberg.
- Nuance Communications Inc. (2013). Vocalizer for NVDA (Version 3.0.10). Retrieved from <https://vocalizer-nvda.com/>
- NV Access Ltd. (2015). NonVisual Desktop Access, (Version 2015.1). Retrieved from <http://www.nvaccess.org/>
- Office of Ministry of Information and Communication Technology. (2011). *Executive Summary. Thailand Information and Communication Technology Policy Framework (2011-2020)*. Bangkok: Retrieved from <http://unpan1.un.org/intradoc/groups/public/documents/ungc/unpan048145~1.pdf>.
- Office of Ministry of Information and Communication Technology. (n.d.). Web Portal for disabled from <http://www.pwdsthai.com/>
- Office of National Education Standards and Quality Assessment. (2012). *the Office for National Education Standards and Quality Assessment*. Retrieved from <http://www.onesqa.or.th/en/home/ONESQA'sBrochure.pdf>.
- Office of the Basic Education Commission of Thailand. (2012). *Disability Action Plan B.E. 2555-2559*. Retrieved from [http://www.teerapongonline.com/sakaew/module/new/upload/File\\_1353651386.PDF](http://www.teerapongonline.com/sakaew/module/new/upload/File_1353651386.PDF).
- Office of the Commission on Higher Education. (2004a). History of the TCU. from <http://lms.thaicyberu.go.th/OfficialTCUen/main/main2.asp>
- Office of the Commission on Higher Education. (2004b). Thai Cyber University. from <http://lms.thaicyberu.go.th/OfficialTCUen/main/main2.asp>
- Office of the Commission on Higher Education. (2013). *The number of students in higher education institutions*. Retrieved from <http://www.info.mua.go.th/information/>.
- Office of the Government Chief Information Officer. (2012). *Web Accessibility Campaign*. Retrieved from [http://www.ogcio.gov.hk/en/community/web\\_accessibility/handbook/doc/Web\\_Accessibility\\_Handbook.pdf](http://www.ogcio.gov.hk/en/community/web_accessibility/handbook/doc/Web_Accessibility_Handbook.pdf).
- Office of the Higher Education Commission (2008). Higher Education Commission. from [http://www.inter.mua.go.th/main2/page\\_detail.php?id=1](http://www.inter.mua.go.th/main2/page_detail.php?id=1)
- Office of the Higher Education Commission. (2012). *Directory Thai Higher Education Institutions*. Retrieved from <http://www.mua.go.th/university.html>.
- Office of the Higher Education Commission. (2013). Higher Educational Information. from <http://www.info.mua.go.th/information/>
- Office of the Higher Education Commission. (2014). Number of Thai universities. from <http://www.mua.go.th/university.html>
- National Education Act of B.E. 2542 (1999) (1999).
- Office of the Ministry of Information and Communication Technology. (2010). *TWCAG2010 (Thai Web Content Accessibility Guidelines 2010)*

- [http://www.thaiwebaccessibility.com/sites/default/files/content\\_types/articles/thwcag2010.pdf](http://www.thaiwebaccessibility.com/sites/default/files/content_types/articles/thwcag2010.pdf).
- Office of the Ministry of Information Communication Technology. (2008). Thai Web Content Accessibility Guide (TWCAG) 2008.
- Office of the Ministry of Public Health. (2005). THAILAND COUNTRY PROFILE.
- Oliver, M., & Barnes, C. (1998). *Disabled people and social policy: from exclusion to inclusion*: Addison Wesley Longman.
- Osborn, J., Stevens, C., & Wheeler, J. (2009). PILS Course Choice Forums October–November 2008. Kelly, L (2009) *Online Getting Started Forums: Executive Summary, OU internal reports*.
- Pagram, P., & Pagram, J. (2006). Issues in e-learning: a Thai case study. from EIJSDC
- Pal, J., Pradhan, M., Shah, M., & Babu, R. (2011). *Assistive technology for vision-impairments: anagenda for the ICTD community*. Paper presented at the Proceedings of the 20th international conference companion on World wide web.
- Palmer, A. (2009). Enhancing learning and teaching through the use of technology: a revised approach to HEFCE's strategy for e-learning.
- Park, H. (2012). *Building web-based learning model applied universal design for students with disabilities*. Paper presented at the World Conference on Educational Multimedia, Hypermedia and Telecommunications.
- Paul, O. (2010). *The student's guide to research ethics*. GB: Open University Press.
- Pearson, S. (2010). The benefits of online learning. *ProQuest Central*, 52.
- Permvattana, R., Armstrong, H., & Murray, I. (2013). E-Learning for the Vision Impaired: A Holistic Perspective. *International Journal of Cyber Society and Education*, 6(1), 15-30.
- Peters, C., & Bradbard, D. A. (2010). Web accessibility: an introduction and ethical implications. *Journal of Information, Communication & Ethics in Society*, 8(2), 206-232. doi: <http://dx.doi.org/10.1108/14779961011041757>
- Petrie, H., Power, C., Swallow, D., Velasco, C. A., Gallagher, B., Magennis, M., . . . Down, K. (2011). The value chain of web accessibility: challenges and opportunities. *Proc. of ADDW 2011*.
- Pinyakong, K., Virasilp, P., & Usa, S. (2007). *Development of private secondary schools in Thailand*: International Institute for Educational Planning.
- Pitiyanuwat, S. (2015). The Standards and Key Performance Indicators of External Quality Assurance of Higher Education in Thailand. *Journal of Research Methodology: JRM*, 18(2), 167-180.
- Poobrasert, O., Sabayjai, P., & Mitsamarn, N. (2011). *Technology-enhanced Learning for Students with Learning Disabilities*. Paper presented at the Advanced Learning Technologies (ICALT), 2011 11th IEEE International Conference on.
- Poon, K., Musti-Ra, S., & Wettasinghe, M. (2013). Special Education in Singapore: History, Trends, and Future Directions. *Intervention in School and Clinic*, 49(1), 59-64. doi: 10.1177/1053451212472230
- Power, C., Freire, A. P., & Petrie, H. (2009). Integrating Accessibility Evaluation into Web Engineering Processes. *International Journal of Information Technology and Web Engineering (IJITWE)*, 4(4), 54-77.
- PowerMapper. (2012). SortSite. from <http://www.powermapper.com/products/sortsite/index.htm>
- Praveen, M. P. (2011). IT policy for curriculum revamp, *The Hindu (English)*. Retrieved from <http://ecu.summon.serialssolutions.com/link/0/eLvHCXMwQ4wAlJcHRkSUB8Der6EueL0IYkAdqax3E2WQdXMNcfbQBRWd8QWQwxjijcyMjUFTeUaGfHNavncHrXJKm70u55dZkE8xAFcPKp0>
- Pressey, S. L. (1927). A machine for automatic teaching of drill material. *School & Society*.
- Punyabukkana, P., Chirathivat, J., Chanma, C., Maekwongtrakarn, J., & Suchato, A. (2007). *The implementation of CU Voice Browser, A Voice Web Navigation Tool for the Disabled Thais*. Paper presented at the Proceedings of the third conference on IASTED International Conference: Advances in Computer Science and Technology.
- Punyabukkana, P., Thanawastien, S., & Jirachiefpattana, A. (2008). *Thailand's national digital divide strategic framework*. Paper presented at the Proceedings of the 2008 international cross-disciplinary conference on Web accessibility (W4A).



- Punyabukkana, P., Thanawastien, S., & Komolsuradej, S. (2009). *The implementation status of Thailand's national social equality in ICT master plan*.
- Punyabukkana, P., Vorapatraton, S., Lertwongkhanakool, N., Hirankan, P., Kertkeidkachorn, N., & Suchato, A. (2012). *ChulaDAISY: an automated DAISY audio book generation*. Paper presented at the Proceedings of the 6th International Conference on Rehabilitation Engineering & Assistive Technology, Tampines, Singapore.
- Queen's University. (n.d.). Education, Training and Awareness for Faculty & Staff. Retrieved 27/2/2015, 2015, from <http://queensu.ca/accessibility/facultystaff/education-training-and-awareness-faculty-staff>
- Ramakrishnan, I., Mahmud, J., Borodin, Y., Islam, M. A., & Ahmed, F. (2009). Bridging the Web Accessibility Divide. *Electronic Notes in Theoretical Computer Science*, 235, 107-124.
- Ramkhamhaeng University. (n.d.). Disability Support Services Center. from [http://joomlas.ru.ac.th/stdaffair/dss/index.php?option=com\\_content&view=article&id=8&Itemid=110](http://joomlas.ru.ac.th/stdaffair/dss/index.php?option=com_content&view=article&id=8&Itemid=110)
- Ratchasuda College Mahidol University. (n.d.). About Ratchasuda College Mahidol University. from [http://www.rs.mahidol.ac.th/about\\_faculty/about-ratchasuda-college.html](http://www.rs.mahidol.ac.th/about_faculty/about-ratchasuda-college.html)
- Reid, A., Petocz, P., & Gordon, S. (2008). Research interviews in cyberspace. *Qualitative research journal*, 8(1), 47.
- Rello, L., Kanvinde, G., & Baeza-Yates, R. (2012). *Layout guidelines for web text and a web service to improve accessibility for dyslexics*. Paper presented at the Proceedings of the International Cross-Disciplinary Conference on Web Accessibility, Lyon, France.
- Ribera, M., Porras, M., Boldu, M., Termens, M., Sule, A., & Paris, P. (2009a). Web Content Accessibility Guidelines 2.0. *Program*, 43(4), 392-406. doi: 10.1108/00330330910998048
- Ribera, M., Porras, M., Boldu, M., Termens, M., Sule, A., & Paris, P. (2009b). Web Content Accessibility Guidelines 2.0: A further step towards accessible digital information. *Program: electronic library and information systems*, 43(4), 392-406.
- Richardson, L. T. (2011). *Does online course design encourage attrition? Assessing usability factors in learning management systems*. (Dissertation/Thesis). Retrieved from [http://ecu.summon.serialssolutions.com/link/0/eLvHCXMwQ7QySS0PgJWNua4heFQDMaKOVNi7iTLlubmGOHvowgrN-JScnHhgnW1kDkxXxoaGfEU36v3zvf1sZ5dccfy47IEQAJV\\_KzQ](http://ecu.summon.serialssolutions.com/link/0/eLvHCXMwQ7QySS0PgJWNua4heFQDMaKOVNi7iTLlubmGOHvowgrN-JScnHhgnW1kDkxXxoaGfEU36v3zvf1sZ5dccfy47IEQAJV_KzQ)
- Riley-Huff, D. A. (2012). Web accessibility and universal design: a primer on standards and best practices for libraries. *Library Technology Reports*, 48(7), 29.
- Ritchie, J., Lewis, J., Nicholls, C. M., & Ormston, R. (2013). *Qualitative research practice: A guide for social science students and researchers*: Sage.
- Rogers, M. (2015). Government accessibility standards and WCAG 2. from <http://blog.powermapper.com/blog/post/government-accessibility-standards/>
- Rømen, D., & Svanæs, D. (2012). Validating WCAG versions 1.0 and 2.0 through usability testing with disabled users. *Universal Access in the Information Society*, 11(4), 375-385. doi: 10.1007/s10209-011-0259-3
- Rotatori, Bakken, J. P., Burkhardt, S., Obiakor, F. E., & Sharma, U. (2014). *Special Education International Perspectives* (Vol. 27): Emerald Group Publishing.
- Rotatori, A. F., Bakken, J. P., & Emerald. (2014). *Special education international perspectives: biopsychosocial, cultural, and disability aspects* (Vol. 27.). Bingley, England: Emerald.
- Rotatori, A. F., Obiakor, F. E., & Bakken, J. P. (2011). *History of special education* (Vol. 21.). Bingley, UK: Emerald.
- Rushbrook, P. (2012). Introduction to the history of education review special issue: centre and periphery in histories of education. *History of Education Review*, 41(2). doi: 10.1108/her.2012.57841baa.001
- Saekow, A., & Samson, D. (2011a). E-learning readiness of Thailand's universities comparing to the USA's cases. *International Journal of e-Education, e-Business, e-Management and e-Learning*, 1(2), 126-131.
- Saekow, A., & Samson, D. (2011b). E-learning Readiness of Thailand's Universities Comparing to the USA's Cases.
- Said, T., Fairouz, K., & Mahieddine, D. (2012). Implementing WAI Authoring Tool Accessibility Guidelines in Developing Adaptive Elearning. *International Journal of Modern Education and Computer Science*, 4(9), 1-13. doi: 10.5815/ijmecs.2012.09.01
- Salkind, N. (2008). Mean. *Encyclopedia of Educational Psychology*. SAGE Publications, Inc: Sage Publications.
- Salomoni, P., Mirri, S., Muratori, L. A., & Battistelli, M. (2012). *Integrating manual and automatic evaluations to measure accessibility barriers*: Springer.

- Sayago, S., & Blat, J. (2011). An ethnographical study of the accessibility barriers in the everyday interactions of older people with the web. *Universal Access in the Information Society*, 10(4), 359-371. doi: 10.1007/s10209-011-0221-4
- Sayed, Y., & Soudien, C. (2005). Decentralisation and the construction of inclusion education policy in South Africa. *Compare: A Journal of Comparative and International Education*, 35(2), 115-125. doi: 10.1080/03057920500129916
- Schiavone, A., & Paternò, F. (2015). An extensible environment for guideline-based accessibility evaluation of dynamic Web applications. *Universal Access in the Information Society*, 14(1), 111-132. doi: 10.1007/s10209-014-0399-3
- Schmidt, S. (2010). *Kruskal-Wallis Test. Encyclopedia of Research Design. SAGE Publications, Inc: Sage Publications.*
- Seale, J. (2006a). A contextualised model of accessible e-learning practice in higher education institutions. *Australasian Journal of Educational Technology*, 22(2), 268.
- Seale, J. (2006b). *E-learning and disability in higher education: accessibility research and practice*: Taylor & Francis.
- Seale, J., & Cooper, M. (2010). E-learning and accessibility: An exploration of the potential role of generic pedagogical tools. *Computers & Education*, 54(4), 1107-1116.
- Seale, J. K. (2013). *E-learning and disability in higher education: accessibility research and practice*: Routledge.
- Sema, A., Kalaian. (2008). *Research Design*: Sage Publications.
- Shah, N. (2011). E-Learning Expands for Special-Needs Students. 31(1), s2. <http://ecu.summon.serialssolutions.com/link/0/eLvHCXMwA20DTjNNTTU2N0k0STKxSEs1MU20BDabTSzNki2SU9KSUuELMUFD5kiluZsog6yba4izhy6oclwvvgBy3EA-uQsxNgLISjIEF2CdOBQCQeBgC>
- Sife, A., Lwoga, E., & Sanga, C. (2007). New technologies for teaching and learning: Challenges for higher learning institutions in developing countries. *International Journal of Education and Development using ICT*, 3(2).
- Singh, L. P. (2010). *Buddhist Tantra: A Philosophical Reflection and Religious Investigation*: Concept Publishing Company.
- Skills and Emloyability Department. (2009). Inclusion of People with Disabilities in Thailand. from [http://www.ilo.org/wcmsp5/groups/public/@ed\\_emp/@ifp\\_skills/documents/publication/wcms\\_112307.pdf](http://www.ilo.org/wcmsp5/groups/public/@ed_emp/@ifp_skills/documents/publication/wcms_112307.pdf)
- Skinner, B. (1961). Why we need teaching machines. *Harvard Educational Review*.
- Sloan, D., & Horton, S. (2014). *Global considerations in creating an organizational web accessibility policy*. Paper presented at the Proceedings of the 11th Web for All Conference.
- Smith, C. R. (1998). *Learning disabilities: the interaction of learner, task, and setting*. Boston: Allyn and Bacon.
- Smith, J. (2011). Web Accessibility and SEO. Retrieved from <http://webaim.org/blog/web-accessibility-and-seo/>
- Sohaib, O., Hussain, W., Ismaili, I., & Bukhari, A. (2012). Exploring the Relationship between Web Usability and the Web Accessibility Guidelines: unpublished.
- Soumplis, A., Koulocheri, E., Kostaras, N., Karousos, N., & Xenos, M. (2011). Learning Management Systems and Learning 2.0. *International Journal of Web-Based Learning and Teaching Technologies*, 6(4), 1.
- Soyoz, S. (2010). Identifying e-Learning Technologists: Key Roles, Activities and Values of an Emerging Group. *eLearn*, 2010(10). doi: 10.1145/1872818.1872820
- Stancliffe, R. J. (2012). Inclusion of adults with disability in Australia: outcomes, legislation and issues.
- Steff, M., & Mudzakir, R. (2010). Equity and Access to Tertiary Education for Students with Disabilities in Indonesia.
- Sun, P.-C., Tsai, R. J., Finger, G., Chen, Y.-Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education*, 50(4), 1183-1202. doi: <http://dx.doi.org/10.1016/j.compedu.2006.11.007>
- Surin: Low English proficiency in Thailand 'urgent problem'. (2013). *Investvine*. Retrieved from <http://investvine.com/surin-low-english-proficiency-in-thailand-urgent-problem/>
- Tan, W., Liu, D., & Bishu, R. (2009). Web evaluation: Heuristic evaluation vs. user testing. *International Journal of Industrial Ergonomics*, 39(4), 621-627.
- Tanaka, E. H., & Rocha, H. (2011). *Evaluation of web accessibility tools*. Paper presented at the Proceedings of the 10th Brazilian Symposium on on Human Factors in Computing Systems and the 5th Latin American Conference on Human-Computer Interaction, Porto de Galinhas, Pernambuco, Brazil.
- Tandy, C., & Meacharm, M. (2009). Removing the Barriers for Students with Disabilities: Accessible Online and Web-Enhanced Courses. *Journal of Teaching in Social Work*, 29(3), 313-328. doi: 10.1080/08841230903022118

- Tanya, E. (2010). Universal instructional design principles for Moodle. *International Review of Research in Open and Distance Learning*, 11(2), 15.
- Tashakkori, A., & Teddlie, C. (1998). *Mixed methodology: Combining qualitative and quantitative approaches* (Vol. 46): Sage Publications, Inc.
- Tashakkori, A., & Teddlie, C. (2010). *Sage handbook of mixed methods in social & behavioral research*: Sage.
- Tavangarian, D., Leypold, M., Nölting, K., Röser, M., & Voigt, D. (2004). Is e-learning the Solution for Individual Learning. *Electronic Journal of e-learning*, 2(2), 273-280.
- TCU. (2012). Statistics for the TCU. from <http://www.thaicyberu.go.th/index.php?lang=en-us>
- Telecommunications Technology Association. (n.d.). Standardization. from [http://www.tta.or.kr/English/new/standardization/eng\\_ttstddesc.jsp?stdno=TTAK.OT-10.0003/R2](http://www.tta.or.kr/English/new/standardization/eng_ttstddesc.jsp?stdno=TTAK.OT-10.0003/R2)
- Thailand Bureau of Student Development. (2012). Tertiary education plan for students with disabilities in Thailand. from [http://webcache.googleusercontent.com/search?q=cache:yxkUtQmEmzYJ:www.mua.go.th/~des/knowledge%2520management/Present%2520KM\\_disabilities%252055.ppt+&cd=8&hl=en&ct=clnk&gl=au](http://webcache.googleusercontent.com/search?q=cache:yxkUtQmEmzYJ:www.mua.go.th/~des/knowledge%2520management/Present%2520KM_disabilities%252055.ppt+&cd=8&hl=en&ct=clnk&gl=au)
- Thailand Cyber University Project. (2004). History of the TCU. from <http://lms.thaicyberu.go.th/OfficialTCUen/main/main2.asp>
- Thailand Ministry of Foreign Affairs. (2011). *Human Rights*. Retrieved from <http://www.mfa.go.th/humanrights/implementation-of-un-resolutions/136-thailands-status-with-regard-to-the-convention-on-the-rights-of-persons-with-disabilities-crp-d-and-the-realization-of-the-mdgs-for-persons-with-disabilities>.
- Thailand Ministry of Science and Technology. (2003). *Information Technology Policy Framework 2001-2010*
- Thailand Vision Towards a Knowledge-Based Economy. Retrieved from [http://www.nectec.or.th/pld/documents\\_pris/IT2010eng.pdf](http://www.nectec.or.th/pld/documents_pris/IT2010eng.pdf).
- Thailand Ministry of Social Development and Human Security. (2005). *Persons with Disabilities Empowerment Act B.E. 2550 (2007)*. Retrieved from <http://prjob.nep.go.th/wp-content/uploads/2013/09/Empowerment-of-Persons-with-Disabilities-Act-as-of-24.6.13.pdf>.
- Thailand National Statistical Office. (2012). *The 2012 disability survey*. Retrieved from [http://service.nso.go.th/nso/nsopublish/service/survey/disabilityRep\\_50.pdf](http://service.nso.go.th/nso/nsopublish/service/survey/disabilityRep_50.pdf).
- Thailand Office of the Prime Minister. (2011). *THE ELEVENTH NATIONAL ECONOMIC AND SOCIAL DEVELOPMENT PLAN*. Retrieved from [http://www.nesdb.go.th/Portals/0/news/plan/p11/Plan11\\_eng.pdf](http://www.nesdb.go.th/Portals/0/news/plan/p11/Plan11_eng.pdf).
- Thailand Permanent Mission. (2010). *Thailand's status with regard to the Convention on the Rights of Persons with disabilities (CRPD)*. Retrieved from <http://www2.ohchr.org/english/issues/disability/docs/study/Thailand.pdf>.
- Thanasankit, T., & Corbitt, B. (2002). UNDERSTANDING THAI CULTURE AND ITS IMPACT ON REQUIREMENTS ENGINEERING PROCESS MANAGEMENT DURING INFORMATION SYSTEMS DEVELOPMENT\*. *Asian Academy of Management Journal*, 7(1).
- The Higher Education Commission. (2009). *The requirement of government funding*. Retrieved from <http://www.mua.go.th/~budget/doc/group52.doc>.
- the Office for National Education Standards and Quality Assessment. (2014). About ONESQA. from <http://www.onesqa.or.th/en/profile/973/>
- The Oxford dictionary. (n.d.). accessibility. from <http://www.oxforddictionaries.com/definition/english/accessible>
- The Pennsylvania State University. (n.d.). Image ALT Tag Tips for HTML. from <http://accessibility.psu.edu/images/imageshtml/>
- Theeraroungchaisri, A. (2012). Thailand Cyber University. from <http://www.slideshare.net/anuchai/thailand-cyber-university>
- Treviranus, J., Mitchell, J., Clark, C., & Roberts, V. (2014). An Introduction to the FLOE Project *Universal Access in Human-Computer Interaction. Universal Access to Information and Knowledge* (pp. 454-465): Springer.
- Turró, M. R. (2008). Are PDF Documents Accessible? *Information Technology and Libraries*, 27(3), 25.
- United Nations. (1948). History of United Nations and Persons with Disabilities - Introduction. from <http://www.un.org/disabilities/default.asp?id=122>
- Convention on the Rights of Persons with Disabilities (2006).
- United Nations. (2008). Conference of States parties. from <http://www.un.org/disabilities/default.asp?id=1535>



United Nations. (2012). Human Rights. from [https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg\\_no=IV-15&chapter=4&lang=en](https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=IV-15&chapter=4&lang=en)

United Nations Children's Fund. (1989). Convention on the Rights of the Child. from <http://www.ohchr.org/en/professionalinterest/pages/crc.aspx>

United Nations Children's Fund. (2013). Children and Young People with Disabilities Fact Sheet.

United Nations Educational Scientific and Cultural Organization. (1988). Consultation on Special Education.

United Nations Educational Scientific and Cultural Organization. (1993). An introduction to 'Special needs in the classroom'.

United Nations Educational Scientific and Cultural Organization. (1994). The Salamanca Statement and Framework for action on special needs education: adopted by the World Conference on Special Needs Education; Access and Quality. Salamanca, Spain, 7-10 June 1994. from [http://www.unesco.org/education/pdf/SALAMA\\_E.PDF](http://www.unesco.org/education/pdf/SALAMA_E.PDF)

United States : Bureau of labor statistics. (2013). *PERSONS WITH A DISABILITY: LABOR FORCE CHARACTERISTICS*. Retrieved from <http://www.bls.gov/news.release/pdf/disabl.pdf>.

United States : Department of Labor. (n.d.). Americans with Disabilities Act. from <http://www.dol.gov/dol/topic/disability/ada.htm>

United States Access Board. (2000). Section 508 Standards for Electronic and Information Technology. from <http://www.access-board.gov/guidelines-and-standards/communications-and-it/about-the-section-508-standards/section-508-standards>

United States Department of Commerce. (2011). Electronic and IT Accessibility Policy. from [http://ocio.os.doc.gov/ITPolicyandPrograms/Policy\\_Standards/dev01\\_003651](http://ocio.os.doc.gov/ITPolicyandPrograms/Policy_Standards/dev01_003651)

United States Department of Justice. (2009). Employment (Title I). from <http://www.ada.gov/cguide.htm>

United States General Services Administration. (n.d.). *Summary of Section 508 Standards*. Retrieved from <http://www.section508.gov/summary-section508-standards#web>

University of Melbourne. (2015). Web Accessibility Training. Retrieved 26/2/2015, 2015, from <http://www.unimelb.edu.au/accessibility/training/courses.htm>

University of Minnesota Duluth. (2013). Higher Ed Accessibility Lawsuits. Retrieved from <http://blog.lib.umn.edu/itsshelp/news/2013/10/higher-ed-accessibility-lawsuits.html>

University of Pennsylvania. (2012). Getting Started: Working with Content in Blackboard.

Unterfrauner, E., & Weiermair-Märki, C. (2008). *User Requirements for Adult Learners with Special Needs in Accessible Lifelong Learning*. Paper presented at the ilearning Forum, Paris, France.

Velleman, E., Meerbeld, C., Strobbe, C., Koch, J., Velasco, C., Snaprud, M., & Nietzio, A. (2007). D-WAB4, Unified Web Evaluation Methodology (UWEM 1.2 Core). *European Commission—WAB Cluster*.

Velleman, E., & van der Geest, T. (2013). *Page sample size in web accessibility testing: how many pages is enough?* Paper presented at the Proceedings of the 15th International ACM SIGACCESS Conference on Computers and Accessibility, Bellevue, Washington.

Vigo, M., Brown, J., & Conway, V. (2013). *Benchmarking web accessibility evaluation tools: measuring the harm of sole reliance on automated tests*. Paper presented at the Proceedings of the 10th International Cross-Disciplinary Conference on Web Accessibility.

Volery, T. (2001). Online education: An exploratory study into success factors. *Journal of Educational Computing Research*, 24(1), 77-92.

Wagner, N., Hassanein, K., & Head, M. (2008). Who is responsible for e-learning success in higher education? A stakeholders' analysis. *Educational Technology & Society*, 11(3), 26.

Wald, M., Draffan, E. A., & Seale, J. (2009). Disabled Learners' Experiences of E-Learning. *Journal of Educational Multimedia and Hypermedia*, 18(3), 341-361.

Walle, S. V. (n.d.). ACCESSIBILITY CHALLENGES TO SCIENCE EDUCATION IN CAMBODIA: AN INSTITUTIONAL ANALYSIS.

WebAIM. (2012). web accessibility evaluation tool. Retrieved 18/08, 2012, from <http://wave.webaim.org/>

WebAIM. (2013a). Cognitive Disabilities Part 2: Conceptualizing Design Considerations. from <http://webaim.org/articles/cognitive/conceptualize/>

WebAIM. (2013b). Creating Accessible Flash Content. from <http://webaim.org/techniques/flash/>

WebAIM. (2014). Screen Reader User Survey #5 Results. from <http://webaim.org/projects/screenreadersurvey5/#primary>

- WebAIM. (n.d.-a). Alternative Text. from <http://webaim.org/techniques/alttext/>
- WebAIM. (n.d.-b). Visual Disabilities. from <http://webaim.org/articles/visual/>
- WebAIM. (n.d.-c). Web Accessibility and SEO. from <http://webaim.org/blog/web-accessibility-and-seo/>
- Willson, J., Craven, J., & Eskins, R. (2010). *Education and training for accessible web design*. Paper presented at the Aslib Proceedings.
- Witt, N., & McDermott, A. (2004). Web site accessibility: what logo will we use today? *British Journal of Educational Technology*, 35(1), 45-45. doi: 10.1111/j.1467-8535.2004.00367.x
- Wong, M. E., Cohen, L. y., & Tan, D. T. (2011). From beliefs to practice: Students with visual impairments, teachers and their perspectives on assistive technology.
- Wood, D., & Hollier, S. (2014). 'The new accessibility panic': remaining challenges to the achievement of Australia's national transition strategy. Paper presented at the Proceedings of the 11th Web for All Conference, Seoul, Korea.
- Woodside, A. (2010). *Case Study Research : Theory, Methods and Practice*. Bradford, GBR: Emerald Group Publishing Ltd.
- World Wide Web Consortium. (1994). The White House. Retrieved 27/2/2015, 2015, from <http://www.w3.org/Press/Clinton.html>
- World Wide Web Consortium. (2002). Using Combined Expertise to Evaluate Web Accessibility. from <http://www.w3.org/WAI/eval/reviewteams.html>
- World Wide Web Consortium. (2005a, 2013). Authoring Tool Accessibility Guidelines (ATAG) Overview. from <http://www.w3.org/WAI/intro/atag.php>
- World Wide Web Consortium. (2005b). Essential Components of Web Accessibility. from <http://www.w3.org/WAI/intro/components.php>
- World Wide Web Consortium. (2005c). Increases findability with search engine optimization (SEO). from <http://www.w3.org/WAI/bcase/fin.html#seo>
- World Wide Web Consortium. (2007). Requirements for WCAG 2.0 Checklists and Techniques. from <http://www.w3.org/TR/2003/WD-wcag2-tech-req-20030207/>
- World Wide Web Consortium. (2008a). Accessibility. from <http://www.w3.org/standards/webdesign/accessibility>
- World Wide Web Consortium. (2008b). Understanding Conformance. from <http://www.w3.org/TR/UNDERSTANDING-WCAG20/conformance.html>
- World Wide Web Consortium. (2008c). Web Content Accessibility Guidelines (WCAG) 2.0. from <http://www.w3.org/TR/WCAG20/>
- World Wide Web Consortium. (2008d). Web Content Accessibility Guidelines (WCAG) Overview. from <http://www.w3.org/WAI/intro/wcag.php>
- World Wide Web Consortium. (2008e). Website Accessibility Conformance Evaluation Methodology 1.0. from <http://www.w3.org/TR/WCAG-EM/>
- World Wide Web Consortium. (2009). Web Content Accessibility Guidelines 2.0. *Program*, 43(4), 392-406. doi: 10.1108/00330330910998048
- World Wide Web Consortium. (2012a). Complete List of Web Accessibility Evaluation Tools.
- World Wide Web Consortium. (2012b). Developing a Web Accessibility Business Case for Your Organization. from <http://www.w3.org/WAI/bcase/>
- World Wide Web Consortium. (2012c). Financial Factors in Developing a Web Accessibility Business Case for Your Organization. from <http://www.w3.org/WAI/bcase/fin>
- World Wide Web Consortium. (2012d). How People with Disabilities Use the Web: Overview. from <http://www.w3.org/WAI/intro/people-use-web/>
- World Wide Web Consortium. (2012e). PDF Techniques for WCAG 2.0. from <http://www.w3.org/TR/WCAG20-TECHS/pdf.html>
- World Wide Web Consortium. (2012f). Social Factors in Developing a Web Accessibility Business Case for Your Organization.
- World Wide Web Consortium. (2014a). Easy Checks - A First Review of Web Accessibility. from <http://www.w3.org/WAI/EO/Drafts/eval/checks>
- World Wide Web Consortium. (2014b). WAI-ARIA Overview. from <http://www.w3.org/WAI/intro/aria>
- World Wide Web Consortium. (2014c). Web Accessibility Evaluation Tools List. from <http://www.w3.org/WAI/ER/tools/>

- World Wide Web Consortium. (2015). Authoring Tool Accessibility Guidelines (ATAG) 2.0. from <http://www.w3.org/TR/ATAG20/>
- World Wide Web Consortium. (n.d.-a). Non-text Content: Understanding SC 1.1.1. from <http://www.w3.org/TR/UNDERSTANDING-WCAG20/text-equiv-all.html>
- World Wide Web Consortium. (n.d.-b). The W3C validators. Retrieved from <http://validator.w3.org/>
- Wutiwiwatchai, C., & Furui, S. (2007). Thai speech processing technology: A review. *Speech communication*, 49(1), 8-27.
- Yesilada, Y., Brajnik, G., & Harper, S. (2009). *How much does expertise matter?: a barrier walkthrough study with experts and non-experts*. Paper presented at the Proceedings of the 11th international ACM SIGACCESS conference on Computers and accessibility, Pittsburgh, Pennsylvania, USA.
- Yesilada, Y., Brajnik, G., Vigo, M., & Harper, S. (2012). *Understanding web accessibility and its drivers*. Paper presented at the Proceedings of the International Cross-Disciplinary Conference on Web Accessibility.
- Yesilada, Y., Brajnik, G., Vigo, M., & Harper, S. (2012). *Understanding web accessibility and its drivers*. Paper presented at the Proceedings of the International Cross-Disciplinary Conference on Web Accessibility, Lyon, France.
- Yesilada, Y., Conway, V., & Connor, O. J. (2011). User Evaluation Methods for Web Accessibility Evaluation. Retrieved 19/08, 2012, from [http://www.w3.org/WAI/RD/wiki/User\\_Evaluation\\_Methods\\_for\\_Web\\_Accessibility\\_Evaluation](http://www.w3.org/WAI/RD/wiki/User_Evaluation_Methods_for_Web_Accessibility_Evaluation)
- Yu, H. (2002). Web accessibility and the law: recommendations for implementation. *Library Hi Tech*, 20(4), 406-419. doi: 10.1108/07378830210452613
- Zeng, X., & Parmanto, B. (2003). *Evaluation of web accessibility of consumer health information websites*. Paper presented at the AMIA Annual Symposium Proceedings.
- Zheng, W. (2013). GB/T 29799-2013; GB/T29799-2013; GBT 29799-2013; GBT29799-2013. from <http://www.chinesestandard.net/PDF-English-Translation/GBT29799-2013.html>
- Zhou, Y. (2010). Are your digital documents web friendly?: Making scanned documents web accessible. *Information Technology and Libraries*, 29(3), 151-160.

## 9.1 POUR – TOTAL FAILED SCORES

The checkpoints of WCAG 2.0 guidelines	Failed Scores		
	Frequency	% within principle	% of total
1.1.1 Non-text Content	675	28	37%
1.2.1 Audio-only and Video-only	60	3	
1.2.2 Caption (Prerecorded)	19	1	
1.2.3 Audio Description or Media Alternative (Prerecorded)	23	1	
1.2.4 Captions (live)	2	0	
1.2.5 Audio description (pre-recorded)	22	1	
1.3.1 Info and Relationships	616	26	
1.3.2 Meaningful Sequence	70	3	
1.3.3 Sensory Characteristics	95	4	
1.4.1 Use of Color	122	5	
1.4.2 Audio Control	7	0	
1.4.3 Contrast (minimum)	291	12	
1.4.4 Resize text	265	11	
1.4.5 Images of text	112	5	
<b>Total Perceivable</b>	<b>2379</b>	<b>100</b>	
2.1.1 Keyboard	205	11	30%
2.1.2 No Keyboard Trap	14	1	
2.2.1 Timing Adjustable	9	0	
2.2.2 Pause, Stop, Hide	146	8	
2.3.1 Three Flashes or Below Threshold	38	2	
2.4.1 Bypass Blocks	303	16	
2.4.2 Page Titled	125	6	
2.4.3 Focus order	35	2	
2.4.4 Link purpose (in context)	592	31	
2.4.5 Multiple ways	198	10	
2.4.6 Headings and labels	218	11	
2.4.7 Focus visible	51	3	
<b>Total Operable</b>	<b>1934</b>	<b>100</b>	
3.1.1 Language of page	563	40	22%
3.1.2 Language of parts	207	15	
3.2.1 On focus	22	2	

3.2.2 On input	81	6	
3.2.3 Consistent navigation	3	0	
3.2.4 Consistent identification	123	9	
3.3.1 Error identification	15	1	
3.3.2 Labels or instructions	369	27	
3.3.3 Error suggestion	0	0	
3.3.4 Error prevention (Legal, financial, data)	8	1	
<b>Total Understandable</b>	<b>1391</b>	<b>100</b>	
4.1.1 Parsing	372	53	<b>11%</b>
4.1.2 Name, role, value	327	47	
<b>Total Robust</b>	<b>699</b>	<b>100</b>	
<b>TOTALS</b>	<b>6403</b>	<b>100%</b>	

## 9.2 AVERAGE FAILURES – UNIVERSITY GROUP

Rank	University code	Mean	Std. Deviation
1	45	3.78	3.04
2	40	5.5	3.761
3	29	5.56	4.949
4	8	5.75	3.671
5	22	5.81	3.919
6	42	5.86	4.83
7	6	6	4.456
8	46	6.17	4.356
9	50	6.33	4.839
10	35	6.67	3.811
11	39	6.67	5.703
12	25	6.71	4.125
13	43	6.71	4.122
14	18	6.72	4.599
15	4	6.73	5.548
16	7	6.73	4.652
17	9	6.85	4.416
18	41	6.89	4.283
19	12	6.94	4.022
20	11	7	4.924
21	3	7.1	3.659
22	27	7.1	5.409
23	44	7.13	4.103
24	48	7.13	3.739
25	37	7.28	5.245
26	34	7.29	5.488
27	30	7.38	4.236
28	5	7.52	5.076
29	23	7.6	3.089
30	32	7.67	5.944
31	49	7.67	4.653
32	13	7.89	4.626
33	26	7.89	4.588
34	36	7.89	5.132
35	2	7.9	3.999
36	20	7.9	5.44

37	10	7.92	5.16
38	47	8.07	5.203
39	17	8.2	3.932
40	38	8.38	4.759
41	28	8.44	5.458
42	15	8.5	4.423
43	16	8.58	6.097
44	24	8.6	4.137
45	19	8.67	5.245
46	14	8.72	4.099
47	33	9.14	4.84
48	1	9.29	5.071
49	31	10	5.444
50	21	10.07	5.599

### 9.3 EMAIL INVITATION TO PARTICIPATE IN A RESEARCH PROJECT

To Whom It May Concern,

My name is Rattanaavee Maisak and I am a student at Edith Cowan University. I am currently doing my Doctoral research in the field of web accessibility. One of the key data collection tools for this research is a web-based survey of senior managers, lecturers and web management staff within Thai universities. The survey will ask questions about experience and attitudes regarding the accessibility of Thai university websites. If you choose to participate in this survey you will be making a valuable contribution to our overall knowledge of how stakeholders within higher education institutions respond to web accessibility in Thai universities.

The survey is an anonymous web-based questionnaire and takes approximately 15-25 minutes to complete. The responses to the survey are confidential and will be held in secure storage by the researcher at the School of Computer and Security Science, Edith Cowan University. The data will be held for a period of five years for reference purposes, after which time it will be destroyed. Data will not be provided to other parties and only aggregated results will be published.

The contact details for the Chief Investigator (PhD Student) in for the research are;  
Rattanaavee Maisak  
School of Computer and Information Science  
Edith Cowan University, Perth Western Australia  
Email: rmaisak@our.ecu.edu.au  
Mobile: (61) 0431 439 248

This research project has been approved by the Ethics Committee of Edith Cowan University. If you require information about the ethics process please contact:  
Research Ethics Officer  
Office of Research and Innovation  
Building 1, Block 'B', Level 2, Room 227,  
Telephone: (61 8) 6304 2170  
Email: research.ethics@ecu.edu.au  
Edith Cowan University  
270 Joondalup Drive  
Joondalup WA 6027

The researcher is Rattanaavee Maisak, Edith Cowan University. Please feel free to contact me for further information by email at rmaisak@our.ecu.edu.au

If you would like to participate in this research please go to [web survey URL]

Your number ID is [number ID].

Many thanks for your participation.

Rattanaavee Maisak  
School of Computer and Security Science  
Edith Cowan University, Perth Western Australia



## 9.4 MAPPING QUESTIONS – QUESTIONNAIRE INSTRUMENT

Questions	Groups of participant			Supporting research questions		
	L	S	W	#1 Awareness	#2 Barrier	#3 Driver Exit
<b>Section 1 : Identification and personal details</b>						
Entering participant ID	x	x	x			
Gender	x	x	x			
Age	x	x	x			
Length of work experience	x	x	x			
Academic rank	x					
Teaching Discipline	x			✓		
Highest level of qualification			x			
Job Description			x			
<b>Section 2 : University website and e-learning Experiences</b>						
Do you use the university website/e-learning as a part of the job?	x	x	x	✓		
How often do you use the university website/e-learning?	x	x	x	✓		
Did you receive formal training in the use of the university website/e-learning?	x	x	x	✓	✓	
To what extent do you feel your students are taking advantage of the university website/e-learning?	x	x	x	✓	✓	
Have you developed your own e-learning materials or improved existing e-learning materials by yourself?	x			✓		
Who developed it for you? (Please check all that apply).	x			✓		
What aspects of your teaching do you use e-learning for? (Please check all that apply)	x			✓		
What types of content do you place in the university website/e-learning	x		x	✓	✓	
Which Learning Management System (LMS) software do you use?	x			✓	✓	
Do you assist lecturing staff with e-learning content?			x	✓		
How often are you ask to develop / modify e-learning contents?			x	✓		
Which technology do you use the university website/e-learning? (Please check all that apply)			x	✓	✓	
Please feel free to add any further comments or thoughts on the use of university website and e-learning at your institution	x	x	x	✓	✓	✓
<b>Section 3 : Experience and attitude towards accessibility knowledge</b>						
Please select the statement that the best describes your knowledge of the needs of students with disabilities:	x	x	x	✓	✓	
Do you understand meaning of people with disabilities as following:?	x	x	x	✓	✓	
<i>Experience/attitude towards students with disabilities and accessible online resources</i>	x	x	x			
Have you ever participated with students with disabilities in your institution?	x	x	x	✓		

Does your university have had any accommodations for students with disabilities? (e.g. extra exam, captioned films, computer with speech output)	x	x	x	✓	✓	
Have you been approached about making accessible online materials for students with disabilities?	x	x	x	✓	✓	
Are you aware of any existing resource(s) that explain how to make accessible online materials to students with disabilities?	x	x	x	✓		
Are the online resources of your university tested for their accessibility to meet the special needs of students with disabilities	x	x	x	✓	✓	
In your opinion, should students with disabilities be provided with facilitates and services by the university to assist their learning needs?	x	x	x	✓	✓	
Have you ever had a student with special needs complain about not being able to make use of online content?	x	x	x		✓	
Do you feel students with special needs should be given equal access to online resource as other students?	x	x	x		✓	✓
In your opinion, who can benefit from accessible online resources? (Please check all that apply)	x	x	x	✓		✓
Do you think your role should be responsible for making online resources accessible for people with disabilities?	x	x	x	✓		✓
Do you know the meaning of the term web accessibility?	x	x	x	✓	✓	
Are you aware that the Thai government has a policy on web accessibility?	x	x	x	✓		
Does your university have a policy in regards to web accessibility?	x	x	x	✓	✓	
How many years has that policy been in place?		x		✓		✓
Are you familiar with assistive technology?	x	x	x	✓	✓	
Are you familiar with web accessibility guideline(s)?	x	x	x	✓	✓	
What, for you, is the most significant barrier to accessible online materials in your university? Please rank, in order to importance, each of the following	x	x	x		✓	
In order to improve web accessibility within the university, to what extent do you agree with the following statement?	x	x	x			✓
Who should be supporting web accessibility at university? (Please check all that apply)	x	x	x	✓		✓
What are your views on web accessibility?	x	x	x	✓		
Thank you for all your responses so far. Please feel free to add any further comments or thoughts regarding any of the issues raised above.	x	x	x	✓	✓	✓
Would you be willing to participate in an interview in the future for the purpose of gathering more information about accessible online resources and web accessibility within your institution?	x	x	x			

## 9.5 LECTURER – WEB SURVEY

Q1 Please enter your Participant ID (as received in the original email from the researcher)

Q2 Gender

- ☐ Male (1)
- ☐ Female (2)

Q3 Age

- ☐ 18-35 (1)
- ☐ 36-50 (2)
- ☐ 51-60 (3)
- ☐ 60+ (4)

Q4 Length of work experience

- ☐ 1 - 5 Years (1)
- ☐ 6 - 10 Years (2)
- ☐ 11-15 Years (3)
- ☐ 15+ Years (4)

Q5 Academic Level

- ☐ Professor (1)
- ☐ Associate Professor (2)
- ☐ Assistant Professor (3)
- ☐ Lecturer (4)

Q6 Teaching Discipline (ie, Computing, Marketing, Engineering etc)

Q7 Do you use the university website/e-learning as a part of the job?

- ☐ Yes (1)
- ☐ No (2)

If No Is Selected, Then Skip To Did you receive formal...

Q8 How often do you use the university website/e-learning?

- ☐ Daily (1)
- ☐ Weekly (2)
- ☐ Several times per semester (3)
- ☐ Rarely (4)

Q9 Did you receive formal training in the use of the university website/e-learning?

- ☐ Yes (1)
- ☐ No (2)

Q10 To what extent do you feel your students are taking advantage of the university website/e-learning?

- ☐ Very little (1)
- ☐ Some (2)
- ☐ A great deal (3)

Q11 Have you developed your own e-learning materials or improved existing e-learning materials by yourself?

- ☐ Yes (1)
- ☐ No (2)

If No Is Selected, Then Skip To Who developed it...

Q12 Who developed it for you? (Please check all that apply).

- ☐ Academic Technology / IT Staff (1)
- ☐ Staff member in your department/faculty (2)
- ☐ Student (3)
- ☐ Web Staff (4)
- ☐ Other (please specify) (5) \_\_\_\_\_

Q13 What aspects of your teaching do you use e-learning for? (Please check all that apply)

- ☐ Uploading lecture notes (1)
- ☐ Using e-mail (2)
- ☐ Use online conferencing (3)
- ☐ Upload lab activities (4)
- ☐ Managing course website (5)
- ☐ Uploading assignments (6)
- ☐ Uploading assignment results (7)
- ☐ Using the chat rooms (8)
- ☐ Other (please specify) (9) \_\_\_\_\_

Q14 What types of content do you place in the university website/e-learning? (Please check all that apply)

- ☐ Word documents (1)
- ☐ PowerPoint documents (2)
- ☐ Excel documents (3)
- ☐ PDF documents (4)
- ☐ Audio-clips (5)
- ☐ Video clips (6)
- ☐ Flash contents (7)
- ☐ Flickr (8)
- ☐ Twitter (9)
- ☐ Facebook (10)
- ☐ YouTube (11)
- ☐ Surveys (12)
- ☐ Online tests (13)
- ☐ Other (please specify) (14) \_\_\_\_\_

Q15 Which Learning Management System (LMS) software do you use?

- ☐ Blackboard (1)
- ☐ Moodle (2)
- ☐ Sakai (3)
- ☐ Wordpress (4)
- ☐ Joomla (5)
- ☐ Do not know (6)
- ☐ Other (please specify) (7) \_\_\_\_\_

Q16 Please feel free to add any further comments or thoughts on the use of university website and e-learning at your institution

Q17 Please select the statement that the best describes your knowledge of the needs of students with disabilities:

- ☐ I have a broad knowledge of the needs of students with a wide range of disabilities (1)
- ☐ I have some knowledge of the needs of student with certain specific disabilities (2)
- ☐ I have a little knowledge of some of the needs of students with disabilities. (3)
- ☐ I have little or no understanding of the needs of students with disabilities. (4)

Q18 Do you understand the meaning of people with disabilities as any of the following?

Physical disability (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vision impairment (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hearing impairment (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Speech and language impairment (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Multiple disabilities (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Intellectual disability (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mental health and emotional disabilities (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developmental disability (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Autistic (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q19 Experience/Attitude towards students with disabilities and accessible online resources

Have you ever participated with students with disabilities in your institution? (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does your university provide any accommodation / assistance for students with disabilities? (e.g. extra exam time, captioned videos, computer with speech output) (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you been approached about making accessible online materials for students with disabilities? (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are you aware of any existing resource(s) that explain how to make accessible online materials for students with disabilities? (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are the online resources of your university tested for their accessibility to meet the special needs of students with disabilities? (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In your opinion, should students with disabilities be provided with facilitates and services by the university to assist their learning needs? (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you ever had a student with special needs complain about not being able to make use of online content? (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q20 Do you feel students with special needs should be given equal access to online resource as other students?

- ☐ Yes (1)
- ☐ No (2)

Q21 In your opinion, who can benefit from accessible online resources? (Please check all that apply)

- ☐ Senior Managers (1)
- ☐ Lecturers (2)
- ☐ Web Staff (3)
- ☐ Students (4)
- ☐ Other (please specify) (5) \_\_\_\_\_

Q22 Do you think your role (lecturers) should be responsible for making online resources accessible for people with disabilities?

- ☐ Yes (1)
- ☐ No (2)

Q23 Please give more details regarding your answer

Q24 Do you know the meaning of the term web accessibility?

- ☐ Yes (1)
- ☐ No (2)

If No Is Selected, Then Skip To Are you aware that the Thai....

Q25 Please explain your own understanding of the concept of web accessibility

Q26 Are you aware that the Thai government has a policy on web accessibility?

- ☐ Yes (1)
- ☐ No (2)

Q27 Does your university have a policy in regards to web accessibility?

- ☐ Yes (1)
- ☐ No (2)
- ☐ Not Sure (3)

Q28 Are you familiar with assistive technology?

- ☐ Yes (1)
- ☐ No (2)

Q29 Are you familiar with web accessibility guideline(s)?

- ☐ Yes (1)
- ☐ No (2)

Q30 What, for you, is the most significant barrier to create accessible online materials for students with disabilities? Please rank, in order to importance, each of the following;

Allocate a rank of 1 to the MOST significant barrier.

Allocate a rank of 10 to the LEAST significant barrier.

- \_\_\_\_\_ Lack of knowledge of the needs of students with disabilities (1)
- \_\_\_\_\_ Lack of knowledge of technologies to create accessible online content (2)
- \_\_\_\_\_ Lack of knowledge of Assistive Technologies (3)
- \_\_\_\_\_ Lack of Accessibility training and awareness (4)
- \_\_\_\_\_ Lack of Assistive Technology equipment and software (e.g. Screen Reader, Dynamic displays devices) (5)
- \_\_\_\_\_ Lack of financial support from a university (6)
- \_\_\_\_\_ Lack of time (7)
- \_\_\_\_\_ Lack of support network (8)
- \_\_\_\_\_ Lack of commitment to Accessible design standards and resources (9)
- \_\_\_\_\_ Lack of demand for Accessible resources (10)

Q31 In order to improve web accessibility within the university, to what extent do you agree with the following statement?

Increasing penalty in laws and legalizations for non compliance to Accessibility. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting web accessibility must start with university policy. (2))	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providing training and workshops is necessary. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing cooperation among stakeholders in university (e.g. Senior managers, Lecturer and Support Staff). (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Giving rewards (e.g. Promotions, Research Grants). (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provision of equipment and technology is crucial. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Support in terms of finance for accessibility projects is crucial. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q32 Who should be main supporting web accessibility at university? (Please check all that apply)

- ☐ Senior Managers (1)
- ☐ Lecturers (2)
- ☐ Web Staff (3)
- ☐ Other (please specify) (4) \_\_\_\_\_

Q33 What are your views on Web Accessibility?

Q34 Thank you for all your responses so far. Please feel free to add any further comments or thoughts regarding any of the issues raised above.

Q35 Would you be willing to participate in an interview in the future for the purpose of gathering more information about accessible online resources and web accessibility within your institution?

- ☐ Yes, for future interview (1)
- ☐ No thanks (2)

## 9.6 WEB STAFF – WEB SURVEY

Q1 Please enter your Participant ID (as received in the original email from the researcher)

Q2 Gender

- ☐ Male (1)
- ☐ Female (2)

Q3 Age

- ☐ 18-35 (1)
- ☐ 36-50 (2)
- ☐ 51-60 (3)
- ☐ 60+ (4)

Q4 Length of work experience

- ☐ 1 - 5 Years (1)
- ☐ 6 - 10 Years (2)
- ☐ 11-15 Years (3)
- ☐ 15+ Years (4)

Q5 Highest level of qualification

- ☐ Masters Degree (1)
- ☐ Bachelors Degree (2)
- ☐ Certificate (3)
- ☐ Other (please specify) (4) \_\_\_\_\_

Q6 Job Description

- ☐ Web Designer (1)
- ☐ Web Programmer (2)
- ☐ Database Administrator (3)
- ☐ Web Project Manager (4)
- ☐ Other (please specify) (5) \_\_\_\_\_

Q7 Do you use the university website/e-learning as a part of the job?

- ☐ Yes (1)
- ☐ No (2)

If No Is Selected, Then Skip To Did you receive formal...

Q8 How often do you use the university website/e-learning?

- ☐ Daily (1)
- ☐ Weekly (2)
- ☐ Several times per semester (3)
- ☐ Rarely (4)

Q9 Did you receive formal training in the use of the university website/e-learning?

- ☐ Yes (1)
- ☐ No (2)

Q10 To what extent do you feel your students are taking advantage of the university website/e-learning?

- ☐ Very little (1)
- ☐ Some (2)
- ☐ A great deal (3)

Q11 Do you assist lecturing staff with e-learning content?

- ☐ Yes (1)
- ☐ No (2)

If No Is Selected, Then Skip To Which technology do you use...



Q12 How often are you ask to develop / modify e-learning contents?

- ☐ Weekly (1)
- ☐ Monthly (2)
- ☐ Once at the beginning of semester (3)
- ☐ Once at the beginning of the year (4)
- ☐ Never (5)

Q13 Which technology do you use in the university website/e-learning? (Please check all that apply)

- ☐ Adobe Flash (1)
- ☐ Adobe Shockwave (2)
- ☐ Portable Document Format (PDF) (3)
- ☐ Microsoft Office (4)
- ☐ Javascript (5)
- ☐ Java Applets (6)
- ☐ Active-X Controls (7)
- ☐ Real Video or Audio (8)
- ☐ Avid Media Composer (9)
- ☐ Adobe Photoshop (10)
- ☐ Quicktime Video or Audio (11)
- ☐ Microsoft(Windows Media) Video or Audio (12)
- ☐ MPEG Video or Audio (13)
- ☐ Other (please specify (14) \_\_\_\_\_

Q14 What types of content do you place in the university website/e-learning? (Please check all that apply)

- ☐ World documents (1)
- ☐ PowerPoint documents (2)
- ☐ Excel documents (3)
- ☐ PDF documents (4)
- ☐ Audio-clips (5)
- ☐ Video clips (6)
- ☐ Flash contents (7)
- ☐ Flickr (8)
- ☐ Twitter (9)
- ☐ Facebook (10)
- ☐ YouTube (11)
- ☐ Surveys (12)
- ☐ Online tests (13)
- ☐ Other (please specify (14) \_\_\_\_\_

Q15 Please feel free to add any further comments or thoughts on the use of university website and e-learning at your institution

Q16 Please select the statement that the best describes your knowledge of the needs of students with disabilities:

- ☐ I have a broad knowledge of the needs of students with a wide range of disabilities (1)
- ☐ I have some knowledge of the needs of student with certain specific disabilities (2)
- ☐ I have a little knowledge of some of the needs of students with disabilities. (3)
- ☐ I have little or no understanding of the needs of students with disabilities. (4)

Q17 Do you understand the meaning of people with disabilities as any of the following?

Physical disability (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vision impairment (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hearing impairment (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Speech and language impairment (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Multiple disabilities (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Intellectual disability (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mental health and emotional disabilities (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developmental disability (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Autistic (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q18 Experience/attitude towards students with disabilities and accessible online resources

Have you ever participated with students with disabilities in your institution? (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does your university provide any accommodation / assistance for students with disabilities? (e.g. extra exam time, captioned videos, computer with speech output) (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you been approached about making accessible online materials for students with disabilities? (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are you aware of any existing resource(s) that explain how to make accessible online materials for students with disabilities? (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are the online resources of your university tested for their accessibility to meet the special needs of students with disabilities? (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In your opinion, should students with disabilities be provided with facilitates and services by the university to assist their learning needs? (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you ever had a student with special needs complain about not being able to make use of online content? (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q19 Do you feel students with special needs should be given equal access to online resource as other students?

- ☐ Yes (1)  
☐ No (2)

Q20 In your opinion, who can benefit from accessible online resources? (Please check all that apply)

- ☐ Senior Managers (1)  
☐ Lecturers (2)  
☐ Web Staff (3)  
☐ Students (4)  
☐ Other (please specify) (5) \_\_\_\_\_

Q21 Do you think your role (web staff) should be responsible for making online resources accessible for people with disabilities?

- ☐ Yes (1)  
☐ No (2)

Q22 Please given more details regarding your answer

Q23 Do you know the meaning of the term web accessibility?

- ☐ Yes (1)  
☐ No (2)

If No Is Selected, Then Skip To Are you aware that the Thai....

Q24 Please explain your own understanding of the concept of web accessibility

Q 25 Are you aware that the Thai government has a policy on web accessibility?

- ☐ Yes (1)
- ☐ No (2)

Q26 Does your university have a policy in regards to web accessibility?

- ☐ Yes (1)
- ☐ No (2)
- ☐ Not Sure (3)

Q27 Are you familiar with assistive technology?

- ☐ Yes (1)
- ☐ No (2)

Q28 Are you familiar with web accessibility guideline(s)?

- ☐ Yes (1)
- ☐ No (2)

Q29 What, for you, is the most significant barrier to create accessible online materials for students with disabilities? Please rank, in order to importance, each of the following;

Allocate a rank of 1 to the MOST significant barrier.

Allocate a rank of 10 to the LEAST significant barrier.

- \_\_\_\_\_ Lack of knowledge of the needs of students with disabilities (1)
- \_\_\_\_\_ Lack of knowledge of technologies to create accessible online content (2)
- \_\_\_\_\_ Lack of knowledge of Assistive Technologies (3)
- \_\_\_\_\_ Lack of Accessibility training and awareness (4)
- \_\_\_\_\_ Lack of Assistive Technology equipment and software (e.g. Screen Reader, Dynamic displays devices) (5)
- \_\_\_\_\_ Lack of financial support from a university (6)
- \_\_\_\_\_ Lack of time (7)
- \_\_\_\_\_ Lack of support network (8)
- \_\_\_\_\_ Lack of commitment to Accessible design standards and resources (9)
- \_\_\_\_\_ Lack of demand for Accessible resources (10)

Q30 In order to improve web accessibility within the university, to what extent do you agree with the following statement?

Increasing penalty in laws and legalizations for non compliance to Accessibility (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting web accessibility must start with university policy. (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providing training and workshops is necessary. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing cooperation among stakeholders in university (e.g. Senior managers, Lecturer and Support Staff). (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Giving rewards (e.g. Promotions, Research Grants). (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provision of equipment and technology is crucial. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Support in terms of finance for accessibility projects is crucial. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q31 Who should be supporting web accessibility at university? (Please check all that apply)

- ☐ Senior Managers (1)  
☐ Lecturers (2)  
☐ Web Staff (3)  
☐ Other (please specify) (4) \_\_\_\_\_

Q32 What are your views on web accessibility?

Q33 Thank you for all your responses so far. Please feel free to add any further comments or thoughts regarding any of the issues raised above.

Q34 Would you be willing to participate in an interview in the future for the purpose of gathering more information about accessible online resources and web accessibility within your institution?

- ☐ Yes, for future interview (1)  
☐ No thanks (2)

## 9.7 Senior Manager- Web Survey

Q1 Please enter your Participant ID (as received in the original email from the researcher)

Q2 Gender

- ☐ Male (1)
- ☐ Female (2)

Q3 Age

- ☐ 18-35 (1)
- ☐ 36-50 (2)
- ☐ 51-60 (3)
- ☐ 60+ (4)

Q4 Length of work experience

- ☐ 1 - 5 Years (1)
- ☐ 6 - 10 Years (2)
- ☐ 11-15 Years (3)
- ☐ 15+ Years (4)

Q5 Do you use the university website/e-learning as a part of the job?

- ☐ Yes (1)
- ☐ No (2)

If No Is Selected, Then Skip To Did you receive formal...

Q6 How often do you use the university website/e-learning?

- ☐ Daily (1)
- ☐ Weekly (2)
- ☐ Several times per semester (3)
- ☐ Rarely (4)

Q7 Did you receive formal training in the use of the university website/e-learning?

- ☐ Yes (1)
- ☐ No (2)

Q8 To what extent do you feel your students are taking advantage of the university website/e-learning?

- ☐ Very little (1)
- ☐ Some (2)
- ☐ A great deal (3)

Q9 Please feel free to add any further comments or thoughts on the use of university website and e-learning at your institution

Q10 Please select the statement that the best describes your knowledge of the needs of students with disabilities:

- ☐ I have a broad knowledge of the needs of students with a wide range of disabilities (1)
- ☐ I have some knowledge of the needs of student with certain specific disabilities (2)
- ☐ I have a little knowledge of some of the needs of students with disabilities. (3)
- ☐ I have little or no understanding of the needs of students with disabilities. (4)

Q11 Do you understand the meaning of people with disabilities as any of the following?

Physical disability (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Vision impairment (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Hearing impairment (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Speech and language impairment (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Multiple disabilities (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Intellectual disability (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Mental health and emotional disabilities (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developmental disability (8)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Autistic (9)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q12 Experience/Attitude towards students with disabilities and accessible online resources

Have you ever participated with students with disabilities in your institution? (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Does your university provide any accommodation / assistance for students with disabilities? (e.g. extra exam time, captioned videos, computer with speech output) (2)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you been approached about making accessible online materials for students with disabilities? (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are you aware of any existing resource(s) that explain how to make accessible online materials for students with disabilities? (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Are the online resources of your university tested for their accessibility to meet the special needs of students with disabilities? (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In your opinion, should students with disabilities be provided with facilitates and services by the university to assist their learning needs? (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Have you ever had a student with special needs complain about not being able to make use of online content? (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13 Do you feel students with special needs should be given equal access to online resource as other students?

- ☐ Yes (1)
- ☐ No (2)

Q14 In your opinion, who can benefit from accessible online resources? (Please check all that apply)

- ☐ Senior Managers (1)
- ☐ Lecturers (2)
- ☐ Web Staff (3)
- ☐ Students (4)
- ☐ Other (please specify) (5) \_\_\_\_\_

Q15 Do you think your role (senior managers) should be responsible for making online resources accessible for people with disabilities?

- ☐ Yes (1)
- ☐ No (2)

Q16 Please given more details regarding your answer

Q17 Do you know the meaning of the term web accessibility?

- ☐ Yes (1)
- ☐ No (2)

If No Is Selected, Then Skip To Are you aware that the Thai...

Q18 Please explain your own understanding of the concept of web accessibility

Q 19 Are you aware that the Thai government has a policy on web accessibility?

- ☐ Yes (1)
- ☐ No (2)

Q20 Does your university have a policy in regards to web accessibility?

- ☐ Yes (1)
- ☐ No (2)
- ☐ Not Sure (3)

If Yes Is Selected, Then Skip To How are staff made aware of that poli...

Q21 How many years has that policy been in place?

- ☐ 2 years or less (1)
- ☐ 5 years or less (2)
- ☐ 5+ years (3)
- ☐ Not Sure (4)

Q22 Are you familiar with assistive technology?

- ☐ Yes (1)
- ☐ No (2)

Q23 Are you familiar with web accessibility guideline(s)?

- ☐ Yes (1)
- ☐ No (2)

Q24 What, for you, is the most significant barrier to create accessible online materials for students with disabilities? Please rank, in order to importance, each of the following;

Allocate a rank of 1 to the MOST significant barrier.

Allocate a rank of 10 to the LEAST significant barrier.

- \_\_\_\_\_ Lack of knowledge of the needs of students with disabilities (1)
- \_\_\_\_\_ Lack of knowledge of technologies to create accessible online content (2)
- \_\_\_\_\_ Lack of knowledge of Assistive Technologies (3)
- \_\_\_\_\_ Lack of Accessibility training and awareness (4)
- \_\_\_\_\_ Lack of Assistive Technology equipment and software (e.g. Screen Reader, Dynamic displays devices) (5)
- \_\_\_\_\_ Lack of financial support from a university (6)
- \_\_\_\_\_ Lack of time (7)
- \_\_\_\_\_ Lack of support network (8)
- \_\_\_\_\_ Lack of commitment to Accessible design standards and resources (9)
- \_\_\_\_\_ Lack of demand for Accessible resources (10)

Q25 In order to improve web accessibility within the university, to what extent do you agree with the following statement?

Increasing penalty in laws and legalizations for non compliance to Accessibility. (1)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Promoting web accessibility must start with university policy. (2))	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Providing training and workshops is necessary. (3)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Increasing cooperation among stakeholders in university (e.g. Senior managers, Lecturer and Support Staff). (4)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Giving rewards (e.g. Promotions, Research Grants). (5)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Provision of equipment and technology is crucial. (6)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Support in terms of finance for Accessibility projects is crucial. (7)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q26 Who should be supporting web accessibility at university? (Please check all that apply)

- ☐ Senior Managers (1)
- ☐ Lecturers (2)
- ☐ Web Staff (3)
- ☐ Other (please specify) (4) \_\_\_\_\_

Q27 What are your views on Web Accessibility?

Q28 Thank you for all your responses so far. Please feel free to add any further comments or thoughts regarding any of the issues raised above.

Q29 Would you be willing to participate in an interview in the future for the purpose of gathering more information about accessible online resources and web accessibility within your institution?

- ☐ Yes, for future interview (1)
- ☐ No thanks (2)