

Web Accessibility Initiatives in Malaysian Academic Libraries: Enthusiasm and Challenges

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ABSTRACT

As a visual medium for structuring and displaying information, website plays an important tool in library service. In fact it has now become the most usable feature that users use when accessing the library without even being there in person. This phenomenon has grown even faster as the search browser and social media applications become a way of life for most people and the influence on how the library should react in dissemination information. Academic libraries on the other hand faced a crucial decision whether to disembark the traditional library services to cope with the current evolution or keep the conventional way literally. These perplexing conditions happened as the academic libraries have to manage the academic stringent in teaching and studying that demand their students to familiar themselves with physical materials. Other crucial issue is that there are not many academic resources available online as there are still matters of copyright and restricted regulations to comply with. On such background, this paper will examine the experience from 20 Malaysian public university libraries in handling the web accessibility issues and evaluates the current state of web accessibility compliance of their website as outlined by WCAG 2.0 and Section 508 based on AChecker and WAVE tools. The results suggest a relatively low level of compliance to the guidelines as specified and conclude that sharing information in an open access framework is crucial in web accessibility but the flexibility and capability of the libraries should also be equal as well.

Keywords: web accessibility, Malaysian public university libraries, automated accessibility tools, WCAG 2.0, Section 508

1. INTRODUCTION

Since the evolution of Internet started in the 60s, the structure and the implication of it to the diversity of human development have grown exponentially. Thus the implementation of new applications and network on every corner of the globe made the Internet a critical tool in confronting human activities in terms of the speed of information dissemination, reliability transaction and easy to use in various appliances. Concomitant with the development, websites have also evolved in leaps and bounds over the years and their functionality such as design, accessibility, personalization and responsiveness has become increasingly sophisticated and cater to customers' desires. The traditional way of information processing and delivery have changed dramatically to the level of adapting the content presented in accordance with the audience, their device type, interactions and even their locations.

This phenomenal resurgence has also affect the way of some organization such as the library, in transforming and modelling their services to adhere the needs of the new generation of users. As such, library websites which were developed in accordance to the objective of dissemination the quality and vast amount of information available have now become more personal and direct communication to user's necessity. As mentioned by Brinkley (1998), the role of the library website as an interface to web-based information has increased to facilitate

the technologies of e-commerce and acts as a gateway to quality information resources relevant to particular subject areas. Therefore the library initiative to optimize their site's functionality to meet customers' expectations has been essential to the success of their core business.

Nevertheless these efforts need to be parallel with the complexity of users capacity in accessing the library website. Demand by the special needs user has increased and asked to be given equal consideration as the rights of their able-bodied counterparts. The web accessibility issues have become crucial as the library website is often the only view these users get of the library and could be the perfect medium regardless of the format of the information delivered through in which to meet their information needs. Thus web accessibility according to Aidi & Rosli (2016) guarantees that all users can access web application regardless to their limitation, ability or context of use and not only restricted to the needs of people with physical disabilities. This include the academic library websites which hold an important role as an institution's presentation of information resources, academic guidance and services (Cohen, 2003) and should be accessible to anyone especially from their own members or stakeholders.

Based on that this paper will explore the enthusiasm from some of the Malaysian Public University Libraries (MPUL) in their effort to transform their website to be able to handle the web accessibility issues and evaluates the current state of web accessibility compliance of their website as outlined by WCAG 2.0 and Section 508. Subsequently it also offers meaningful insights on how to facilitate website design accordingly and address the functionality based on the standard. As such this study will also highlight the challenges faced by MPUL in order to manage their websites and be compliance with the standards as required.

2. A SYSTEM VIEW

The word accessibility can be easily interpreted as an ability for everyone regardless of their disability to engage, access, reach, enter or use from any domain within their environment or element. In fact if we look at it in other way around; it is a process of creating products or services that are usable by everyone within their abilities and operating within every possible situations or circumstances.

In terms of web accessibility the definition is equal but focused more on how the website (World Wide Web Consortium (W3C), 2005) supports people with disabilities to perceive, understand, navigate, and interact effectively for equal chances to contribute to the web community activities. It encompasses all type of disabilities that affect access to the Web, including visual, auditory, physical, speech, cognitive and neurological disabilities. Furthermore according to Henry (2006), it can be defined as the way of a website which has been designed to meet the standards and quality so that it can be used by everyone with ease, navigable and understandable even in limited conditions, constraints or situations. In a simple word, web accessibility refers to the "application of technical solutions to the design of a website in order to render it more accessible to users" as mentioned by Craven (2008: 2).

As such, Kirkpatrick (2003) gave a wide interpretation on web accessibility as a matter of designing the websites that can disseminate information to any people regardless their abilities or disabilities, software or equipment. These include people with physical and mental problem difficulties such as movement, hearing, blindness or unable to process information as normal people; people using text-only or small screen; people with slow internet connection; people who do not speak or understand the language provided; people who get distracted by a sudden condition and people who still uses an out of date version of browser or system (Wijayaratne, 2008; Andrés, Lorca & Martínez, 2010; Terras, 2010; Providenti & Zai III, 2011; Aidi & Rosli, 2016). In short, web accessibility facilitates not only the need of disabled

people but also widely covered all sorts of users ability to navigate the website while taking into consideration on the complexity and diversity in their requirements, potentials and contextual environment.

Significantly on an average day, over 90% of Malaysian citizens accesses the Internet for some form of information-seeking purpose (MCMC, 2016) with more than 19% of them are college or university students. In fact it is estimated that more than 21million Malaysian citizen use the Internet on a regular basis in 2016 (Internet Live Stats, 2017) which is 68.6% penetration of total population. It is also an evidence that smartphone remained the most popular means for people to access the Internet (89.3%) in Malaysia while followed by laptop (46%), PC/Desktop (30.3%) and tablet (24.8%). These statistical users of Internet also accounting those who classified as students or leaners with disability problem which cover of more than 26 thousands people on the average age between 7-35 years old. This quantity comprise of about 365,677 disabled people in Malaysia as reported by Department of Social Welfare in 2015 where 35% (127,987) of them have learning disabilities, 124,330 with physical struggle, 32911 with vision impair, 29254 with hearing problems, 29254 with mental difficulties and 21941 of other disabilities.

Even though the enrollment of disability student into the colleges or universities in Malaysia is still small in numeral, for example only 4255 students (1.1%) out of a total of 382,997 students in public universities in 2007 (Hasnah, Mohd Hanafi, Mohd Mokhtar & Norasuzaini, 2009) and 1572 (0.3%) of the 481,361 students in 2013 (Aidi & Rosli, 2016), the facilities and services to cope with their difficulties are still largely disappointing. According to Tinklin & Hall (1999), the main obstacle for university students with disabilities in Scotland are physical environment, enrollment process, information accessibility during study and low level of awareness on disabilities necessity among the academic and administration staff. This study corresponding with Hasnah..et al. (2009) research on the obstacle those disabilities students have to endure in Malaysian higher learning institution. In terms of information accessibility, their research confirmed that most of the students have difficulties to access information provided through regular tools such as computers as their limitation hinders them to do so. This includes the hardship to access the library books with no braille format or tools to assist them to read and also accessing online resources transmitted through the Internet.

In dealing with this issue, the Malaysian government has enforced a special act called Persons with Disabilities Act 2008 or Act 685 which apparently allocates an equal right for the disabled people in Malaysia. According to Part IV of the act, it clearly stated that the disabled people have the right to access to information, communication and technology on equal basis with persons without disabilities; the Government and the provider of information, communication and technology shall in order to enable persons with disabilities to have such access and facilitate them with the use of Malaysia Sign Language, Braille, augmentative and alternative communication and all other accessible means, modes and formats of communication of their choice in official transactions without additional cost. In terms of web accessibility, the government also imposes a guideline to heighten government service delivery amongst the public sectors via the Malaysian Government Portals and Websites Assessment (MGPWA). This self-assessment manual provides a thoroughly guide on how the government portal and websites should be addressed and functioned thus encompass with conformance to W3C disability accessibility standard or Web Content Accessibility Guidelines (WCAG) as provided by World Wide Web Consortium (W3C).

Due to that as comparison, Malaysian scored at 6th place out of 11 East Asia & Pacific countries for Government Online Services Index (GOSI) as shown in Table 1 and 28th place out of 85 countries in world ranking for the same category in 2014. The index covers on assesses the quality, relevance and usefulness of government websites in providing online information and participatory tools and services for people. This Web Index is provided by

World Wide Web Foundation and measures the World Wide Web’s contribution to social, economic and political progress in countries across the world. The scores are given in the areas of universal access; freedom and openness; relevant content and empowerment.

Table 1. GOSI Rank for East Asia & Pacific Countries, 2014

Ranks	1	2	3	4	5	6	7	8	9	10	11
Countries	SIN	KOR	JPN	AUS	NZD	MYS	CHN	PHI	THA	VTM	INA

Legend : SIN-Singapore; KOR-Korea; JPN-Japan; AUS-Australia; NZD-New Zealand; MYS-Malaysia; CHN-China; PHI-Philippine; THA-Thailand; VTM-Vietnam; INA-Indonesia

2.1 Web Accessibility Standards

There are two standards and guidelines that are currently being used; the Web Content Accessibility Guidelines (WCAG) 2.0 and Section 508 of the United States Rehabilitation Act.

As stated earlier, the WCAG standard that was developed by W3C has been used alongside with MGPWA in terms of Malaysian initiative. Since it was founded in 1994, the W3C has initiated common protocols for the evolution of the web with an exercise known as Web Accessibility Initiative (WAI), which later produced the WCAG (Aidi & Rosli, 2016). WCAG 1.0 was developed in the late 1990s and has been finalized in 1999 before the WCAG 2.0 has been proposed in 2000 and became official in 2008 by W3C. Since then the WCAG has been widely used both as design guidelines and as heuristics in website evaluations (Rømen & Svanæs, 2012) and also accepted as an international web standard to facilitate web accessibility among the disabled person. As defined by this standard, the guideline provides a platform on “how to make Web content more accessible to people with disabilities. Accessibility involves a wide range of disabilities, including visual, auditory, physical, speech, cognitive, language, learning, and neurological disabilities. Although these guidelines cover a wide range of issues, they are not able to address the needs of people with all types, degrees, and combinations of disability. These guidelines also make Web content more usable by older individuals with changing abilities due to aging and often improve usability for users in general” (W3C, 2008).

As for Section 508, it is an amended act in 1998 of United State Rehabilitation Act of 1973 where it require Federal agencies to make their electronic and information technology (EIT) accessible to people with disabilities. Under the law all Federal agencies must give disabled employees and members of the public access to information that is comparable to access available to others.

2.1.1 Web Content Accessibility Guidelines (WCAG) 2.0

As outlined by the W3C, WCAG 2.0 covers a wide range of recommendations for making Web content more accessible which will make content accessible and more usable to users in general particularly for people with disabilities, including blindness and low vision, deafness and hearing loss, learning disabilities, cognitive limitations, limited movement, speech disabilities, photosensitivity and combinations of these (W3C, 2008). Thus to concordance with standard, WCAG 2.0 recommends 4 principles with 12 layers of guidance to comply as described in Table 2.

Table 2. WCAG 2.0 Guidelines

Principle 1 – Perceivable: *Information and user interface components must be presentable to users in ways they can perceive.*

1.1 Text alternatives: Provide text alternatives for any non-text content.

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- 1.2 Time-based media: Provide alternatives for time-based media.
 - 1.3 Adaptable: Create content that can be presented in different ways (for example simpler layout) without losing information or structure.
 - 1.4 Distinguishable: Make it easier for users to see and hear content including separating foreground from background.

Principle 2 – Operable: *User interface components and navigation must be operable.*

- 2.1 Keyboard accessible: Make all functionalities available from a keyboard.
- 2.2 Enough time: Provide users enough time to read and use content.
- 2.3 Seizures: Do not design content in a way that is known to cause seizures.
- 2.4 Navigable: Provide ways to help users navigate, find content and determine where they are.

Principle 3 – Understandable: *Information and the operation of user interface must be understandable.*

- 3.1 Readable: Make text content readable and understandable.
- 3.2 Predictable: Make web pages appear and operate in predictable ways.
- 3.3 Input Assistance: Help users avoid and correct mistakes.

Principle 4 – Robust: *Content must be robust enough that it can be interpreted reliably by a wide variety of user agents, including assistive technologies*

- 4.1 Compatible: Maximize compatibility with current and future user agents, including assistive technologies.
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Further WCAG 2.0 also setup three levels of conformance requirement which are A (lowest), AA and AAA (highest). According to Aidi & Rosli (2016:197), “Level A (the lowest compliance) specified the compulsory elements of the web for people with disability to get access to the materials provided. Meanwhile, Level AA listed the advanced requirements that will likely removed significant accessibility barriers for a wider group of audience to be able to access the web content. The highest conformance level (Level AAA) stipulated other advanced features that ensured widest accessibility of the web among the audience”. By definition, at least one of the mention levels of requirements especially Level A has to be met or satisfied in full for any website to be clarified as WCAG conformance.

2.1.2 Section 508

Section 508 of the United States Rehabilitation Act stressed that there are 16 standards in order to compliance with web accessibility and to ensure more accessible web content. These standards are shown in Table 3 below.

Table 3. Section 508 Standards

Section 508 Standards	Description
1. Text equivalents	For every non-text element shall be provided (e.g., via "alt", "long desc", or in element content).
2. Multimedia equivalents synchronized	Equivalent alternatives for any multimedia presentation shall be synchronized with the presentation.
3. Color also available without color	Web pages shall be designed so that all information conveyed with color is also available without color, for example from context or markup.
4. Stylesheets in use	Documents shall be organized so they are readable without requiring an associated style sheet.
5. Text links for server-side image map	Redundant text links shall be provided for each active region of a server-side image map.
6. Client-side image maps instead of server-side	Client-side image maps shall be provided instead of server-side image maps except where the regions cannot be defined with an available geometric shape.

7. Row/column headers for data tables	Row and column headers shall be identified for data tables.
8. Associate data cells and header cells	Markup shall be used to associate data cells and header cells for data tables that have two or more logical levels of row or column headers.
9. Frames shall be titled	Frames shall be titled with text that facilitates frame identification and navigation.
10. Avoid flicker	Pages shall be designed to avoid causing the screen to flicker with a frequency greater than 2 Hz and lower than 55 Hz
11. Text-only page	A text-only page, with equivalent information or functionality, shall be provided to make a web site comply with the provisions.
12. Script must have functional text	The information provided by the script shall be identified with functional text that can be read by assistive technology.
13. Applets etc. must comply	A link is provided to a page where the plug-in can be downloaded.
14. Accessible forms	The form shall allow people using assistive technology to access the information, field elements, and functionality required.
15. Skip repetitive navigation links	A method shall be provided that permits users to skip repetitive navigation links.
16. Timed response	When a timed response is required, the user shall be alerted and given sufficient time to indicate more time is required.

2.2 Web Accessibility Evaluation Tools

As projected by Abuaddous, Jali and Nurlida (2013), web accessibility evaluation tools assist the website developer to check and determine whether their website structures are in compliance with the standards as required. This includes finding various design construction, potential conformity problems, use of jargon etc. As a major tool to generate assessment result on web accessibility, it delivers a first-hand evaluation and function as a technical guidance for any webmaster while developing their website.

For this study, AChecker and WAVE accessibility tools has been chosen to assist as they approximately cover and highly correspond to the applicable web accessibility standards/guidelines such as WCAG 1.0, WCAG 2.0 and Section 508. Table 4 shows the comparison of automated accessibility tools as recommended by Usabilitygeek.com at <http://usabilitygeek.com/10-free-web-based-web-site-accessibility-evaluation-tools/> and W3C at <https://www.w3.org/WAI/ER/tools/>. As a matter of fact WAVE has also been recommended by Malaysia Digital Economy Corporation (MDeC) for checking the web accessibility by Malaysian Government website as mentioned by Aidi & Rosli (2015).

Table 4. Comparison of Automated Accessibility Tools

Tools	Accessibility Standards Adapted		
	WCAG 1.0	WSAG 2.0	Section 508
Accessibility Valet	Yes	No	Yes
AChecker	Yes	Yes	Yes
Cynthia Says	Yes	No	Yes
EvalAccess	Yes	No	No
FAE	No	No	No
MAGENTA	Yes	No	No
OCAWA	Yes	No	No

TAW	Yes	Yes	No
WAVE	Yes	Yes	Yes

Source: Adapted from <http://usabilitygeek.com/10-free-web-based-web-site-accessibilityevaluation-tools> and <https://www.w3.org/WAI/ER/tools/>

It is worth mentioning that while the tools provided a useful automated prediction on web accessibility on conformity to standards as assigned, part of the result reported and assessment should also include human intervention or inspection of the web (Peters and Bradbad, 2010). It is because depending on WCAG standards alone do not guarantee web accessibility (Rømen & Svanæs, 2012). Website developers should involve their users in performing a usability test on their website especially people with very wide ranging abilities. Hence there is a limitation on how the result from these automated accessibility tools should be interpreted and deserve a careful scrutiny (Aidi & Rosli, 2016). However even with some limitations, these tools has been chosen by many researchers for several web accessibility studies as mentioned in the literature review section and proved to be the most appropriate, open source friendly, easy to handle and recommended choice for the scope of this study.

2.3 Malaysian Public University Libraries (MPUL)

Currently there are 20 Malaysian Public Universities that offer higher education environment locally and internationally. They are funded by the government and governed as self-managed institutions. As part of the educational system, MPUL as described in Table 4, coexist alongside with their parent institution with an objective to facilitate the needs of their stakeholders in terms of information and resources in every format available. They provide library facilities for the whole campus and the collection comprises of printed materials, databases and other electronic resources.

Table 5. Malaysian Public University Libraries

Name of MPUL	Institution Category	Website URL
1. IUUM Library, International Islamic University Malaysia (IIUM)	CU	http://lib.iium.edu.my/
2. Tun Abdul Razak Library, Universiti Teknologi MARA (UiTM)	CU	http://library.uitm.edu.my
3. UKM Library, Universiti Kebangsaan Malaysia (UKM)	RU	http://www.ukm.my/ptsl/
4. UM Library, Universiti Malaya (UM)	RU	https://umlib.um.edu.my
5. UMK Library, Universiti Malaysia Kelantan (UMK)	FU	http://perpustakaan.umk.edu.my
6. UMP Library, Universiti Malaysia Pahang (UMP)	FU	http://umplibrary.ump.edu.my
7. UMS Library, Universiti Malaysia Sabah (UMS)	CU	http://library.ums.edu.my
8. Sultanah Nur Zahirah Library, Universiti Malaysia Terengganu (UMT)	FU	http://psnz.umt.edu.my/
9. Tuanku Syed Faizuddin Putra Library, Universiti Malaysia Perlis (UNIMAP)	FU	http://mylibrary.unimap.edu.my/
10. Centre for Academic Information Services, Universiti Malaysia Sarawak (UNIMAS)	CU	http://www.cais.unimas.my/
11. UNISZA Library, Universiti Sultan Zainal Abidin (UNISZA)	FU	https://perpustakaan.unisza.edu.my
12. Sultan Abdul Samad Library, Universiti Putra Malaysia (UPM)	RU	http://www.lib.upm.edu.my/

13. Jeneral Tun Ibrahim Library, Universiti Pertahanan Nasional Malaysia (UPNM)	FU	http://lib.upnm.edu.my/
14. Tuanku Bainun Library, Universiti Pendidikan Sultan Idris (UPSI)	FU	http://pustaka3.upsi.edu.my
15. USIM Library, Universiti Sains Islam Malaysia (USIM)	FU	http://lib.usim.edu.my/
16. Hamzah Sendut Library, Universiti Sains Malaysia (USM)	RU	http://www.lib.usm.my
17. UTEM Library, Universiti Teknikal Malaysia Melaka (UTEM)	FU	http://library.utm.edu.my
18. Tunku Tun Aminah Library, Universiti TunHussein Onn Malaysia (UTHM)	FU	http://library.uthm.edu.my
19. UTM Library, Universiti Teknologi Malaysia (UTM)	RU	http://library.utm.my/
20. Sultanah Bahiyah Library, Universiti Utara Malaysia (UUM)	FU	http://www.lib.uum.edu.my

Legend : RU-Research University; CU-Comprehensive University; FU-Focused University

3. EARLIER WORKS

In general, web accessibility gain considerable amount of studies on higher learning education institution which concentrates on university or colleges homepage such as on several departments in the university (Zaphiris & Ellis, 2001 & Krach, 2007) and colleges or universities website (Spindler, 2002; Hasnah...et al. (2009); Thompson, Burgstahler & Moore, 2010; Maslina, Wan Abdul Rahim & Norzainuriah, 2010; Didegah & Mohammad Amin, 2010; Erickson, Trerise, Lee, VanLooy, Knowlton & Bruyère, 2013; Abuaddous, Jali & Nurlida, 2013; Solovieva & Bock, 2014; Aidi & Rosli. 2015, 2016). Most of the studies examined issues related to universities portal which described as a major gateway for university communication with various stakeholders, particularly prospective students.

Meanwhile related to the studies that examined the issue on academic library website such as design, usability, navigation, content and accessibility, there are quite a few to begin with. For example, a study by Hightower et al. (1998) highlighted the issue in developing an academic library website; Cohen & Still (1999) make a comparison on the library website functionality between a 100's research universities in the United States; Heinrichs, Lim K, Lim J & Spangenberg (2007) study three alternative models of academic library Web site usage based on Technology Acceptance Model (TAM) which depict relationships among various intrinsic and extrinsic determinant factors; Comeaux & Schmetzke (2007) investigates the web sites of all 56 ALA-accredited library schools and of the libraries on these campuses which reveal an increase in accessibility but still unable to cope with errors permanently; Hasnah...et al. (2009) indicate some of the difficulties face by disabled students in Malaysian universities including the library; Mohamad, Adnan and Sobariah (2010) study the effectiveness of a specific library portal at UiTM based on the opinions of students in the Faculty of Information Management, and Billingham (2014) who explained on how Edith Cowan University (ECU) library improved the accessibility of their web site.

The studies also used various web accessibility evaluation tools such as HERA, Bobby, WAVE, AChecker, Cynthia Says, SortSite, AccVerify, WebXact etc. as shown in Table 6. Generally it displays the diversity of tool used by the researchers in their study which depend on their objectives and resources available.

Table 6. Diversity of Evaluation Tools Used by Previous Studies

Tools	Relevant Studies
WAVE	Adepoju & Shehu, 2014; Lujan-Mora, Navarrete & Penafiel, 2014; Aidi & Rosli, 2016
AChecker	Abuaddous, Jali & Nurlida, 2013 ; Adepoju & Shehu, 2014; Lujan-Mora, Navarrete & Penafiel, 2014; Aidi & Rosli, 2016
Bobby	Zaphiris & Ellis, 2001; Spindler, 2002; O’Grady & Harrison, 2003; Krach, 2007; Abdul Latif & Masrek, 2010 ; Comeaux & Schmetzke, 2013
HERA	Adepoju & Shehu, 2014
TAW	Lujan-Mora, Navarrete & Penafiel, 2014; Abuaddous, Jali & Basir, 2013
AccVerify	Erickson...et al., 2013
KWCAG	Maslina, Wan Abdul Rahim & Norzainuriah, 2010;; Hajar & Zahra, 2011; Noh, Jeong, You, Moon & Kang, 2015
Manual	Hasnah...et al., 2009; Thompson, Burgstahler & Moore, 2010
Cynthia Says	Solovieva & Bock, 2014
WebXact	Zaphiris & Ellis, 2001; Krach, 2007

4. METHODOLOGY

This study examined the web accessibility advancement among the 20 MPUL websites and particularly focused on the respective organization homepage as it display and function as a major entrance by users to their online resources. By default it should be the most up to date, frequently maintained (Providenti & Zai III, 2011) and advanced in terms of usability and technology. Furthermore AChecker and WAVE were used as preferred automated tools with WCAG 2.0 and Section 508 as the guidelines. The website accessibility analysis has been conducted from Friday, 09 June 2017 to Saturday, 10 June 2017. The result offers a significant comparison on web accessibility among the MPUL based on the automated tools employed.

As an added value to the study, a structured questionnaire on understanding the initiative and effort done by the MPUL in organizing their websites was also formed. The questionnaire which consists of 27 questions generally measures their effort in terms of web application, access usability, adaptation, resources and challenges. It also offers meaningful insights on their opinion of web accessibility assessment. It was conducted online as the representatives of MPUL were asked to give their feedback in stipulated time from Thursday, 01 June 2017 until Friday, 09 June 2017. As a result, a total of 18 out of 20 MPUL (90%) has responded to the questionnaire and consequently analyzed.

5. FINDING AND ANALYSIS

5.1 Web Accessibility Initiative and Enthusiasm

Demographically about 18 out of 20 (90%) Malaysian Public University Libraries (MPUL) has responded to this study and answered the questions accordingly. At a glance, MPUL exist in parallel with its parent organization, in this case the university. The earliest MPUL that develop and make use of the website as online information gateway is in 1995 by Universiti Kebangsaan Malaysia (UKM) to the latest in 2010 by Universiti Tun Hussein Onn Malaysia (UTHM).

In terms of application most of the libraries, 14 in total (78%) depend on the expertise of their own staff to develop and manage the website and only 4 of them (22%) embraced the external services such as commercial webmasters or templates. In case of software, most of the MPUL (13 out of 18 or 72%) website uses Content Management System (CMS) such as Joomla,

Drupal, Moodle etc. and Blog such as WordPress as their core system. Not surprisingly this happens because most of the systems are open source software's and score as favorites among the non-profit organization wherein only a few MPUL (6 out of 18) do a hardcore programming in developing their website. At average about 13 MPUL websites have a significant transformation between 1-5 times in 4 to 7 years of operational. This includes a total change in template interface, system makeover and highly embedded scripting language into the website background.

As a matter of accessibility, about 14 out of 18 (78%) MPUL agree that their websites does not conformance with W3C standards which covers only between 10-30% as required. The most tools or initiatives available in terms of accessibility are responsive website template to mobile devices such as smartphones, selection of font size and colors, variety of languages and video subtitle as depicted in Table 7.

Table 7. The Most Accessibility Tools Adapted by MPUL

Tools/Initiatives	Total Count of MPUL	%
1. Responsive website to mobile devices such as smartphones, tablets, laptop,	10	37
2. Selection of font size	5	19
3. Selection of font or background colors	3	11
4. Selection of languages or translation	4	15
5. Video with embedded subtitle or narrative	1	3
6. None	4	15

Undoubtedly the figures show that almost all MPUL adapt basic tools to help disabilities user accessing their websites and it is a common case by any government base organizations. This also happen as the W3C standards such as WCAG 2.0 is not a mandatory requirement (Aidi & Rosli, 2015) in any Malaysian government website but instead just a self-assessment procedure as assigned by the Malaysia Digital Economy Corporation (MDec). The Malaysian Government Portals and Websites Assessment (MGPWA) mentioned that all government websites are only required to comply with Level A of Web Content Accessibility Guidelines (WCAG) 2.0 and recommended WAVE as their accessibility evaluation tool.

Meanwhile if we look at the ranking of services provided by the MPUL websites, the top 5 services that gather the most audience are shown in Table 8. It shows that online services and resources become more significant to the life style of users nowadays in seeking for information and the more friendlier the websites to mobile application or devices, the more it become a necessity.

Table 8. Ranking base on Services Provided by MPUL Websites

Rank	Website Services
1	Seeking for library materials
2	Research information through online subscription databases
3	Downloading electronic resources such as digital items
4	Using third party services such as Turnitin, Inter Library Loan etc.
5	Seeking guidance through chat, electronic forms, FAQ's etc.

The data also showed that from 2014 to 2016, there is an increase about 27% of users who use MPUL websites as shown in Figure 1. In 2014, the total of users is 4,173,931, 5,790,809 in 2015 and 5,311,320 in 2016. This numeral evidence expresses the degrees of users who depended on MPUL websites for their studying and research purposes. Thus, it is important for any educational institution to maintain their websites regularly especially for the libraries as they have the obligation to serve everyone equally. This responsibility also caters for

disabled person who seek information and materials as much as their friends who are normal.

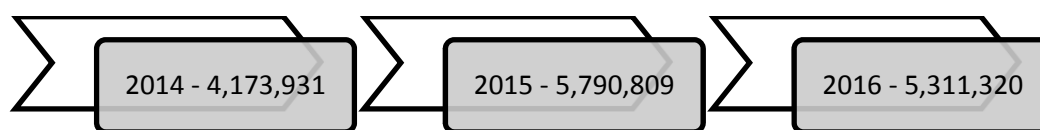


Figure 1. Total Users of MPUL Websites, 2014-2016

5.2 Web Accessibility Results Base on AChecker

For starters, AChecker evaluate web accessibility based on two standards namely WSAG 2.0 which are divided into three sets of levels: A, AA and AAA and Section 508. On top of it the system will identify three types of problem that may envelop the targeted website which are (1) Known Problems, problems that have been identified with certainty as accessibility barriers, (2) Likely Problems, problems that have been identified as probable barriers, but require a human to make a decision and (3) Potential Problems, problems that the system cannot identify, thus requires human intervention to decide.

Based on Table 9, unfortunately none of the MPUL websites passed the test even for the lowest Level A as required by WSAG 2.0 or Section 508 assessment. Overall the result indicates the level of compliance of MPUL websites is relatively very low with a total known errors or problems of 1181 for Level A, 1585 for Level AA, 1500 for Level AAA and 382 for Section 508. As mentioned by Aidi & Rosli (2016:201), “this result is consistent with what has been reported by similar studies worldwide such as in the Middle East countries (Shawar, 2015), Nigeria (Adepoju & Shehu, 2014) and Malaysia (Abdul Latif & Masrek, 2010; Abdul Aziz et al., 2010; Abuaddous et al., 2013)” and also on their own studies in 2016.

Table 9. AChecker Results Summary based on WSAG 2.0

MPUL	Level A				Level AA				Level AAA				Section 508			
	K	L	P	R	K	L	P	R	K	L	P	R	K	L	P	R
IUM	18	1	605	F	18	1	656	F	18	1	666	F	11	12	103	F
UiTM	32	0	651	F	116	0	712	F	33	0	717	F	15	28	135	F
UKM	24	6	538	F	24	6	578	F	24	6	604	F	19	24	52	F
UM	4	0	417	F	29	0	446	F	34	0	476	F	14	19	67	F
UMK	5	0	332	F	62	0	343	F	62	0	358	F	2	18	78	F
UMP	72	14	1166	F	118	14	1222	F	91	4	1227	F	14	14	196	F
UMS	17	1	391	F	45	1	427	F	45	1	434	F	11	35	99	F
UMT	15	0	435	F	15	0	463	F	15	0	468	F	17	14	84	F
UNIMAP	68	4	538	F	88	4	572	F	52	2	597	F	29	49	149	F
UNIMAS	9	1	218	F	23	1	229	F	23	1	240	F	6	21	57	F
UNISZA	65	1	777	F	69	1	818	F	69	1	828	F	68	27	189	F
UPM	117	7	460	F	140	8	479	F	140	8	517	F	23	11	56	F
UPNM	232	0	920	F	270	0	970	F	270	0	975	F	47	18	80	F
UPSI	23	1	389	F	29	1	411	F	31	1	422	F	30	36	90	F
USIM	229	0	720	F	239	0	774	F	239	0	767	F	28	13	101	F
USM	43	1	514	F	47	1	531	F	47	1	536	F	7	12	65	F
UTEM	13	0	472	F	17	0	506	F	17	0	542	F	7	18	90	F
UTHM	84	0	316	F	105	0	337	F	105	0	344	F	10	11	51	F
UTM	79	0	545	F	97	0	585	F	151	0	604	F	19	42	111	F
UUM	32	2	611	F	34	2	641	F	34	2	665	F	15	30	94	F
Total	1181	39	11015		1585	40	11700		1500	28	11987		382	452	1947	

Legend: MPUL-Malaysian Public University Libraries; K-Known Problems; L-Likely Problems; P-Potential Problems; R-Result; F-Fail

The data also indicates that Universiti Malaya (UM), Universiti Malaysia Kelantan (UMK) and Universiti Malaysia Sarawak (UNIMAS) library websites scored the top three with the lowest errors identified which is 4 (UM), 5 (UMK) and 9 (UNIMAS) in Level A section.

Even though the result shows the non-conformance level on all MPUL websites, in the author's opinion it can still be accepted as the number of errors are small and almost parallel with other studies as mentioned earlier and also the WSAG 2.0 or Section 508 standards are almost unfamiliar or compulsory among Malaysian government organization websites to begin with.

Thus if we look deeper within the result on Table 10, the most error that surrounded the low level of web accessibility among MPUL websites and deserve a crucial attention is *Text alternatives* with 371 issues (31%), followed by *content adaptation* with 362 issues (30%) and *distinguishable* with 163 issues (14%). It is surprisingly acknowledged that these issues came from the same principle which is Perceivable and under Level A which is the lowest and basic conformance to achieve. It showed that most of the MPUL websites have a low level of accessibility to begin with.

Table 10. Known Problems as per WCAG 2.0

Known Problems	(Level A)		(Level AA)		(Level AAA)	
	Total	%	Total	%	Total	%
Principle 1 - Perceivable						
1.1 Text alternatives: Provide text alternatives for any non-text content.	371	31	454	29	353	23.5
1.2 Time-based media: Provide alternatives for time-based media.	0	0	0	0	0	0
1.3 Adaptable: Create content that can be presented in different ways (for example simpler layout) without losing information or structure.	362	30	367	23	365	24
1.4 Distinguishable: Make it easier for users to see and hear content including separating foreground from background.	163	14	247	15	297	20
Principle 2 - Operable						
2.1 Keyboard accessible: Make all functionalities available from a keyboard.	91	8	184	12	180	12
2.2 Enough time: Provide users enough time to read and use content.	0	0	0	0	0	0
2.3 Seizures: Do not design content in a way that is known to cause seizures.	0	0	0	0	0	0
2.4 Navigable: Provide ways to help users navigate, find content, and determine where they are.	118	10	234	14.7	211	14
Principle 3 - Understandable						
3.1 Readable: Make text content readable and understandable.	12	1	29	2	18	1
3.2 Predictable: Make web pages appear and operate in predictable ways.	0	0	0	0	0	0
3.3 Input Assistance: Help users avoid and correct mistakes.	57	5	65	4	69	5
Principle 4 – Robust						
4.1 Compatible: Maximize compatibility with current and future user agents, including assistive technologies.	7	1	5	0.3	7	0.5
Total	1181	100	1585	100	1500	100

Other issues that need to be handled are navigability, keyboard accessibility, input assistance, readability and compatibility. All of these issues marked the crucial needs for amendment on every parts of MPUL websites as shown in every level and section of assessment. For starters, by using the data from this result all MPUL can improve their websites accordingly and at least achieve the lowest level of compliance which is Level A in the coming years for the sake of their stakeholders and own objectives.

The same situation goes for Section 508 assessment as shown in Table 11 where three issues dominate the list of 16 standards required. There are text equivalents with 251 (66%) errors or known problems followed by the use of script with 120 (31%) errors and accessibility to form with 11 (3%) errors. These three issues are identical to a study by Aidi & Rosli (2016) where they also identified the same phenomenon but encircle the main institution environment, in this case the universities website itself.

Table 11. Known Problems as per Section 508

Known Problems	Section 508	
	Total	%
A - Text equivalents	251	66
B - Multimedia equivalents synchronized	0	0
C - Color also available without color	0	0
D - Stylesheets in use	0	0
E - Text links for server-side image map	0	0
F - Client-side image maps instead of server-side	0	0
G - Row/column headers for data tables	0	0
H - Associate data cells and header cells	0	0
I - Frames shall be titled	0	0
J - Avoid flicker	0	0
K - Text-only page	0	0
L - Script must have functional text	120	31
M - Applets etc. must comply	0	0
N - Accessible forms	11	3
O - Skip repetitive navigation links	0	0
P - Timed response	0	0
Total	382	100

5.3 Web Accessibility Results Base on WAVE

In comparison if we look at the WAVE result as shown in Table 12, the data shows a similar situation with all the MPUL websites do not pass the assessment test as required. It revealed that only two libraries have less than 10 errors which is Universiti Malaya (UM) with only 3 errors and Universiti Teknikal Malaysia Melaka (UTEM) with 8 errors. For the rest of the MPUL websites they have common errors such as empty link, linked image missing alternative text, missing form label, empty heading and document language missing.

As specified by Aidi & Rosli (2016:206), “WAVE provides visual feedback about the accessibility of the web content by injecting icons and indicators onto the page. All analysis was entirely carried out within the browser. WAVE analyses the web accessibility errors, alerts, features, structural elements, HTML5 and Accessible Rich Internet Applications (ARIA) and contrast errors based on WCAG 2.0 (Level A), WCAG 2.0 (Level AA) and Section 508”. So being the recommended tool by the Malaysian Government Portals and Websites Assessment (MGPWA), this result can surely clarify the needs of improvement to be done in terms of web accessibility among MPUL websites. The highest errors that deserve further attention are structural element with 1002 errors, followed by contrast error with 728 frequencies. Again, the result serves as a basic evaluation for the MPUL to take necessary action; as most of the errors were common elements in website architectural environment and practically can be rectified accordingly.

Table 12. WAVE Result Summary

MPUL	Errors	Alerts	Features	Structural Elements	HTML 5 & ARIA	Contrast Error	Total
IUM	16	12	27	64	10	14	143
UiTM	41	23	33	65	4	58	224
UKM	42	16	5	24	7	23	117
UM	3	86	31	37	0	3	160
UMK	31	93	53	70	11	23	281
UMP	23	25	70	113	9	82	322
UMS	16	18	19	53	33	63	202
UMT	16	21	10	22	11	31	111
UNIMAP	27	14	33	54	99	18	245
UNIMAS	28	24	26	61	5	87	231
UNISZA	65	66	29	53	6	16	235
UPM	29	22	52	22	11	90	226
UPNM	43	37	0	68	210	48	406
UPSI	23	7	14	28	26	1	99
USIM	34	39	18	102	4	19	216
USM	17	7	17	36	3	6	86
UTEM	8	32	38	40	51	8	177
UTHM	11	7	9	16	4	91	138
UTM	16	11	25	35	18	14	119
UUM	15	25	37	39	5	33	154
Total	504	585	546	1002	527	728	3892

5.4 Challenges Ahead for MPUL Websites

As a final review from the result, most of the MPUL agrees that they expect a few major challenges ahead in terms of website development and management. The biggest challenge that has to be expected from the MPUL point of view is the rapid changes of technology surrounding the website framework with 15 counts out of 18 MPUL. They fear the technology will be so advanced in a few years' time that their services won't be able to catch up and fulfill their stakeholder's needs as required. On top of that, they have to cope with the web accessibility compliance that put their effort much harder to achieve which score the second crucial challenge with 13 counts. Apart from having pressure from external elements as mentioned, they have to deal with a shortage of internal finesse in terms of suitable and qualified personnel to maintain their websites. In short they have to depend on outside professional which will affect their tight budget. This challenge took the third place with 10 counts.

Other challenges that is worth to mentioning is their proactive action in specifying the most suitable services and facilities to cope with their parent institution objective in promoting various learning and teaching scope. This fourth challenge which scored 8 counts from MPUL puts them in a very tight situation as they have to make sure the services including website performance is in accordance to the complexity of higher learning educational needs but overshadowed by a decrease in budget allocation. This puts the budget issue in fifth place of challenge that the MPUL have to face with 7 counts. Other challenges are the increase of expenditure on maintaining the operational and hardware of the websites and the pressure from social media application and browser engine such as Google which can take over the whole role of library in a short time.

6. CONCLUSION

To conclude the AChecker and WAVE evaluation point of view, the whole assessment is a good step to: (1) marked a necessary point for MPUL web developers or webmasters to improve their websites; (2) crucial indicators for MPUL to take serious obligation and commitment to ensure web accessibility for all their stakeholders; and not least (3) acknowledge the importance of various diversity of people in needs especially while gathering information to make their objective accomplished as successful as they can.

Undoubtedly the web accessibility automated tools may indicate crucial errors or problems according to the standards outline but it still needs a human touch on certain factors. As mentioned earlier, part of the result reported and assessed should also include human intervention or inspection of the website altogether as it will ensure a comprehensive and practical finding. As the audience of the website merely came from the human consumption, it should also take a psychological intake on how the human reacts to certain web issues because of the differences in physical and intellectual abilities between them. This weakness should be emphasized in future study and the influence of a conformance or non-conformance web accessibility on users should also be worth to look at as well.

Hence, we have to ensure that equal web accessibility is a necessity to achieve perfect information dissemination through library website especially in academically environment. It is worth to mention a significant thought by Canadian National Institute for the Blind (CnIB) as “accessibility is best represented when features are “built in” as an integral part of the design & development process. Unfortunately, much of the time accessibility is an afterthought and features need to be “retro-fitted” or adapted to ensure compliance”. Thus reforming the MPUL websites is crucial not only to fulfill the needs of obvious party but also to confront the rapid future in information technology.

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