Comparison of accessibility of OER repositories of developed countries and developing countries based on WCAG 2.0 guidelines

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Abstract. Access to quality education in the era of ICT technology is growing rapidly, by utilizing this technology ideally it is not a problem, thus the presence of technology can be a problem solver that occurs such as inequality of quality educational material and access to the intended materials, this is certainly a dream all parties because, in reality, all this is not easy. The biggest challenge in equalizing the quality of education is experienced by almost all countries in the world, especially countries with large territories and populations. Inequalities and gaps in differences and equal access to quality education material occur in almost every country in the world. Distance learning can be carried out easily by utilizing ICT infrastructure. Almost every country in the world strives to provide open wide access through the use of web-based applications to facilitate and facilitate the population of the needs of teaching materials according to the population. This article will discuss, analyse and explore the comparison of the accessibility of the Open Educational Resources (OER) repository in developed countries with developing countries.

1. Introduction
Access to quality learning material in the era of ICT technology is growing rapidly, by utilizing this technology it is ideally not a problem, so that the presence of technology not only can solve problems but also anticipate of inequity in quality of education material and access to the intended material, this is exactly the dream of all people all around the world because, in fact, all of this is not an easy job. The biggest challenge in equalizing the quality of education is experienced by almost all countries in the world, especially countries with large regions and populations. Inequalities or gaps in differences and equal access to quality educational material occur in almost every country in the world. Distance learning can be done easily by utilizing ICT infrastructure. Almost every country in the world strives to provide wide-open access through the use of web-based applications to facilitate and provide support to the population on the needs of teaching materials according to their needs.

This article will discuss, analyse, and explore the comparison of accessibility of the Open Education Resource (OER) repository website in developed countries with developing countries. In this paper, we present the results of evaluating the accessibility of all OER repositories websites using the automatic TAW tool (www.tawdis.net) by referring to the guidelines of the WCAG 2.0 publication from W3C. It aims to
find errors (problems) inherent in the OER repository website in question and check their suitability with web accessibility guidelines. The main objective of this research is to evaluate the accessibility level of official OER repository websites in developed and developing countries around the world by comparing several OER repository websites in developed and developing countries, evaluations are based on the Web Content Accessibility Guidelines, WCAG 1.0, and WCAG 2.0.

OER repository is a set of services offered by organizations, government institutions, the private sector and universities to community members for the management and dissemination of digital materials made by institutions and members of their communities. This is basically an organizational commitment to managing this digital material, including long-term conservation if appropriate, as well as organization and access or distribution [1,2].

The term OER refers to various types of documents and open licensed media can be used for teaching, learning, education, assessment and research purposes [3,4]. The aim of the OER repository is to support educators in finding content in a structured way, sharing their own resources, reusing existing materials and creating new resources through adapting or translating, and in collaborating with other members of the user community by commenting, reviewing, promoting and developing resources. From a review of some of the literature that has been conducted it can be concluded that the efforts underlying OER (and the creation of ROER) can be said it is consist of four main themes, the activities referred to Search, Sharing, Reuse, and Collaboration [5]. OER repository is a set of services offered by the Government, NGO organizations, public or private universities and private companies that have concentrations in providing online and open digital material services.

Accessibility of a website page is a very important component and must be considered by the developer in developing a website page because the accessibility of a website can facilitate users in accessing data and the information displayed can be easily understood and according to the purpose of developing a website [6]. The scope of accessibility of using a website page is not only limited to normal humans but also humans with limitations must have the same capability. Accessibility of a good website make it easier for everyone to understand the information sought and presented on the website. Accessibility of websites can facilitate all people, both normal and disabled, so they can feel, understand, navigate, and interact on websites, and even make contributions to the website [7]. International web standards determine what is needed for the accessibility of a web page, a standard issued by the W3 consortium (World Wide Web Consortium) in the world has been referred to by web developers to date [8].

In order to explore more detailed information about the repositories' accessibility by users, it is necessary to explore and compare each aspect both in terms of content and website compatibility with global standards made by the World Wide Web Consortium (W3C). Every website developer in the world to improve the quality and level of accessibility is advised to use guidelines published by the W3 consortium (an independent international body that creates Internet standards and programming languages) that are available online, free of charge and open to everyone [7].

WCAG is an internationally accepted guideline consisting of guidelines and methods for measuring specifications on how to develop the accessibility of a website page, WCAG Guidelines can be viewed from the official W3C website (www.w3.org). WCAG plays an important role in building website accessibility standards. WCAG was developed by the W3C through WAI and the funding is supported by the U.S. Federal. from Health and Human Services, National Institute for People with Disabilities, Independent Life, and Rehabilitation Research (NIDILRR) [9].

While WAI itself is a working group supported by the W3C. Currently, the version of the Web Content Accessibility Guidelines (WCAG) has arrived in version 2.0, and 2.1 whose main goal is to determine how to make Web content more accessible to people with disabilities. Accessibility involves a variety of disabilities, including vision, hearing, physical, speech, cognitive, language, learning, and neurological disabilities [9-11]. There are many tools that can be used as a guide or guideline in developing website
accessibility, such as EvalAccess 2.0, Achecker, TAW, and Watchfire Bobby [1] and also Wave [12], however it is recommended to use WCAG because it is considered to have a more complete and widely used standard in the world.

Evaluation of accessibility of a website is also called assessment, audit, and testing [8]. Researchers in the world in conducting research on web accessibility is generally in the form of quantitative metrics using tools proposed by the Web Accessibility Initiative (WAI), in the context of Web Accessibility Content Guidelines [8]. Which is used to measure the suitability of web pages with the set of guidelines mentioned above. Web pages that are identical to all checkpoints receive an ‘AAA’ rating if they fulfil all 1 priority checkpoints and 2 are rated as AA; A rank is obtained if all priority 1 checkpoints are satisfied, and finally, the web page is ‘not appropriate’ otherwise. If a priority check 1 checkpoint is not according to the results, the page becomes inappropriate.

TAW is a set of tools for conducting accessibility analysis on websites, TAW was developed by a company based in Spain namely the Spanish Fundación CTIC. TAW is used to analyse the accessibility of a web page with a thorough global analysis of each item and page on a site that aims to check website accessibility and development for access to each individual regardless of the characteristics of the website [13].

2. Methods

2.1. Research procedure

In this study, analyse of 10 OERs repositories from developed countries and 5 (five) more from developing countries [5]. 10 OER web repositories were chosen to assess the accessibility of the website. The analytical method is used for analysing content and survey methods with a qualitative approach. The survey was conducted by monitoring and observing the results of website accessibility analysis using the TAW evaluation tool (www.tawdis.net). To get information about the accessibility of the website under study.

The OER repository web page address data is obtained from The OER World Map https://oerworldmap.org The OER World Map works by collecting and visualizing data about the increasing number of actors and activities in the field of open education throughout the world. The aim is to accelerate the evolution of the global OER ecosystem by providing a comprehensive and responsive picture of the OER movement. OER World Map provides information needed to support the process of self-regulation in the OER movement.

The stages of research carried out in this study include: First, literature studies are available with a variety of relevant international journals from reliable sources on the topic of website accessibility. The aim is to sharpen understanding of topics about website accessibility and emerging research trends. Second, collecting data by conducting OER repository website observations in developed countries and developing countries, then analysed using the TAW tool (www.tawdis.net) to identify problems, incompatibilities or violations of each OER repository website that is the object of research. The third step is to process data obtained from the TAW application using Microsoft office Excel. The next step is to draw conclusions and recommendations about the accessibility of the OER repository website and finally to write a report.

Detailed analysis was carried out in January-March 2019. Further analysis was carried out in April 2019 on the repository page listed in chart 1.

2.2. Data analysis technique

After the data are collected and validated, the data analysis is then carried out. Data generated from TAW is an error or violation on the website that is the object of research. All data that has been compiled are grouped according to the criteria of the guidelines outlined in WCAG 2.0. Data is processed based on errors for each success criterion based on the guidelines on WCAG 2.0, then divided by the number of errors in
the guideline success criteria multiplied by 100%. Summary of the report Guidelines for the 10 OER Web Repositories that are the object of research based on the WCAG 2.0 guidelines with AA Level of Analysis and Technology: HTML, CSS data seen on chart 1.

3. Results and discussion
The following chart explains the criteria for errors in the WCAG 2.0 guideline which are a problem in the OER Web Repository which is the object of research generated from TAW evaluation tools in developed and developing countries.

Figure 1. Summary report 10 OER repository.

3.1. The results of the OER TAW repository evaluation in developed countries
Table 1 shows that the Hokkaido Open Course Ware (HU-OCW) repository (ocw.hokudai.ac.jp) is located in Japan, the OER repository has 61 violations problems, 90 warnings and 18 not reviewed and the smallest number of errors in four OER repositories; Massachusetts Institute of Technology, Universidad de Alicante, TU Delft and ARKive.
Table 1. Violation of guidelines 5 OER repositories in developed countries.

| Error criteria | Hokkaido University Open Course Ware (HU-OCW) (ocw.hokudai.ac.jp) | Massachusetts Institute of Technology (ocw.mit.edu) | Universidad de Alicante (ocw.ua.es) | TU Delft (ocw.tudelft.nl) | ARKive (arkive.org) | Total |
|----------------|-------------------------------------------------------------------|--------------------------------------------------|----------------------------------|--------------------------|---------------------|-------|
| Problems       | 61                                                                | 55                                               | 24                               | 16                       | 31                   | 187   |
| Warnings       | 90                                                                | 141                                              | 76                               | 90                       | 29                   | 426   |
| Not reviewed   | 18                                                                | 14                                               | 17                               | 17                       | 17                   | 83    |
| Total          | 169                                                               | 210                                              | 117                              | 123                      | 77                   | 696   |

Figure 2. Violation of the OER repository guidelines in developed countries.

3.2. The results of the OER TAW repository evaluation in developing countries

Table 2 shows that USU Open Course Ware repository (ocw.usu.ac.id) is located in Indonesia, the OER repository has 6 violations problems, 42 warnings and 16 not reviewed and the smallest number of errors then the four others OER repositories; Pontificia Universidad Católica de Valparaíso (ocw.pucv.cl), the South African Institute for Distance Education (Saide) (oerafrica.org), Saudi OER Network (shms.sa) and Central Institute of Educational Technology (nroer.gov.in).

Table 2. Domestic violation 5 developing country repositories.

| Criteria   | (shms.sa) | (ocw.usu.ac.id) | (nroer.gov.in) | (ocw.pucv.cl) | (oerafrica.org) | Total |
|------------|-----------|----------------|----------------|---------------|-----------------|-------|
| Problems   | 39        | 6              | 43             | 7             | 24              | 119   |
| Warnings   | 111       | 42             | 66             | 161           | 114             | 494   |
| Not reviewed | 18        | 16             | 18             | 18            | 17              | 87    |
| Total      | 168       | 64             | 127            | 186           | 155             | 700   |
4. Conclusion

In general, from the results of testing and processing the evaluation of data using the TAG, the guide to the comparison of the OER repository of accessibility in developing countries and developing countries based on WCAG 2.0 was not too significant.

Accessibility of the OER web repository is important not only for web developers and content but also for users of various levels with each capacity, reliability, and purpose, especially for developers to consider when designing, developing and running repository services, with good accessibility and following the standard guidelines recommended by the W3C with the WCAG guide proved to be very helpful, so that the repository can facilitate all users when accessing data and information presented and needed. In addition to the above, the accessibility of the OER repository can also be affected to the appreciation, image and trust of all parties throughout the world, so that in the end the open education movement with the OER concept can be realized, so that in the end the distribution of quality education in the world can be realized.

Analysis of website accessibility can be done with the help of freely available software. One of them is TAW software, by integrating various applications such as Microsoft office excel or open office as a tool for data processing.

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