

Comparative Usability Study of the Websites of Top Universities in Three Continents: A Case Study of the University of Cape Town, Oxford University, and Harvard University

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Abstract—Academic websites play an important role in promoting education for all. They allow universities to provide users with digital academic services to save time and resources. A university website is not only a cost-effective and timely way to communicate with a variety of stakeholders, such as students, faculty, and visitors, but it is also a vehicle for the university to shape its image. The quality of a website is a major factor that universities consider in cyberspace. Potential students can easily apply to universities where the website provides useful and clear information. This has made the usability of websites an important area in meeting the needs and expectations of website users. In this paper, a comparative usability study of the University of Cape Town, Oxford University, and Harvard University academic websites (<http://www.uct.ac.za/>, <https://www.ox.ac.uk/>, and <https://www.harvard.edu/>) was carried out. The proactive user feedback technique was adopted for the comparative usability assessment of the aforementioned universities. The method was used by the researchers to collect and log records from the participants in real time. The result shows that the average dwell time on the websites of Harvard University, Oxford University, and Cape Town University in seconds for the three tasks are 51.58, 33.28, and 54.82 respectively. The System Usability Scale (SUS) scores for Harvard, Oxford, and the University of Cape Town are 49.81, 69.43, and 54.14 respectively. The result of the Analysis of Variance on the dwell time data shows a significant difference ($p = .009$) on the three websites. Our findings show that Oxford University has the most suitable website in terms of usability factors and other metrics than the other websites investigated. Practical implications are highlighted, and recommendations for improved website usability are suggested.

Keywords—Usability factors, user feedback, university websites, University of Cape Town, Harvard University, Oxford University.

I. INTRODUCTION

THE Internet has expanded significantly over the past 20 years and turned into a medium for worldwide communication. Website is part of the Internet that provides the ability for individuals and organizations to share information with their users and it has become inevitable for businesses that want to stay competitive in the post-Covid era [1]. Having a website has become vital for universities [2] as it is an interface to provide information to students, faculty, prospective students, alumni, parents, and the public. Information about

admission criteria for prospective students, courses offered, news updates, fees etc. is displayed on the websites [3]. Users visit the university website for various purposes and they differ in terms of their frequency of use and competence with the use of technology. Their expectations vary [4]; therefore, the university website should be designed to cater for these variations. For universities to provide needed information and carry out their transactions, there is the need for a functional and usable website.

A website is a domain (area) on the web and is a group of associated internet pages, photographs, videos, and other digital belongings [5]. In the university, a website is a timely and cost-effective approach to reach out to a variety of stakeholders, such as students, professors, and visitors, but it also serves as a tool for establishing the university's reputation. Websites also create an interface for universities to link up for research collaborations with other national and international universities and industries [5], [6]. In designing the websites, there are three critical criteria to be considered which include content visibility, ease of content access, and ease of content browsing. These criteria are essential for catching the attention of users [7].

The academic website is more than a showcase of the offerings, capabilities, and features of a university. These websites are also enhanced by a variety of business procedures and features. For instance, it is used for numerous administrative duties, including online admission, access to the learning management system, registration, and the dormitory administration system. Consequently, academic websites have become web systems of enormous scale and complexity, managed by various users. The success of any school website and its users depends on how convenient, effective, and efficient it is, as they have become a crucial component of any institution's ability to execute numerous academic operations. Indeed, academic websites are becoming increasingly important as institutions in developing nations upgraded their services to cover online courses in this post-COVID period.

Ironically, users are the group that contributes the least to the creation of websites [8]. One important aspect of a university's

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online presence is the website's quality. Students can easily submit applications to universities where the website offers helpful and understandable information. To satisfy the demands and expectations of website visitors, usability has become crucial. Numerous definitions of usability abound, depending on the model considered. The International Organization for Standardization (ISO) 9241 includes requirements and guidelines that should be followed while creating and assessing applications, as well as usability guidelines. ISO 9241 defines usability as the degree to which a product may be utilized by a specific user to achieve a specific goal with efficiency, effectiveness, and satisfaction in a specific context of usage [9]-[11]. According to the definition given above, efficiency is the thoroughness and precision with which a user completes a given task [12], [13].

The usability of university websites has already been studied using common usability measures [14]. The goal of this research is to conduct a comparative usability study of the academic websites of the University of Cape Town, Oxford University, and Harvard University to examine their effectiveness, attractiveness, and learnability. Our hypothesis is that university websites differ in terms of the usability of the design. For this reason, the following research questions are considered:

1. Is the satisfaction of end-users met while using these websites?
2. Which of the university websites under study is better in terms of usability?
3. Does any of the university websites have usability issues?
4. In what way can these universities' websites be improved?

This research is organized as follows: Section II reviews the literature on websites. Section III explains the methodology of the research and presents the experimental procedure and the user study. Results are presented in Section IV. Section V discusses the findings and Section VI concludes with a summary and a direction for future work.

II. LITERATURE REVIEW

Usability has numerous definitions based on the field of study. The standard definition of usability according to the ISO [10] is "effectiveness, efficiency, and satisfaction with which a specified set of users can achieve, in a specified set of tasks in a particular environment". The concept of usability is divided into five main factors [15] – Learnability, which deals with the ease of completing a task; the number of tasks that the user can accomplish by using the system, known as Efficiency; Memorability of the system; ability to recover from system errors and Satisfaction of the user. Usability is an important feature for a website to have [16]. If a website is found not usable or not meeting users' needs and standards, they leave for other websites. Thus, evaluating the usability of websites is essential and helpful for identifying usability problems with the interface design or its usage.

A. Educational Website

The use of the internet has increased greatly, leading to the development of efficient language communication mechanisms

that speed up the transmission of educational data and the virtual processing of educational transactions. Universities now depend on educational websites because they are a quick and trustworthy way to give consumers access to academic information and opportunities [17]. Academic websites are crucial for fostering universal education. As a result, these websites enable traditional universities and other higher education institutions provide digital academic services to their consumers, saving them time and resources [17]. Websites for academic institutions are platforms that offer student opportunities, academic centers, and industry partnerships. An academic website can only make an institution effective and viable if its layout supports the usability aspect [7]. If the website has the essential functions and desired usability traits, users will be happy [5], [7]. Website usability is generally understood to be a quality attribute that specifies how simple it is for a user to navigate through a website [9].

In their empirical review of an academic website, Ahmet and Turan [18] noted that usability is essential for enabling interaction between the institution and its users, this ultimately drives Higher Educational Institutes (HEIs) towards a better administration. Following a heuristic analysis of three university websites, Lyla [19] argued that the academic websites showed a variety of usability issues related to inconsistency, language, navigation, content, incomplete information, and unsuitable design, which hindered the efficient and effective use of these websites. Research shows that all HEI websites do not consistently present academic operations and information [20]. For instance, whereas other websites only permit students to print forms and submit them in person or by mail, some websites present all necessary information online and allow students to do all tasks electronically [6]. The usability issues become compounded when websites are aimed at providing all academic operations digitally or online.

Generally, usability problems greatly impede the success of software systems. Studies show that most of the total maintenance costs are linked to the user's problems with the software, rather than to technical defects [20]. Furthermore, among these problems, 64% are usability problems [20]. Usability issues prevent users from accomplishing their tasks/goals with software systems effectively and satisfactorily. Websites are more prone to usability problems because websites are generally information-oriented and involve relatively more user interactivity. Therefore, this accounts for the necessity and importance of website usability. Poor usability has been shown to adversely affect a website's trustworthiness in general, which results in people losing trust in that website [21]. Therefore, evaluating the usability of academic websites is essential, and many studies have worked in this direction.

B. Related Work

Arshad and Fyiaz [22] examined the effectiveness of the top 50 institutions in the US by evaluating their websites. They assessed preset website characteristics that were scored using a five-factor Likert scale. The standard evaluation metrics were not used for the study, thereby limiting the findings; a similar

non-standardized approach for the evaluation of websites, was carried out by Marzie and Elhindi [23]. Rahman and Ahmed [24] used a survey to evaluate the University of Dhaka's website. A seven-factor Likert scale questionnaire was employed, and it included the Joint Information System Committee (JISC) checklist for educational websites, a Questionnaire for User Interaction Satisfaction (QUIS), and a Website Analysis and Measurement Inventory (WAMMI). A total of 864 university students representing various faculties took part in the study. The findings of the study suggest that students were unhappy with the university websites because of a dearth of updates and content.

An improved method of evaluation of a website is the use of Heuristics. Koulocheri et al. [25] applied heuristics to assess the website of the Hellenic Open University. They described the process and findings of the heuristic assessment of the LMS learning environment, whose structure is built on a series of learning activities. The study found 54 usability flaws with the navigation, engagement with the content, aesthetics and minimalist design, consistency and standards compatibility, communication through dialogue boxes, and icon design. Yani et al. [26] analyzed usability aspects based on ten heuristic evaluation factors using the ANP technique. The approach enhanced system status visibility and system fit. 24 academic websites were heuristically evaluated by Chamba-Eras et al. [27] using a tool named Prometheus which has 10 heuristics. Their findings suggest that expert feedback can be applied to enhance the usability of websites. In addition, they encouraged the website owners to redesign and update their sites to satisfy usability standards.

Using 600 participants, including end users (students) and experts (software design specialists), Sarga and Saha [28] conducted a study by evaluating the usability of 50 educational websites via the SUS. The study made use of one of the SUS programs available for academic websites, in which users are surveyed to determine usability based on their interactions with individual websites rather than being asked to perform certain tasks before assessing a particular website. The results show that experts only gave lower SUS values for 10 websites, compared to end-users who gave lower SUS scores for 38 websites, indicating that end-users encounter more design and usability challenges than experts. The drawback of the use of heuristics is that it cannot be successfully applied by novice evaluators since they need some background knowledge in web design and evaluation. Also, the evaluated websites using heuristics were discovered to be poor in terms of usability as designers placed a lot more effort into the technology, organizational shape, and enterprise goals of the website rather than usability components [29].

Studies have been conducted using standard evaluation metrics to evaluate the usability of websites [30]. The results from the 364 respondents in a study conducted by Jabar et al. [31] to assess the University of Putra Malaysia (UPM) website found that the website was good in terms of manageability, usability, and efficiency, but poor in terms of elegance and learnability. The study used a questionnaire along with the five usability factors namely attractiveness, manageability,

usefulness, efficiency, and ease of learning. The usefulness and accessibility of 10 randomly selected public university websites in Nigeria were assessed in a comparative study using the traditional usability approach and the automated tool, SortSite by Fortune et al. [32]. Their findings demonstrated that the assessed websites did not adhere to the Usability Guild Lines and Web Content Accessibility Guidelines (WCAG), making it challenging to access and navigate the websites.

Using the Website Analysis and Measurement Toolkit (WAMMI) and 20 questions, Caglar and Mentis [33] examined the Website of European Lefke University to determine its usefulness; 293 students responded, and the findings indicate that users were not satisfied with the website's usability. Through an accessibility assessment, Adepoju and Shehu [34] conducted a study to ascertain the website usability of Nigerian Federal Universities. To ensure that websites adhere to WCAG standards, they used computer technologies like HERA, WAVE, and website accessibility tools. They discovered numerous accessibility issues and poor usability on the website. Data were gathered from 252 users of 9 different Jordanian universities as part of an automated usability assessment of university websites in Jordan by Mustafa and Al-Zoua'bi [35]. The study's findings show that the websites had a "normal" rating, but there were numerous usability and interface design faults that needed to be fixed. A common usability survey - WAMMI and Morea Software were used in an empirical study of the Benue State University website from the viewpoint of the students by Undu and Akuma [14]. Their findings revealed usability difficulties with the website, and suggestions were made to enhance the user experience.

An empirical study of the top 50 US-based universities' websites was also carried out by Marzie and Elhindi [23] to assess their effectiveness. The websites were evaluated based on a series of predefined website features that were rated on a five-point Likert scale. Many other researchers adopted the heuristic web evaluation method to evaluate some academic websites [20]. Another study used SortSite, an automated tool to assess the usability and accessibility conformance of ten websites of public sector universities in Nigeria which were selected at random. The findings indicated that the examined websites did not adhere to usability and web content accessibility guidelines (WCAG) implementation, making it difficult for users to access and browse the academic website. They offered suggestions on how to redesign such websites in order to increase their usability [32]. Four important factors - utility, content, interface quality, and user satisfaction were examined by Benaïda and Namoun [36] to see how they affected the perception of usability of four academic websites in Algeria. They surveyed 200 students from four universities in Algeria using the IBM Computer System Usability Questionnaire (CSUQ). The findings show that the four study-covered criteria require major usability improvements [36]. Another study looked at how well two algorithms viz Simple Additive Weighting (SAW) and Linear Weightage Model (LWM) performed when rating university websites based on five usability factors: backlinks, stickiness, traffic, page rank, and load time [37].

A SUS comprised of 10 questions was recently used in a study to assess the usability of 50 academic websites objectively. 600 participants including end-users (students and experts) with knowledge of software design were used to gather the data. Two usability experts browsed and looked at every website page, including those pertaining to colleges and departments, as part of the study. Assessors gathered and analyzed feedback as well as the website's usability problems. On the website of the University of Basrah, they discovered a total of 3,143 usability problems. The discovered usability issues were categorized into 25 distinct kinds along with their locations. The findings demonstrate that heuristic evaluation successfully identifies numerous usability problems and provides appropriate information about particular types of usability concerns [38].

Our study considers the usability of the websites of the best universities in North America, Europe, and Africa. Harvard University was selected for the North American study, the University of Oxford for the European study, and the University

of Cape Town for the African study. We opted for a hybrid approach to cover the gap in the previous studies. Screen recording and SUS were used for capturing data.

III. METHODOLOGY

The methodology adopted for usability benchmarking in this research was User Testing (user feedback) on the aforementioned universities' websites. User feedback is any information received about a user's or customer's experience with a product or service. This can be proactive by asking the user, or it can be reactive, where the user sends feedback without asking. Thus, this study adopted a proactive user feedback approach that allows the collection of factual data from participants. The architectural flow of the methodology adopted is shown in Fig. 1. This research work was approved by the Benue State University's ethics board and the ethical guidelines were strictly followed.

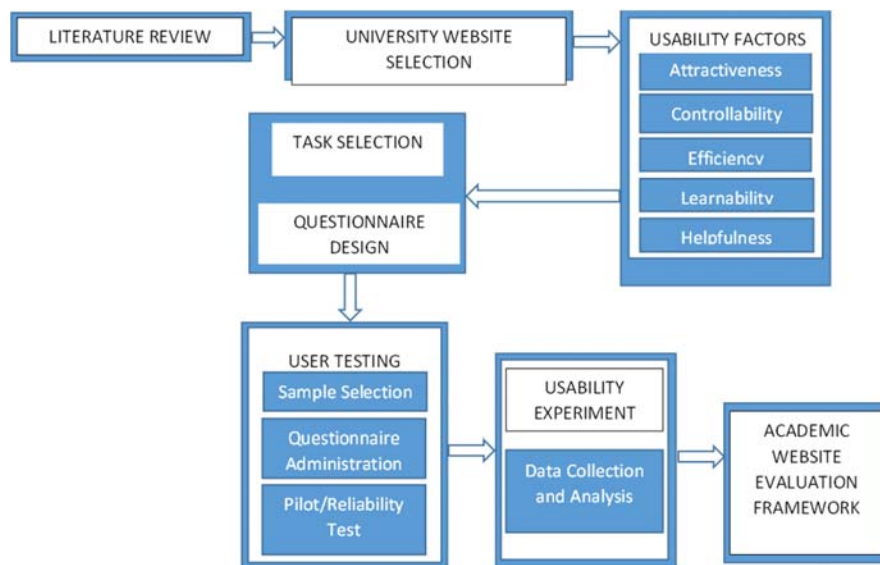


Fig. 1 Architectural flow of the methodology

The SUS for grading the usability of websites was also used for the evaluation. It is the most widely used questionnaire to assess usability [39]. There are 10 questions on the SUS, each with five possible answers. The grading system is presented in Table I. The table depicts the entire curved grading scale, displaying the variety of SUS scores for each grade and the corresponding percentile variety. The quickest way to calculate a SUS score for a website is as follows:

Step1. For each of the 10 questions, convert the scale into a number:

- Strongly Agree: 5 points
- Agree: 4 points
- Neutral: 3 points
- Disagree: 2 points
- Strongly Disagree: 1 point

Step2. Add all the odd-numbered questions' scores, then subtract 5 from the sum

- $X =$ The total points for all odd-numbered questions – 5
 - Step3. Add all the even-numbered questions' scores, then subtract the sum from 25
 - $Y = 25 -$ Sum of the points for all even-numbered questions
 - Step4. Aggregate the results in Step 2 and Step 3, then multiply it by 2.5
 - $SUS\ Score = (X + Y) \times 2.5$
- Each of the questions is worth 10 points, for a total of 100.

A. University Website Selections

Three universities were chosen for the research: Oxford University (United Kingdom), Cape Town University (South Africa), and Harvard University (USA). The reason why the universities were selected for the study is that all the universities are on top of the world universities' rankings table both nationally and internationally in terms of quality of education. The universities also have many features similar to

other university websites such as information relating to all the courses offered by the universities like entry requirements, description of the course and services, online course registration, download documents, upload documents, and online payments that can be useful to students and other visitors to the sites.

TABLE I
CURVED GRADING SCALE FOR THE SUS

| Grade | SUS | Percentile |
|-------|-------------|------------|
| A+ | 84.1 – 100 | 96-100 |
| A | 80.8 - 84.0 | 90-95 |
| A- | 78.9 - 80.7 | 85-89 |
| B+ | 77.2 – 78 | 80-84 |
| B | 74.1 - 77. | 70-79 |
| B- | 72.6 - 74.0 | 65-69 |
| C+ | 71.1 – 72 | 60-64 |
| C | 65.0 – 71 | 41-59 |
| C- | 62.7 - 64.9 | 35-40 |
| D | 51.7 - 62.6 | 15-34 |
| F | 0 - 51.6 | 0-14 |

The selected universities are shown in Table II with their rankings. According to the Center for World University Rankings [40]: Harvard University is ranked first nationally and internationally and came third internationally in terms of quality of education with an overall ranking of 100%, Oxford University, is ranked fifth internationally and first nationally and came seventh in terms of quality of education with an overall ranking score of 93.3%. Finally, on an international level, Cape Town University is ranked 267th, on a national level it is ranked first. In terms of quality of education, it is ranked 170th globally which is first from the African continent, and has an overall ranking score of 77.4%.

TABLE II
NATIONAL AND INTERNATIONAL RANKING OF THE SELECTED WEBSITES [40]

| World Rank | University | Location | Nationally | Quality of Education | Score |
|------------|------------|--------------|------------|----------------------|-------|
| 1 | Harvard | USA | 1 | 3 | 100 |
| 5 | Oxford | UK | 2 | 7 | 93.3 |
| 267 | Cape Town | South Africa | 1 | 170 | 77.4 |

B. Task Selection

The tasks were:

1. Locate information about the university's history
2. Locate the page with the computer science course information
3. Visit the admission page

C. Questionnaire Design

We used a closed-ended questionnaire, which gives participants the option of selecting one of several possible responses to each topic. The user feedback method of website assessment is used in the questionnaire, which places a strong emphasis on usability from the user's standpoint. As a result, the participants were given closed-ended questionnaires to complete to get their opinions on the website's layout, content, and ease of use.

D. Pre-Test Questionnaire

The pre-test questionnaire given to the participants required answers for demographic information that included their name, sex, age, and their computer proficiency.

E. Post-Test Questionnaire

The Website Evaluation and Measurement Inventory (WAMMI) questionnaire, used in the research by Undu and Akuma [14], was given to the participants for their post-test. The post-test questionnaire comprised 20 questions, which were divided into five usability factors: attractiveness, controllability, efficiency, learnability, and helpfulness. The participants were asked five questions to gauge their level of happiness with the websites, and the remaining 15 questions sought the users' opinions of the websites under investigation. We used a five-component Likert scale, with the first factor being "strongly agree" and the last being "strongly disagree" in the following order: strongly agree (SA), agree (A), Undecided (N), disagree (D) and strongly disagree (SD).

F. Experimental Procedure

A total number of 26 participants comprising Year 4 students of Computer Science, Benue State University who are fluent in English as well as proficient in the usage of the computer and other mobile devices were recruited for this study. The selected students, who were, on average, 25 years old were issued questionnaires as well as provided with a laptop to carry out the tasks in a controlled setting. The respondents were given a task to navigate through the universities' websites based on the instructions on the given tasks. After this, the participants answered the post-test questionnaire.

In the course of this study, the data collection for all sessions followed the identical method. The participants' interactions with the websites were recorded using the screen-capturing software Morae Recorder. The Morae recorder's autopilot mode was activated, allowing it to automatically record the tasks and the 20 surveys without an observer, however, one of the researchers sat and watched the participants as they performed the task. To conduct the usability test, only one laptop with the following specifications: Intel®, Pentium®, CPUB 960 @ 2.20, GHz 4.00 GB (3.5 GB useable), 64-bit Operating System; and a 4G internet connection was employed. Before the session began, we gave a full explanation of the study's objectives, the number of tasks, and the number of questions that needed to be answered after each activity. In addition, we also gave the participants a detailed explanation of their right to exit the session if they were uncomfortable with the entire process which was included in the consent form. The "start task" and "stop task" buttons were then instructed to be clicked by the students to begin and end the task, respectively, in the Morae Log Tasks Window. The tasks were:

1. Locate information about the university's history
2. Locate the page with the computer science course information
3. Visit the admission page

After the tasks, the Morae recorder automatically logged the students' interactions with the system. Each participant was

required to visit the websites under investigation. The participants were therefore obliged to use the system three times each day for each university. The following parameters were captured:

1. Dwell Time: the length of time it takes the participant to complete a particular task.
2. Task success: whether or not the participant was successful and to what degree the task was easy to complete, difficult to complete, or failed to complete.

G. Research Metrics

The products under test are the University of Cape Town, Oxford University, and Harvard University websites. In this study, the usability factors are the standard metrics for measuring the usability of the aforementioned university websites. This includes attractiveness, efficiency, controllability, learnability, and helpfulness as shown in Fig. 2.

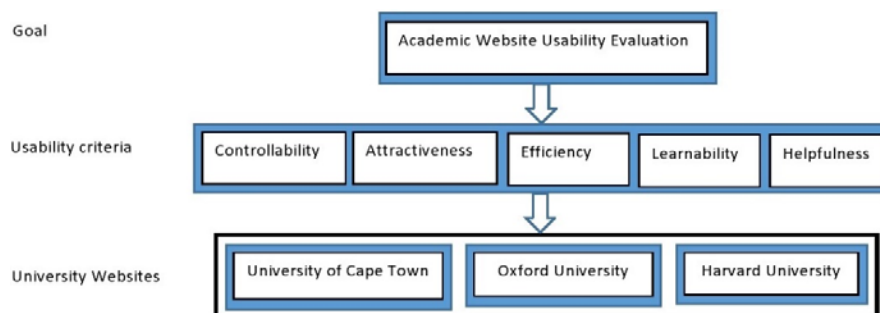


Fig. 2 Research Model [14]

H. Data Collection Process

To evaluate usability problems associated with the three universities, two methods are used, user testing (lab experiment) and thinking aloud. During the experiment, the participants were allowed to speak out and then the researcher recorded what was verbalized and took notes during the experiment. Besides that, the participants answered the WAMMI post questionnaire after they spent twenty minutes exploring the website to familiarize themselves with it. The WAMMI questionnaire was selected because it is more accurate, reliable, and valid, based on previous studies [14]. Moreover, it is also one of the most appropriate methods that can be used to evaluate website usability between different websites. The advantage of WAMMI is that it can be summarized into a short list of questions and it is free to use. The WAMMI questionnaire contains twenty questions administered automatically by Morae recorder at the end of the experiment after the participant is familiar with the website. The participants were instructed to read each question carefully and fill out the questionnaire by using the scale (five-point Likert-type scale) from “1” strongly disagree to “5” strongly agree.

IV. RESULTS

In the previous section, we described the usability test methodology for this research. In this section, we carried out the usability test and also compared the dwell time and the SUS score of the aforementioned universities (University of Cape Town, Harvard University, and Oxford University). The dwell time (seconds) of the participants in each of the universities are shown in Tables III-V, as well as their corresponding graphs shown in Figs. 3-5, describing the time spent by each participant to complete a single task. The average dwell time and a corresponding graph for all the participants are shown in

Table VI and Fig. 6. In the usability test for Harvard University, one of the participant’s (Participant 27) records was not captured due to a system error (see Table VI and Fig. 6). This participant’s data were excluded from the entire analysis of the websites.

TABLE III
DWELL TIME MEASURED IN SECONDS FOR HARVARD UNIVERSITY WEBSITE

| Participants | Task 1 | Task 2 | Task 3 | Participants | Task 1 | Task 2 | Task 3 |
|----------------|--------|--------|--------|----------------|--------|--------|--------|
| Participant 1 | 106.6 | 86.6 | 96.6 | Participant 15 | 128.4 | 108.4 | 118.4 |
| Participant 2 | 89.4 | 69.4 | 79.4 | Participant 16 | 22.8 | 2.8 | 12.8 |
| Participant 3 | 205 | 185 | 195 | Participant 17 | 53 | 33 | 43 |
| Participant 4 | 64 | 44 | 54 | Participant 18 | 68.8 | 48.8 | 58.8 |
| Participant 5 | 59 | 39 | 49 | Participant 19 | 42.6 | 22.6 | 32.6 |
| Participant 6 | 42.6 | 22.6 | 32.6 | Participant 20 | 43.2 | 23.2 | 33.2 |
| Participant 7 | 36.8 | 16.8 | 26.8 | Participant 21 | 58.4 | 38.4 | 48.4 |
| Participant 8 | 32 | 12 | 22 | Participant 22 | 34.6 | 14.6 | 24.6 |
| Participant 9 | 79.8 | 59.8 | 69.8 | Participant 23 | 47.6 | 27.6 | 37.6 |
| Participant 10 | 26.6 | 6.6 | 16.6 | Participant 24 | 57.8 | 37.8 | 47.8 |
| Participant 11 | 34.4 | 14.4 | 24.4 | Participant 25 | 48 | 28 | 38 |
| Participant 12 | 32 | 12 | 22 | Participant 26 | 74.4 | 54.4 | 64.4 |
| Participant 13 | 76.4 | 56.4 | 66.4 | Participant 27 | - | - | - |
| Participant 14 | 36.8 | 16.8 | 26.8 | | | | |
| Average | 61.58 | 41.58 | 51.58 | | | | |

The result shown in Table VI is the average dwell time for the three tasks of the three websites with the University of Cape Town having the highest mean dwell time of 54.82, followed by Harvard University with 51.58 then Oxford University with 33.28. The corresponding graph of the average dwell time for the tested universities' websites is presented in Fig. 6

A. One-way ANOVA

The dwell time for the three tasks was aggregated according to each university, producing 234 entries. A one-way Analysis of Variance was conducted using IBM SPSS on the dataset to

investigate if there is a significant difference in the dwell time on the three websites. It was found that there was a significant difference between the three websites in terms of the dwell time, at $p \leq 0.05$ level. The results show: $[F(21032.526, 499370.647) = 4.865], p = .009]$.

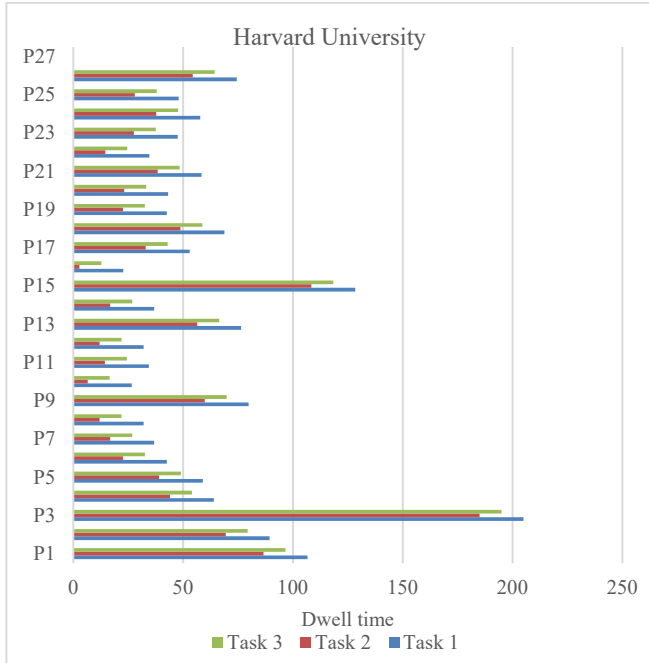


Fig. 3 Dwell time graph for Harvard University website

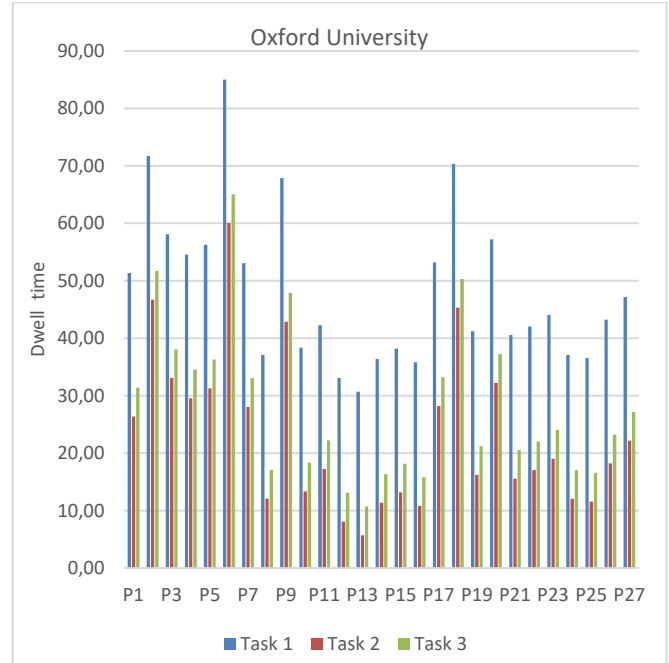


Fig. 4 Dwell time graph for Oxford University website

TABLE IV
DWELL TIME MEASURED IN SECONDS FOR OXFORD UNIVERSITY WEBSITE

| Participants | Task 1 | Task 2 | Task 3 | Participants | Task 1 | Task 2 | Task 3 |
|----------------|--------|--------|--------|----------------|--------|--------|--------|
| Participant 1 | 51.38 | 26.38 | 31.38 | Participant 15 | 38.17 | 13.17 | 18.17 |
| Participant 2 | 71.7 | 46.7 | 51.7 | Participant 16 | 35.84 | 10.84 | 15.84 |
| Participant 3 | 58.09 | 33.09 | 38.09 | Participant 17 | 53.2 | 28.2 | 33.2 |
| Participant 4 | 54.54 | 29.54 | 34.54 | Participant 18 | 70.33 | 45.33 | 50.33 |
| Participant 5 | 56.28 | 31.28 | 36.28 | Participant 19 | 41.23 | 16.23 | 21.23 |
| Participant 6 | 85.02 | 60.02 | 65.02 | Participant 20 | 57.22 | 32.22 | 37.22 |
| Participant 7 | 53.06 | 28.06 | 33.06 | Participant 21 | 40.55 | 15.55 | 20.55 |
| Participant 8 | 37.09 | 12.09 | 17.09 | Participant 22 | 42.05 | 17.05 | 22.05 |
| Participant 9 | 67.87 | 42.87 | 47.87 | Participant 23 | 44.03 | 19.03 | 24.03 |
| Participant 10 | 38.34 | 13.34 | 18.34 | Participant 24 | 37.06 | 12.06 | 17.06 |
| Participant 11 | 42.24 | 17.24 | 22.24 | Participant 25 | 36.56 | 11.56 | 16.56 |
| Participant 12 | 33.09 | 8.09 | 13.09 | Participant 26 | 43.22 | 18.22 | 23.22 |
| Participant 13 | 30.71 | 5.71 | 10.71 | Participant 27 | 47.19 | 22.19 | 27.19 |
| Participant 14 | 36.36 | 11.36 | 16.36 | | | | |
| Average | 48.24 | 23.24 | 28.24 | | | | |

TABLE V
DWELL TIME MEASURED IN SECONDS FOR UNIVERSITY OF CAPE TOWN WEBSITE

| Participants | Task 1 | Task 2 | Task 3 | Participants | Task 1 | Task 2 | Task 3 |
|----------------|--------|--------|--------|----------------|--------|--------|--------|
| Participant 1 | 160.39 | 120.39 | 125.39 | Participant 15 | 67.69 | 27.69 | 32.69 |
| Participant 2 | 80.53 | 40.53 | 45.53 | Participant 16 | 76.88 | 36.88 | 41.88 |
| Participant 3 | 67.03 | 27.03 | 32.03 | Participant 17 | 68.71 | 28.71 | 33.71 |
| Participant 4 | 39.85 | 0.15 | 4.85 | Participant 18 | 70.03 | 30.03 | 35.03 |
| Participant 5 | 43.62 | 3.62 | 8.62 | Participant 19 | 80.86 | 40.86 | 45.86 |
| Participant 6 | 45.62 | 5.62 | 10.62 | Participant 20 | 52.72 | 12.72 | 17.72 |
| Participant 7 | 42.39 | 2.39 | 7.39 | Participant 21 | 77.9 | 37.9 | 42.9 |
| Participant 8 | 46.22 | 6.22 | 11.22 | Participant 22 | 82.17 | 42.17 | 47.17 |
| Participant 9 | 35.89 | 4.11 | 0.89 | Participant 23 | 57.55 | 17.55 | 22.55 |
| Participant 10 | 52.56 | 12.56 | 17.56 | Participant 24 | 73.42 | 33.42 | 38.42 |
| Participant 11 | 56.55 | 16.55 | 21.55 | Participant 25 | 83.55 | 43.55 | 48.55 |
| Participant 12 | 84.76 | 44.76 | 49.76 | Participant 26 | 65.53 | 25.53 | 30.53 |
| Participant 13 | 385.24 | 345.24 | 350.24 | Participant 27 | 82.02 | 42.02 | 47.02 |
| Participant 14 | 74.57 | 34.57 | 39.57 | | | | |
| Average | 79.79 | 40.1 | 44.79 | | | | |

Following the result of the One-way ANOVA, a Post hoc comparison using the Turkey HSD test was conducted, the results show that there is a significant difference in terms of the mean dwell time between Oxford University and Harvard University ($p = 0.039$), no significant difference between Harvard University and University of Cape Town ($p = 0.901$), and a significant difference between Oxford University and University Cape Town ($p = 0.012$).

B. SUS for the Universities

The SUS results obtained from the usability test experiment carried out on the universities are shown in Table VII and Fig. 7.

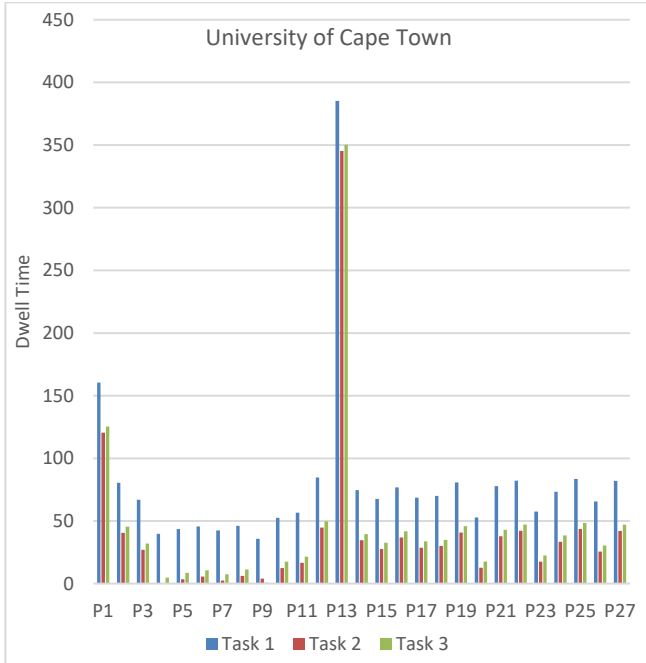


Fig. 5 Dwell time graph of the University of Cape Town website

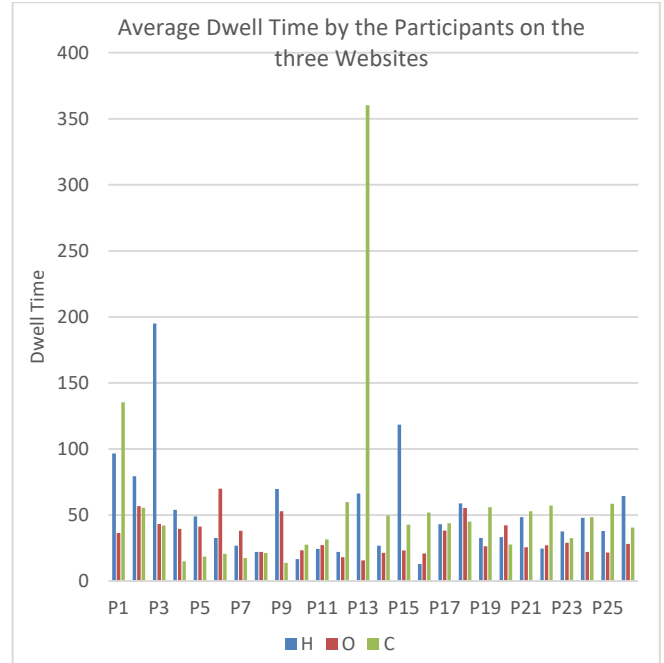


Fig. 6 Average Dwell time measured in seconds for the three tasks for all the aforementioned universities

TABLE VI
 AVERAGE DWELL TIME MEASURED IN SECONDS FOR THE THREE TASKS FOR ALL UNIVERSITIES

| Participants | Harvard University (H) | Oxford University (O) | University of Cape Town (C) |
|----------------|------------------------|-----------------------|-----------------------------|
| Participant 1 | 96.6 | 36.38 | 135.39 |
| Participant 2 | 79.4 | 56.7 | 55.53 |
| Participant 3 | 195 | 43.09 | 42.03 |
| Participant 4 | 54 | 39.54 | 14.95 |
| Participant 5 | 49 | 41.28 | 18.62 |
| Participant 6 | 32.6 | 70.02 | 20.62 |
| Participant 7 | 26.8 | 38.06 | 17.39 |
| Participant 8 | 22 | 22.09 | 21.22 |
| Participant 9 | 69.8 | 52.87 | 13.63 |
| Participant 10 | 16.6 | 23.34 | 27.56 |
| Participant 11 | 24.4 | 27.24 | 31.55 |
| Participant 12 | 22 | 18.09 | 59.76 |
| Participant 13 | 66.4 | 15.71 | 360.24 |
| Participant 14 | 26.8 | 21.36 | 49.57 |
| Participant 15 | 118.4 | 23.17 | 42.69 |
| Participant 16 | 12.8 | 20.84 | 51.88 |
| Participant 17 | 43 | 38.2 | 43.71 |
| Participant 18 | 58.8 | 55.33 | 45.03 |
| Participant 19 | 32.6 | 26.23 | 55.86 |
| Participant 20 | 33.2 | 42.22 | 27.72 |
| Participant 21 | 48.4 | 25.55 | 52.9 |
| Participant 22 | 24.6 | 27.05 | 57.17 |
| Participant 23 | 37.6 | 29.03 | 32.55 |
| Participant 24 | 47.8 | 22.06 | 48.42 |
| Participant 25 | 38 | 21.56 | 58.55 |
| Participant 26 | 64.4 | 28.22 | 40.53 |
| Participant 27 | 0 | 32.19 | 57.02 |
| Minimum | 12.8 | 15.71 | 13.63 |
| Maximum | 195 | 70.02 | 360.24 |
| Mean | 51.58 | 33.28 | 54.82 |
| Standard Dev. | 38.64 | 13.8 | 66.77 |

TABLE VII
 SUS RESULTS FOR ALL UNIVERSITIES

| Participants | University of Cape Town | Harvard University | Oxford University |
|----------------|-------------------------|--------------------|-------------------|
| Participant 1 | 72.5 | 45 | 75 |
| Participant 2 | 37.5 | 85 | 67.5 |
| Participant 3 | 77.5 | 30 | 90 |
| Participant 4 | 75 | 30 | 72.5 |
| Participant 5 | 75 | 40 | 70 |
| Participant 6 | 72.5 | 30 | 37.5 |
| Participant 7 | 60 | 92.5 | 50 |
| Participant 8 | 30 | 30 | 85 |
| Participant 9 | 40 | 75 | 72.5 |
| Participant 10 | 82.5 | 100 | 97.5 |
| Participant 11 | 85 | 70 | 95 |
| Participant 12 | 90 | 65 | 100 |
| Participant 13 | 40 | 55 | 97.5 |
| Participant 14 | 57.5 | 52.5 | 77.5 |
| Participant 15 | 60 | 50 | 82.5 |
| Participant 16 | 40 | 52.5 | 85 |
| Participant 17 | 50 | 55 | 60 |
| Participant 18 | 57.5 | 17.5 | 60 |
| Participant 19 | 17.5 | 32.5 | 65 |
| Participant 20 | 27.5 | 17.5 | 60 |
| Participant 21 | 30 | 37.5 | 42.5 |
| Participant 22 | 25 | 35 | 50 |
| Participant 23 | 25 | 22.5 | 55 |
| Participant 24 | 22.5 | 72.5 | 45 |
| Participant 25 | 80 | 57.5 | 35 |
| Participant 26 | 77.5 | 45 | 77.5 |
| Participant 27 | 52.5 | 0 | 67.5 |
| Minimum | 17.5 | 17.5 | 35 |
| Maximum | 90 | 100 | 100 |
| Mean | 54.14 | 49.81 | 69.43 |
| Standard Dev. | 23.03 | 22.55 | 19.19 |

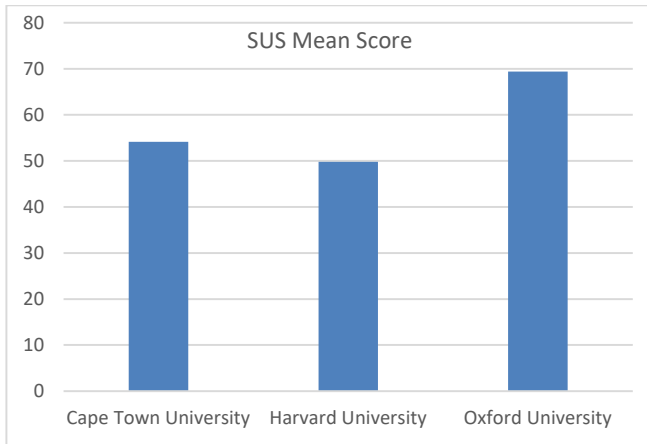


Fig. 7 SUS mean scores for the three Universities

Fig. 7 shows the SUS mean scores as 49.81 for Harvard University, 69.43 for Oxford University, and 54.14 for the University of Cape Town. The result shows that the Oxford University website performed better followed by the University of Cape Town and then Harvard University with a mean score of 69.43, 54.14, and 49.81 respectively. Thus, this result has shown that the participants of this study conveniently completed all three tasks on the Oxford University website followed by the University of Cape Town and Harvard University.

C. Merit Points and Usability Points of the Usability Factors

The merit points for each of the aforementioned universities are shown in Tables VIII-X with the corresponding graphs depicted in Figs. 8-10. The automated recorded merit points indicate the students' satisfaction on each website based on the usability factors. The average of each value is also determined as shown in the tables as well as their corresponding graphs.

TABLE VIII
 MERIT POINT OF HARVARD UNIVERSITY WEBSITE

| Usability factor | Merit Point of X | Usability Points of X |
|------------------|------------------|-----------------------|
| Attractiveness | 12.11 | 3.09 |
| Controllability | 11.36 | 2.45 |
| Efficiency | 7.45 | 1.89 |
| Learnability | 12.11 | 2.58 |
| Helpfulness | 14.01 | 2.82 |

TABLE IX
 MERIT POINT OF UNIVERSITY OF CAPE TOWN WEBSITE

| Usability factor | Merit Point of X | Usability Points of X |
|------------------|------------------|-----------------------|
| Attractiveness | 15.48 | 3.09 |
| Controllability | 12.23 | 2.45 |
| Efficiency | 9.45 | 1.89 |
| Learnability | 12.88 | 2.58 |
| Helpfulness | 14.12 | 2.82 |

The overall Merit Points of the websites of all three universities investigated are shown in Table XI and Fig. 11.

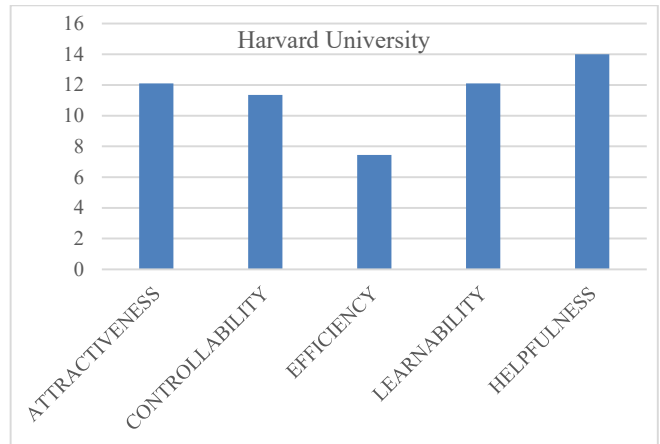


Fig. 8 Merit Point for Harvard University website

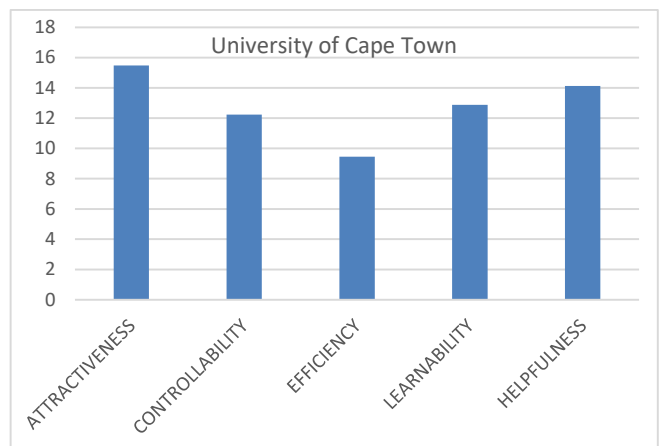


Fig. 9 Merit Point of University of Cape Town

TABLE X
 MERIT POINT OF OXFORD UNIVERSITY WEBSITE

| Usability factor | Merit Point of X | Usability Points of X |
|------------------|------------------|-----------------------|
| Attractiveness | 16.62 | 3.32 |
| Controllability | 15.58 | 3.11 |
| Efficiency | 17.75 | 3.55 |
| Learnability | 16.88 | 3.37 |
| Helpfulness | 15.22 | 3.04 |

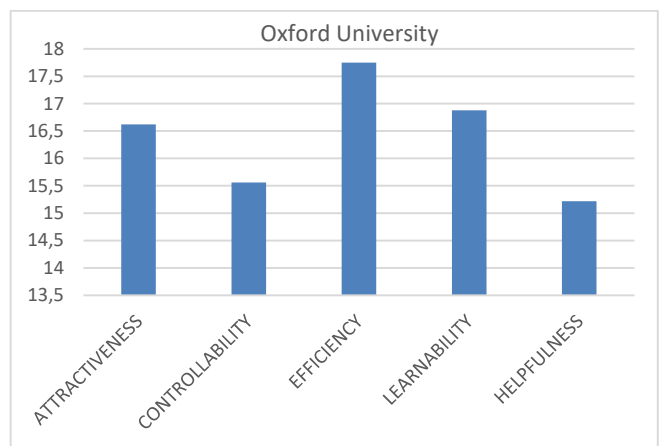


Fig. 10 Merit Point of Oxford University

TABLE XI
 OVERALL MERIT POINTS FOR THE THREE UNIVERSITY WEBSITES

| Usability factor | Merit Point of x | | | Usability product of x | | |
|------------------|------------------|--------|-----------|------------------------|--------|-----------|
| | Harvard | Oxford | Cape Town | Harvard | Oxford | Cape Town |
| Attractiveness | 12.11 | 16.62 | 15.48 | 3.09 | 3.32 | 3.09 |
| Controllability | 11.36 | 15.56 | 12.23 | 2.45 | 3.11 | 2.45 |
| Efficiency | 7.45 | 17.75 | 9.45 | 1.89 | 3.55 | 1.89 |
| Learnability | 12.11 | 16.88 | 12.88 | 2.58 | 3.37 | 2.58 |
| Helpfulness | 14.01 | 15.22 | 14.12 | 2.82 | 3.04 | 2.82 |
| Mean | 11.74 | 16.09 | 13.86 | 2.77 | 3.22 | 2.77 |

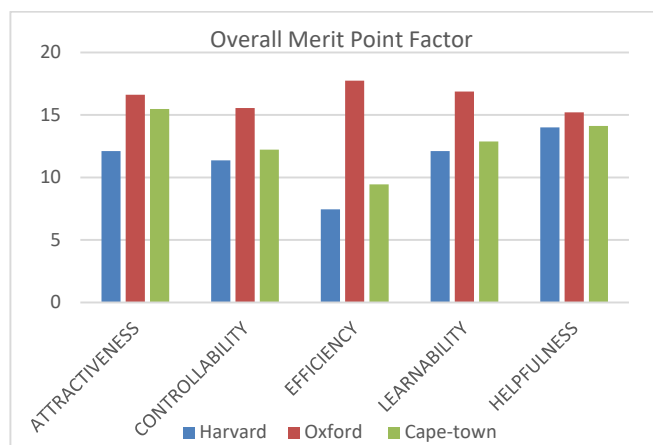


Fig. 11 Overall Merit Points for three University websites

V. DISCUSSION

The field of website usability evaluation has generated significant interest in the last decade. Heuristic guidelines, surveys, and some automated technologies have been used to evaluate academic websites. Most of the time, the examined websites had poor usability, indicating that designers had focused more on the technology, organizational structure, and business objectives of the university than on usability-related factors [29]. Researchers have provided suggestions on how to improve the interface design of educational websites and resolve usability problems. Some of the recommended rules, however, are out of date because they only apply to the academic websites that the particular researchers have reviewed.

From the research carried out and the results shown in the tables as well as the graphical representations, the extent to which the users of the aforementioned websites were able to use the websites to locate and finish the tasks was stated. The average dwell time of the participants on the Harvard University website based on Task 1, Task 2 and Task 3 are 61.58, 41.58, and 51.58 respectively. Oxford University has 48.24, 23.24, and 28.24 respectively while the University of Cape Town has an average dwell time of 79.79, 40.1, and 44.79 respectively. The total average dwell time of Harvard, Oxford, and Cape Town Universities in seconds for the three tasks are 51.58, 33.28, and 54.82 respectively. Following the result of the average dwell time, the Oxford University website with an average dwell time of 33.28 is the least average dwell time spent by the students in performing the tasks. This indicates that the users performed the tasks faster on the Oxford University

website, suggesting that Oxford University's website was built with better usability as compared to the other two websites. The next website after Oxford University based on the metrics of average dwell time is Harvard University with a score of 51.58 and then the University of Cape Town with a score of 54.82. The ANOVA results showed a significant difference in the dwell time mean between the university websites under investigation, pointing to the fact that there is a difference in the usability of the websites. It is also pertinent to note that users spent more time on Task 1 which was to locate the history of the university. This can easily be found on the "about" page of the websites, but the users struggled and spent an enormous amount of time looking for a "history" page or link on the websites.

The SUS scores of each of Harvard University, Oxford University, and the University of Cape Town are as follows; 49.81, 69.43, and 54.14 respectively which clearly shows that Oxford University's website with a score of 69.43 has better usability than the websites of the other universities investigated in this research, followed by University of Cape Town and lastly Harvard University. Furthermore, the result shown in Table XI and Fig. 11 shows that Oxford University also performed better in terms of user satisfaction as captured by the five usability factors which include attractiveness, controllability, efficiency, learnability, and helpfulness followed by the University of Cape Town and Harvard University. The results show that the Mean Merit Point for Harvard University is 11.74, for Oxford University is 16.09, and 13.86 for the University of Cape Town. The result for the Mean Merit Point is consistent with that of the Mean Usability Product. Harvard University has a 2.77 score for Mean Usability Product, Oxford University has the highest Mean Usability Product of 3.22, while the University of Cape Town scored 2.77 as Harvard University. In all the metrics used, Oxford University performed better than the other two universities evaluated.

VI. CONCLUSION

This study compared the usability of three leading universities on three continents of the world – Harvard University for North America, Oxford University for Europe, and the University of Cape Town for Africa. User tasks were given to a set of participants to perform in a controlled study while Morae screen recorder software was used to automatically record and log the participant's interaction on the websites. The results from the SUS score, dwell time, and usability factor Merit Point show that the Oxford University website has better usability than the Harvard University and the University of Cape Town websites. The study carried out on the aforementioned universities showed that user-usability is a key concern in every academic website. The contribution of this work is in three folds: First, the research evaluates the ease of use and effectiveness of the three websites investigated. Secondly, it used a multiple-scoring evaluation approach to rate the websites. Lastly, the work provides quantifiable data on users' engagement on the aforementioned sites.

Although the contribution of this research is novel, the study

is limited to three evaluation matrices (SUS score, average dwell time, and usability factor Merit Point). Further studies can use mouse clicks and mouse movements as additional metrics in studying the usability of websites. This research, therefore, recommends that the university management, as well as website designers of the aforementioned universities, invest more time and resources in user usability on their academic websites. We recommend that the developer of the Harvard University website should improve the website in terms of controllability. The participants expressed dissatisfaction with some aspects of the website navigation as they struggled to find information. The management of the University of Cape Town should improve its websites in terms of helpfulness and learnability. All the aforementioned websites should create a link labelled, "history of the university" that can take users to a page containing the history of the university and link it to the "about" page. The SUS Score showed a grade below A for all the websites examined. This can be improved to grade A if all the usability issues are corrected.

REFERENCES

- [1] F. M. Adedeji et al, "A Systematic Review on Usability Evaluation for University Websites," *International Journal of Computer Applications Technology and Research*, vol. 11, (2), pp. 22-23, 2022.
- [2] C. Pinho, M. Franco and L. Mendes, "Web portals as tools to support information management in higher education institutions," *A Systematic Literature Review. International Journal of Information Management*, pp. 80-92, 2018.
- [3] F. B. Deedam, E. Thomas and O. E. Taylor, "Accessibility and Usability Evaluation of State-Owned Universities Website in Nigeria," *International Journal of Engineering Trends and Technology*, vol. 56, (1), pp. 31-36, 2018.
- [4] Stephen Akuma, "Investigating the Effect of Implicit Browsing Behaviour on Students' Performance in a Task Specific Context," *I.J. Information Technology and Computer Science*, vol. 5, pp. 11-17, 2014.
- [5] S. Iqbal et al, "Maximizing coverage, reducing time: a usability evaluation method for web-based library systems," *Sci. Rep.*, vol. 12, (1), 2022.
- [6] G. Loren, *International Trends in Higher Education 2016–17*. Oxford, UK: University of Oxford, 2017.
- [7] A. Saverimoutou, B. Mathieu and S. Vatou, "Web View: A Measurement Platform for Depicting Web Browsing Performance and Delivery," *IEEE Commun Mag*, vol. 58, (3), pp. 33-39, 2020.
- [8] K. Davis and D. Douglas, "Translating usability test data into client-ready findings and recommendations," *Proc Hum Factors Ergon Soc*, pp. 1764-1768, 2015.
- [9] C. Z. Acemyan et al, "Summative Usability Assessments of STAR-Vote: A Cryptographically Secure e2e Voting System That Has Been Empirically Proven to Be Easy to Use," *Hum. Factors*, vol. 64, (5), pp. 866-889, 2022.
- [10] Ergonomics requirements for office work with visual display terminals. Available: <https://www.iso.org/standard/16883.html>.
- [11] ISO 9241-11:2018(en): Ergonomics of human-system interaction — Part 11: Usability: Definitions and concepts. Available: <https://www.iso.org/obp/ui/#iso:std:iso:9241:-11:ed-2:v1:en>.
- [12] F. Verissimo et al, "A Checklist Proposal to Evaluate the Quality of University Websites," *Springer. Ser. Des. Innov.*, vol. 19, pp. 134-145, 2022.
- [13] S. Akuma and R. Iqbal, "Development of relevance feedback system using regression predictive model and tf-idf algorithm (J)," *International Journal of Education and Management Engineering, IJEME*, vol. 8, (4), pp. 31-49, 2018.
- [14] A. Undu and S. Akuma, "Investigating the Usability of a University Website from the Users' Perspective: An Empirical Study of Benue State University Website," *International Journal of Computer and Information Engineering*, vol. 12(10), pp. 922-929, 2018.
- [15] J. Nielsen, *Usability Engineering*. Boston: Academic Press, 1993.
- [16] K. H. Ramanayaka, X. Chen and B. Shi, "UNSCALE: A Fuzzy-based Multi-criteria Usability Evaluation Framework for Measuring and Evaluating Library Websites," *IETE Tech. Rev.*, vol. 36, (2), pp. 1-20, 2018.
- [17] H. Şereföğlü Henkoğlu, "Web Accessibility Evaluation of University Library Websites in Turkey in Terms of Web Content Accessibility Guidelines," *Bilgi Dnyasi*, vol. 22, (2), pp. 251-288, 2021.
- [18] M. S. Ahmet and A. H. Turan, "Assessing the usability of university websites: An empirical study on Namik Kemal University," *Turk. Online J. Educ. Tech.*, vol. 11, pp. 61-69, 2012.
- [19] H. Layla, "Heuristic evaluation of three Jordanian university websites," *Inf. Educ. Int. J.*, vol. 12, pp. 231-251, 2013.
- [20] A. Ansar, N. Q. Noorulhassan and A. H. Muhammad, "Evaluating Usability of Academic Websites through Fuzzy Analytical Hierarchical Process," pp. 4, 2021.
- [21] B. Fatemeh, "The Effectiveness of Website Design in Higher Education Recruitment", 2016.
- [22] A. Arshad and K. Fyiaz, "Heuristic Evaluation to Enhance the Usability: A Proposal," Paper Presented at the Meeting of IMDC 2016, Gujrat, Pakistan, 2016.
- [23] A. Marzie and M. Elhindi, "An Empirical Study of University Websites," *Issues in Information Systems*, vol. 9(2), pp. 460, 2008.
- [24] M. Rahman S. and S. Ahmed Z., "Exploring the factors influencing the usability of academic websites: A case study in a university setting," *Business Information Review*, vol. 30(1), pp. 40-47, 2013.
- [25] E. Koulocheri et al, "Usability inspection through heuristic evaluation in E-learning environments: The LAMS case," in *VII International Conference on ICT in Education, Challenges*, University of Minho, Braga, Portugal, 2011, pp. 617-630.
- [26] F. Yani, O. D. Nurhayati and A. P. Widodo, "Heuristic evaluation and analytical network process for analyzing the role of websites in higher education," *J. Phys. Conf. Ser.*, vol. 1943 (1), (1), 2021.
- [27] L. Chamba-Eras et al, "Analysis of usability of universities Web portals using the Prometheus tool – SIRIUS," *ICEDEG 2017 - 4th International Conference on eDemocracy & eGovernment*. DOI: 10.1109/ICEDEG.2017.7962533. Quito, 2017.
- [28] K. Sarga and A. Saha, "The effect of user variables on academic websites usability: An empirical study," 2019.
- [29] J. Valacich and J. Georgem, *Modern System Analysis & Design*. 9th Edition Pearson, 2020.
- [30] E. Hopkins et al, "Developing a Criteria-Based Evaluation Tool for User Experience Design that Balances Standardization and Creativity," *IEEE Syst. Inf. Eng. Des. Symp., SIEDS*, 2021.
- [31] M. Jabar, U. Usman and A. Awal, "Assessing the usability of University websites from users' perspective," *Australian Journal of Basic and Applied Sciences*, vol. 7(10), pp. 98-111, 2013.
- [32] B. Fortune D., T. Enefa and E. Onate T., "Accessibility and Usability Evaluation of State-Owned Universities Website in Nigeria," *International Journal of Engineering Trends and Technology (IJETT)*, vol. 56(1), 2018.
- [33] E. Caglar and S. Menten A., "The usability of university websites—a study on European University of Lefke," *International Journal of Business Information Systems*, vol. 11(1), pp. 22-40.
- [34] S. Adepoju A. and I. Shehu S., "Usability Evaluation of Academic Websites Using Automated Tools," 3rd International Conference on User Science and Engineering (i-USER). UiTM Shah Alam Malaysia., 2014.
- [35] S. Mustafa H. and L. Al-Zoua'bi F., "Usability of the Academic Websites of Jordan's Universities an Evaluation Study," Paper Presented at the Meeting of the 9th International Arab Conference for Information Technology (ACIT'2008), Tunisia., 2008.
- [36] M. Benaida and A. Namoun, "An Exploratory Study of the Factors Affecting the Perceived Usability of Algerian Educational Websites," *Turk. Online J. Educ. Technol.*, vol. 17, pp. 1-12, 2018.
- [37] T. Wahyuningrum, N. Rokhman and A. Musdholifah, "Algorithm comparison performance in assessing the quality of university websites," in *In Proceedings of the 4th International Conference on New Media Studies, Hotel Santika Premier, Indonesia*, 2017, pp. 19–24.
- [38] H. Zainab and M. A. Hania, "Usability Evaluation of Educational Websites: A case Study of University of Basrah Website," *Solid State Technol.*, vol. 63, 2020.
- [39] Measuring and Interpreting System Usability Scale (SUS). Available: <https://uiuxtrend.com/measuring-system-usability-scale-sus/>.
- [40] Center for World University Rankings, "World University Rankings 2019-20," 2019.