University Website UX: Prospective Student's Perspective

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ABSTRACT

The world is a global village where online presence ensures the existence of an entity. Like any other organization, official websites are also the faces of academic institutes in the world wide web. They have many online visitors with multiple purposes and one important user group among them is prospective students who want to pursue higher education abroad. Many students around the world use these university websites for most of their communications, yet from the user experience perspective, how their search procedure is, how well the information is served to them through these websites, are still unexplored. In this exploratory research we have investigated the motives and factors that drive prospective students to search necessary information, quantified how much effort from their end is required to accomplish such tasks and finally compared and analyzed our findings with usability score measured by a professional web user-experience analytics service provider. The insights uncovered in this work might play a major role in the designing phase of academic websites.

INTRODUCTION AND MOTIVATION

A website is a person or organization's location on the World Wide Web [3]. Technically, it is a collection of web pages with related contents, which is identified by a common domain name and published on at least one web server. Nowadays for any organization whether business or academic, presence on the web is a must. As people are getting more dependent on online services, for any type of communications, transactions or activity, these websites are playing crucial roles in people's lives. That is why, website developers and designers are trying to provide users with the best experience while they are interacting with the websites. People define good user experience (UX) in terms of how effortless or pleasing it is to use by them. One important component of user experience is usability, which is basically the degree to which an item is able or fit to be used. Like any other product or services, these metrics are also well defined for the websites, which are essential factors for overall user satisfaction.

Academic websites, more specifically the university websites, have many online visitors or users who fall mostly under the category of students, faculty members, internal and external researchers or organizations etc. These user groups have different purposes to visit the site, but most of the time, this is the only channel or tool which prospective students use to know more about the university and determine about any program for enrollment [20]. There are more than thousands of students who fly overseas for higher studies every year, to them, these university websites play critical role in this major decision making process. But little is known about their search effort and how well the university websites are serving that purpose. So, in this research we explored motivation, effort and user experience of university websites from the perspective of prospective students.

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CHI'21, May 8–12, 2021, Yokohama, Japan

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ISBN 978-1-4503-6708-0/20/04…$15.00

DOI: https://doi.org/10.1145/3313831.XXXXXXX

Contributions

Motivated by research opportunity, in this paper we make the following contributions:

1. We investigate the factors which are important for prospective students while considering universities for higher education.

2. Based on the factors, we design and measure the tasks which are carried out regularly by the prospective students on university websites.

3. We correlate task workload with usability of the respective university websites and rank them accordingly.

BACKGROUND

In this section, we discuss preliminary concepts about user experience, usability, NASA-TLX and WAMMI which are required to explain the research methodology and to interpret our research findings. Then we briefly introduce the relevant work, gap analysis and how this research is an addition to the existing body of knowledge.

User Experience

The international standard on ergonomics of human-system interaction, ISO 9241-210 [8] defines user experience as "a person's perceptions and responses that result from the use or anticipated use of a product, system or service". That means, user experience includes all the users' emotions, beliefs, preferences, perceptions, physical and psychological responses, behaviors and accomplishments that occur before, during and after use. According to them, three factors that influence user experience are: the system, the user and the context of use. In our research, we are considering the "context of use" as the purpose from prospective student's perspective.

User Experience is associated with wide range of meanings, ranging from traditional usability to beauty, hedonic, effective or experiential aspects of technology usage [9]. From users' point of view, a product or service has to meet the needs first without any problem to offer better user experience. Then their preference is on the simplicity and elegance they feel by owning or using it. On the web, which is a self-service product, that means there is no instruction manual or training to guide users, then UX becomes more important. Users roam around with their purposes in mind, and keep on searching until they find it. These "searching activity" and "rightly found information" add to the user experience with this site. As web is used mostly by screen whether touch or with pointers, sometimes with voice, this user interface (UI) and their interaction with it develop the UX for the user.

Usability

Usability as a part of UX, is a quality attribute that assesses how easy user interfaces are to use. "Effort" is connected to "Easy" for a person who is doing an activity. If the person can use the system's functionality well, that means, with ease and pleasure, then that can be considered as usable. Usability has 5 quality components [14]: Learnability, Efficiency, Memorability, Errors, Satisfaction. In WAMMI [10]: usability of websites is measured by: Learnability, Efficiency, Helpfulness, Controllability and Attractiveness. We have used this metrics for our research.

NASA-TLX

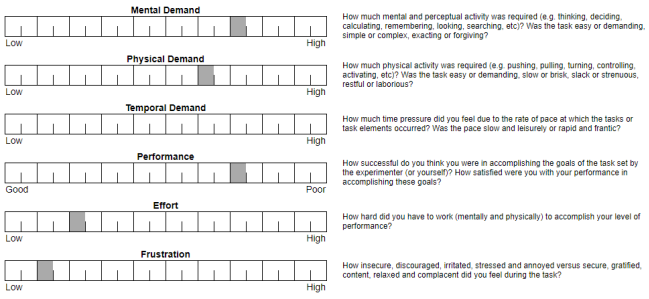


Figure 1. NASA-TLX App Interface

NASA-TLX (Task Load Index) is a standard and commonly used assessment tool to evaluate the rate of perceived workload, when users perform in human-machine interface systems [13]. It was developed by NASA's Ames Research Center's Sandra Hart. It incorporates multi-dimensional ratings to evaluate the total workload. Specifically, it contains six questions using 20-gradations on the scale(100-points range with 5-point steps) from six perspectives: mental demand, physical demand, temporal demand, performance, effort, and frustration (Figure 1). The total workload is based on a weighted average of these six ratings.

The questions in this questionnaire are listed as following:

- **Mental Demand:** How much mental and perceptual activity was required (e.g. thinking, deciding, calculating, remembering, looking, searching, etc)? Was the task easy or demanding, simple or complex, exacting or forgiving?
- **Physical Demand:** How much physical activity was required (e.g. pushing, pulling, turning, controlling, activating, etc)? Was the task easy or demanding, slow or brisk, slack or strenuous, restful or laborious?
- **Temporal Demand:** How much time pressure did you feel due to the rate of pace at which the tasks or task elements occurred? Was the pace slow and leisurely or rapid and frantic?
- **Performance:** How successful do you think you were in accomplishing the goals of the task set by the experimenter (or yourself)? How satisfied were you with your performance in accomplishing these goals?
- **Effort:** How hard did you have to work (mentally and physically) to accomplish your level of performance?
- **Frustration:** How insecure, discouraged, irritated, stressed and annoyed versus secure, gratified, content, relaxed and complacent did you feel during the task?

WAMMI

WAMMI (Website Analysis and Measurement Inventory) is a professional analytics tool to evaluate the usability of websites[10]. It measures the user satisfaction with browsing the website by comparing user' expectations and what they actually experience. It is composed of 20 statement questions on a 5-point Likert-type scale (Figure 2) to gather participants' ratings to the website. It also contains some open-ended questions, asking participants about advantages and disadvantages of the websites from design perspective.

WAMMI offers the results regarding the ratings of statement questions (Figure 2). The diagrams show how participants had rated each question in a percentage way, from "mostly agreement" to "less agreement". The green bars and red bars in the right of figure indicate participants' levels of favor to the particular website. The green bars mean participants are satisfied with the websites in terms of corresponding statement questions, while the red bars mean the opposite. The length of bars represents how much participants agree or disagree with statement questions. The longer green bars represent the higher percentage of satisfaction.

Based on participants' ratings, WAMMI also provides a comprehensive analysis report from the perspectives of attractiveness, controllability, efficiency, helpfulness, learnability and global usability. An attractive website refers to a visually pleasant website that provides much interest to users. An efficient website is defined as the website that users are able to perform any tasks in an efficient and effective way. Controllability is considered as the ability whether users are able to easily browse the website as per their expectation. A helpful website provides organized web structure and informative contents, and achieves users' needs when they search for any information. The website with high learnability means users are able to start the website easily, without much effort to learn how this website works. Global usability refers to the combination of previous five factors, and measures users' overall user experience with the site. In this case, we will use the report from

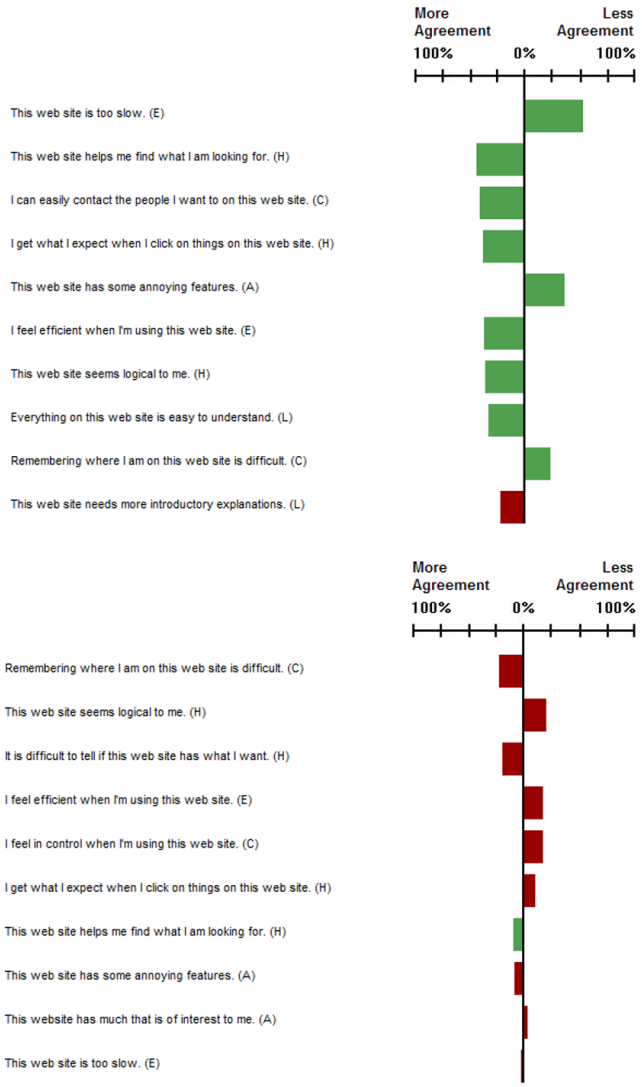


Figure 2. WAMMI Questionnaire and Statement Analysis

WAMMI to evaluate the usability of university websites and analyze its relationship with participants' workloads.

Literature Review

Emotional reactions as an user satisfaction metric, were measured in [15] and they evaluated 6 websites. They also created prompting list of emotion words that might be useful in eliciting users' reactions to websites during evaluation. Later in extension of that work [16], they added think aloud protocols to measure the user experience with the websites. These techniques are more instantaneous feedback than WAMMI but less rich. To measure the user experience on a large scale, user-centered metrics for web applications, HEART (Happiness, Engagement, Adoption, Retention, and Task-success) Framework was developed by Google [18]. In their tests with the product teams, this framework was proven effective. But this measurement, is developed to bring in more loyal users or customers of the product, which is not much useful in our academic websites' contexts. A set of heuristics for user experience evaluation for E-Commerce websites was proposed in [4]. But these are based on functional requirements and guidelines in regard to the quality of the E-Commerce sites and did not provide any instruction to customize them for other purpose. A comprehensive model of user experience with news websites is tested in [1]. A psychometric measure of trust in news providers was developed and they used that to extend the model by predicting users' satisfaction with the news sites. In our case, we do not have to consider "Trust", because, university websites are already official sites, there should not be any issues with trustworthiness like news. Besides, we did not explicitly design any model, but the UX components were inherent which were tested with the tasks and questionnaires based on well established ISO 9241-210 [8] guideline.

Aula et.al[2] proposed an observational user study to show that with different web expertise, users had different completion speed of performing tasks. They also proved the correlation between task completion speed and task variables, such as the type of tasks, the speed of query iteration, the length of the queries, the proportion of precise queries, and the speed of evaluating result documents. In our work, we will have three different tasks for each university website, and keep the difficulty level of each task in the different university website the same. Another usability study on academic websites was performed by Chaparro [6]. They designed common tasks carried out by faculties, stuff and students, for an university website before it was lunched. They collected task load data by ratings on difficulty only and connected that with satisfaction level. The tests and measurements were comparatively simple and this was done for a single website and no comparison with other websites were made. Manzoor et.al[11] developed a web usability evaluation model to evaluate the usability of educational websites from the perspectives of web structure, page layout, navigation and accessibility features. Kindi et.al [5] compared the search systems and navigation on two academic websites with the one on Google, and showed the importance of search and navigation systems in organizing information effectively.

WAMMI was first used for academic websites by Mentes et.al [12]. But they also tested it for a single site and focused on usability perception and it's relation to gender, age, internet experience and position in the university. To the best of our knowledge, we are analyzing it for the first time from prospective students perspective who are one of the most frequent visitors of academic websites. Roy et.al [19] presented a statistical study to evaluate the usability and accessibility of three university websites by using two types of usability evaluation techniques. One is to use the WAMMI questionnaire, another is to evaluate participants' performance by analyzing their success rate, completion time and satisfaction feedback. They show that completion time and satisfaction level are negatively correlated in some tasks. However, they fail to explain the reason for the varying correlation in different tasks between task completion time and satisfaction level. They also lack the analysis of any pairwise correlation among the global usability score from WAMMI questionnaire, success rate, completion time and satisfaction feedback except the correlation of com-

pletion time and satisfaction feedback. In our work, we will focus on the correlation between multiple factors, not only the factors mentioned above, but also perceived workload when participants perform tasks. We will also investigate why task completion time and satisfaction level has varying correlation on different tasks. Whereas their main theme was human perception, we narrowed it down to the perspective student's view.

METHODOLOGY

Our research goal is 3 folded here, starting with knowing the factors which contribute most in university choices among prospective students, then how easy or hard this search process is based on their priorities, and finally, how user friendly or well organized the university websites are to serve their purpose.

Research Question

Based on the objective of this research, in this paper we answer the following 3 research questions:

- **RQ1:** What are the important factors prospective students consider before applying for higher studies?
- **RQ2:** How effortlessly students can find their required information in the university websites?
- **RQ3:** Is there any correlation between student's effort and university website's usability?

System Implementation

For RQ1, we just talked to fellow students who already got admission or others who are looking for admissions. We also informally reconfirmed the important factors for higher study and university selection through Facebook polls. For RQ2, we utilized an app of NASA-TLX a java script based open source tool, and customized it for our data collection purpose. We basically, made it simpler by removing pairwise comparison module. This helped us to measure the effort projected by a student to search the required information on the respective websites. For RQ3, we created google forms and customized the WAMMI website to get the usability data for those respective university websites (2 forms for each university, that is 10 in total).

Research Design

Our research is an exploratory and deductive study at the cross section of website usability and human effort. We have applied both qualitative and quantitative approach to tackle our research problem.

In our experimental design, for quantitative analysis, we defined Time and Click as independent variables and we tested whether they have any influence over NASA-TLX (effort) and WAMMI (usability) score. For dependency and correlation check we utilize statistical hypothesis testing. Whenever there needed in-depth analysis of user behavior and feedback, we utilized qualitative analysis as WAMMI also provides an option to collect participant's opinions regarding the websites while conducting usability test.

To answer the research questions, we use a laboratory experiment and three questionnaires to collect data on: 1) important factors that prospective students consider before applying for higher studies; 2) prospective students' experiences with academic websites. The procedure is organized in following steps:

- **Step1:** A pre-questionnaire about participants' demographic information. A detailed instruction (including a video) tells participants how to start the experiment. Five university website forms for five university websites are provided. Participants are able to read the instruction and the scenario at any time of the experiment.
- **Step2:** Participants follow the instructions to finish three tasks for each university.
- **Step3:** Two post-questionnaires asking about participants' experiences and feedback.

Participants

We recruited 12 participants from University of Waterloo by posting the recruitment on Piazza and sending the recruitment through email. All of them have experience applying to universities. They finished their undergraduate education from 12 different universities and 5 different countries, America, Bangladesh, Canada, China, and Iran. All participants are in the computer science and mathematics department. 3 of 12 participants are PhD students, and 9 of 12 participants are master students. 4 of master students are considering applying for PhD programs in the future. All participants prefer countries in North America for higher education, such as America, Canada, etc. One participant also considers Europe(United Kingdom, Sweden, Germany, etc.) as his preferable countries. When asking about internet skills and knowledge, all the participants rated themselves as very experienced and technical users. We obtained the research ethics TCP approval.

Experimental Procedure

Initially an informal discussion done with few of the prospective students and the students who already got admission to get an high level idea of the factors which prospective student's consider before applying. Actually, the we were also prospective students once, so we knew about most of the factors, but, to reconfirm, we conducted few polls over Facebook (Figure 3) and prioritize factors which might be used to design the tasks for the experiment.

Before the experiment, participants were given a pre-questionnaire using Google Forms regarding their prior experience of applying for higher education. Specifically, the questionnaire is asking the important factors when applying for universities, preferred countries for higher study, major, and graduation information.

After filling the pre-questionnaire, participants were presented with a detailed instruction. Following the instruction, participants were asked to download two tools we provided. One is Mouse Clickr, which calculates the number of mouse clicks. Another one is xntimer, which calculates the time.

Participants were also presented with five university website forms for each university, Stanford University, McMaster University, Curtin University, University of Waikato, and University of Essex. We used the university website forms that were used to evaluate usability of academic websites based on human perception from Roy et al.[19]. Each form contains 3 tasks to complete on each university website: 1) go to the "Computer Science" department page; 2) find any professor who has research area in "Machine Learning"; 3) find the Computer Science PhD/MS deadline for application. Therefore, each participant had to finish the 15 tasks in total.

After carefully reading the forms and setting up these tools, participants began the experiment. Firstly, they opened the link of an official university website we provided. In the meantime, they restarted time calculator and mouse clickers. Secondly, they tried to find the answer for task 1, a link directing to the Computer Science Department page. Once they found the answer, they paused time and mouse clicker calculators, and recorded the website link, current time and the number of clicks. Then, they repeated the above steps and finished the rest 2 tasks.

After finishing each university website form, participants were asked to complete two post-questionnaires. One questionnaire is NASA-TLX from [13]. This questionnaire assesses participants' workload during the experiment. It is based on a weighted average of ratings on six subscales, mental demand, physical demand, temporal demand, performance, effort and frustration. It contains 6 questions using 20-gradations on the scale(100-points range with 5-point steps). The questions in this questionnaire are listed as Figure 1.

Another questionnaire is WAMMI as mentioned earlier (Figure 2). This questionnaire helps us understand how participants think of the university website. It includes a series of questions using scale from strongly agree to strongly disagree, and some open-ended questions asking participants about the website's strong and weak design aspects.

Data Analysis Procedure

Students' comment and Facebook poll were used to identify important tasks which are carried out by the prospective student regularly. Then we shortlisted these factors to answer our RQ1.

Several measurements are used to solve RQ2: average task completion time, average task clicks, task success rate, NASA-TLX score, scores from WAMMI.

Average task completion time is the average time that participants spent on completing a task. Completing a task is defined as the participants performed on the websites and thought they have found the answer for the task. The time was counted from the beginning of a task and the end of a task.

Average task clicks is the average number of mouse clicks that participants performed on the websites and completed a task. The clicks were counted from the beginning of a task and the end of a task.

Task success rate is the ratio of the number of successful tasks over the number of total tasks. It is to measure whether participants were able to complete the task successfully. A successful task means participants gave a website link that correctly answers the task.

NASA-TLX score measures participants' workload during the experiment from the perspectives of mental demand, physical demand, temporal demand, performance, effort and frustration. NASA-TLX questionnaire contains 6 questions, scaling from 5 to 100. NASA-TLX score is the average score of the questionnaire for each university website. Higher scores means participants feel heavier workload.

A data report for each university website was generated by www.wammi.com, based on the result of WAMMI questionnaire. This data report contains the score of attractiveness, controllability, efficiency, helpfulness, learnability and global usability. Attractiveness is defined as how much interest and pleasant participants think of the university website. Controllability is defined as how participants feel they can navigate around the website with ease and do the things they want to do. Higher efficiency score means participants could browse the website in an efficient way and locate quickly. High helpfulness score means the university website is corresponded with participants' expectations, and they could find the information they were looking for. Global usability is defined as the level of difficulty that participants think of the university website when they find the information.

Finally, for RQ3 we planned for correlations among Task Time, Task Click, NASA-TLX and Usability score. But there were not sufficient data to make it statistically significant, so used synthetic Gaussian data generator tool to make the sample size around 30. Then we executed our correlation analysis on the total dataset.

FINDINGS AND ANALYSIS

We have examined questionnaires about users' demographic information and experience feedback, and university website forms. Here we report the findings to answer our research questions, respectively: (a) important factors that participants consider before applying for higher studies; (b) how easy or hard the task of searching information in the university websites; and (c) participants' experiences with academic websites based on the usability score and it's relationship with effort.

Factors (RQ1)

We were prospective students once, so we are already experienced with the pain of searching information through the vast ocean of information i.e. world wide web for a suitable higher study program. The search spans not only in a few countries but also across sub-continents. But the basic requirements are simple as figured out in [7]. As per our discussion with local and international students, which had been confirmed by informal Facebook poll also, (Figure 3) scholarship or funding is the first priority for them. But we did not consider this answer to define tasks as most of the institutes they offer higher studies (except business programs), they have guaranteed funding if admitted in the research based STEM programs. Self-funded students can also enroll but those are course based programs,

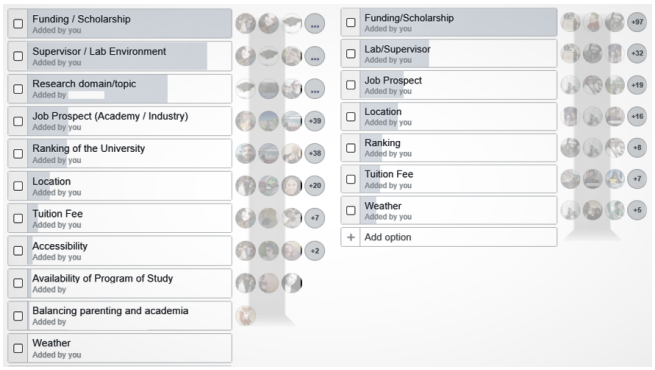


Figure 3. Facebook Poll to Find Factors Important for Higher Studies

so they do not have interest in securing funded research positions. Then we focused on the 2nd most important factor, which is research group/supervisor or department. We have used this in defining our first two tasks i.e. Task-1 and Task-2. Where participants were asked to go to certain department page and find a supervisor working in certain research group as mentioned in the task question. We ignored other factors like job prospect or ranking as those are not part of the university website information, instead, we have chosen application deadline date search, which is a crucial piece of information for students who have decided to apply. So, to get the answer for RQ2, how effortlessly the students figure out these essential information, is our next analysis.

Task Load and Usability (RQ2)

To find the relationship between time, the number of clicks and success rate, and investigate the difference between university websites in each task, we examined the average time, average number of clicks and average success rate for completing a task. Figure 4 shows the average time that participants spent on each task in each university website. Figure 5 shows the average number of clicks for completing each task in each university website. Figure 6 shows the success rate of completing each task for each university website.

Task1 always requires participants finding the Computer Science Department website page. For task1, participants used the shortest time on Stanford University's website. The time for other university websites is similar and longer. Participants also used the least number of clicks on Stanford University's website, and more number of clicks on other university websites. The success rates for all the university websites are similar to each other, which range from 75% to 83.3%.

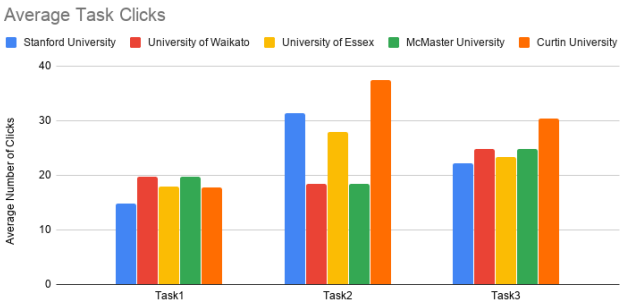


Figure 5. Average Task Clicks

Task2 asks participants to find the contact information of a professor working in a specific field related to computer science. For task2, participants spent much more time on the websites of Stanford University, University of Essex, and Curtin University than the rest two. They also used the larger number of clicks on these three university websites. For success rate, participants gave the most wrong answer and obtained a pretty low success rate for Curtin University, which is 50%.

Task3 requires participants finding the application deadline for a specific term. For task3, when performing the task on Stanford University' website, participants obtained good performances on all the aspects, including average time, average number of clicks, and task success rate. Participants took more time and number of clicks on Curtin University's website. For success rate, participants achieved low success rates ranging from 66.7% to 75% for University of Waikato, University of Essex, and Curtin University.

From Figure 4 and Figure 5, it is clear to conclude that average time is closely related to average number of clicks for each task. When participants spend more time on a task, the number of clicks is larger. However, average time and average number of clicks are not directly related to success rate. For example, participants used similar time and number of clicks on task3 when performing the websites of University of Waikato and McMaster University, while they obtained a lower task success rate on the former website and a higher task success rate on

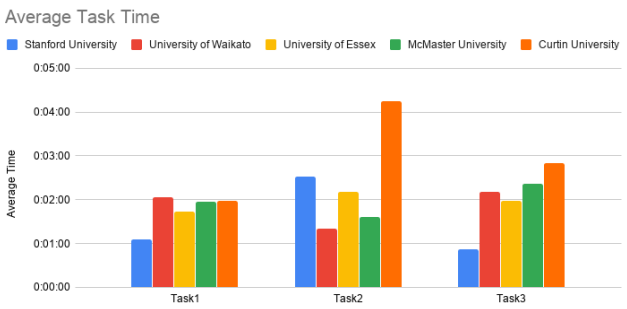


Figure 4. Average Task Time

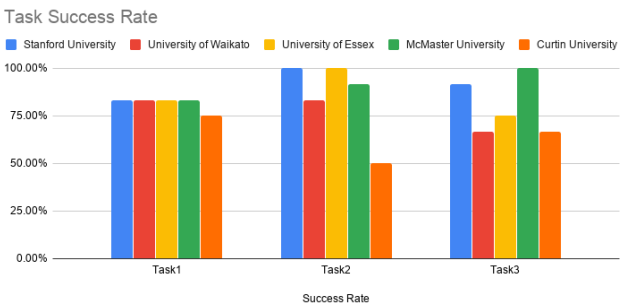


Figure 6. Task Success Rate

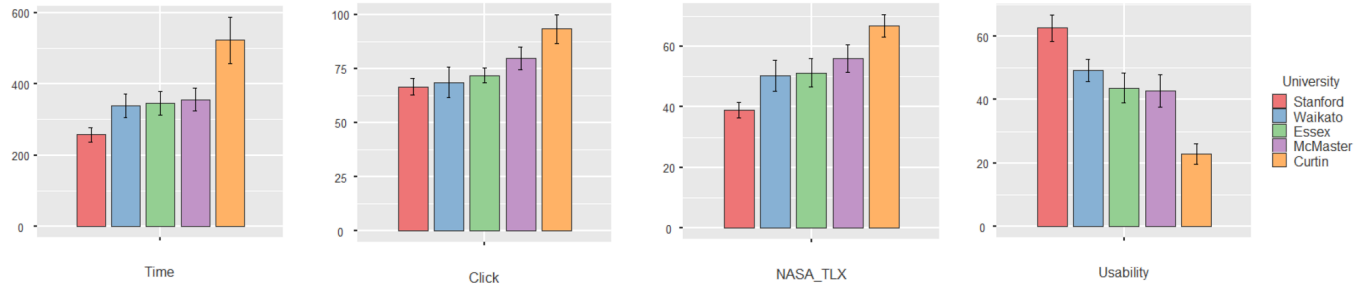


Figure 7. Histogram of Total Time, Total Clicks, NASA-TLX (Task-Load) Index, WAMMI Usability Score splitted by 5 Universities

the latter one. From the performance on Curtin University's website, we can only get the result that the possible relationship is when participants have extremely long time and large number of clicks, they might get a low success rate.

On the other hand, participants had controversial performances when completing different tasks for Stanford University and University of Waikato. To explain this, we examined their responses to open-ended questions asking about the experience and feelings. The responses helped explain the difference from multiple aspects.

For Stanford University, most participants used all positive expressions to describe the website, such as "simple", "clear", and "informative". One participant commented: *"The interface is simple and clear. I can find what I need easily."* However, there are some complaints about finding a professor. For example, a participant stated: *"It misses categories for professors in different areas. It should have more description of professors and their research."* These comments explain the reason for more time and number of clicks on task2, and less time and number of clicks on task1 and task3.

For University of Waikato, participants took the least time and number of clicks on task2. Most participants think that the home page of this university website is clearly structured and designed. One participant answered that: *"You can find all subjects offered by the university. Easy navigation also helps to find necessary information within a short time."* On the other hand, participants obtained the lowest success rate on task3. Some responses revealed that it is hard to find useful information in this website for prospective students. For example, one participant stated that: *"To find deadlines and professors in department, we have to look elsewhere."* Similarly, another participant wrote that: *"From the first page, it gave me hard time to find the school and deadline that I am looking for."*

Curtin University had bad performances in all the aspects. The responses show that the website has bad content organization, and participants feel lost when finding important information. For example, one participant commented: *"The organization of the website is unusual than what I used before. I suppose that the department of faculty information should be placed in a significant position, especially for the prospective students. However, I found it at the end of the webpage."* Another participant responded: *"... Professors list cannot be found categorised by department. Also application deadlines are not clearly given only other things are given under the section to apply."*

To find the difficulty level of searching information on the university websites from participants' perspective, we examined multiple aspects of counting all the tasks for each university website. Figure 7 shows total time, total number of clicks, NASA-TLX score and global usability score from WAMMI for each university website. It reveals that participants spent the most time and number of clicks, and felt the heaviest workload when completing tasks on Curtin University, and they thought Curtin University had the worst performance in terms of usability. For Stanford University, participants achieved least time and number of clicks, and felt the lightest workload and greatest usability.

Overall, in terms of difficulty level based on participants' experience and feelings, the ranking of university websites from best to worst is Stanford University, University of Waikato, University of Essex, McMaster University and Curtin University.

Correlations (RQ3)

During the experiment, we collected user's data of the Task Time, Task Clicks, NASA-TLX (Task Load) and WAMMI Usability scores. The first thing naturally we did with that, is to plot the histograms and looked for any pattern. Our analysis was grouped by universities first, and we observed an interesting pattern (Figure 7). The increase in time and click are seemed highly correlated. This event is expected, as if more time requires for completion of a task, usually the clicks should be higher too, exception is someone is reading a page for long time or watching a video. But in our test, we gave particular tasks and advised users not to get distracted rather focus on the task completion. When the tasks were completed, the participants were surveyed with the NASA-TLX form, to give their feedback on how much effort required by them to complete the task, the output was plotted as histogram of Task-Load index, and it showed similar pattern for the same sequence of universities. Finally, when we added WAMMI usability score for the respective universities, we found different pattern. But that gives rise to the hypothesis: if user's perception is that, it takes more effort, the Task-Load is high, perhaps it affects user's satisfaction with the websites and hence low usability score.

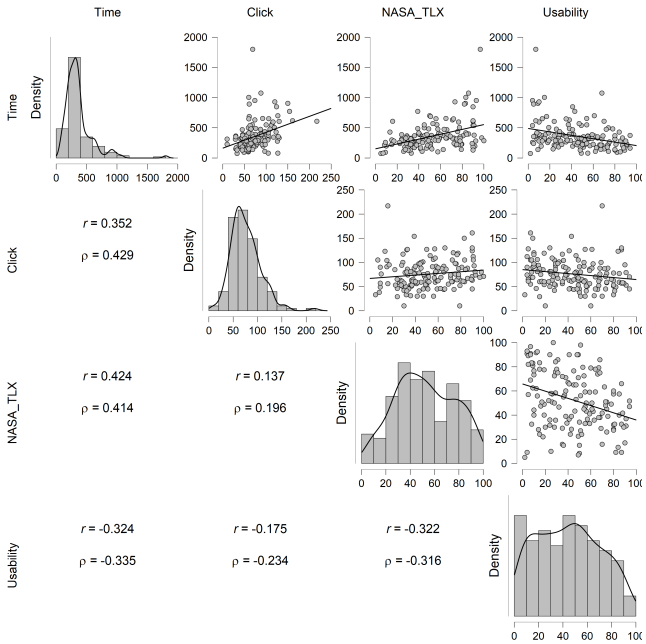
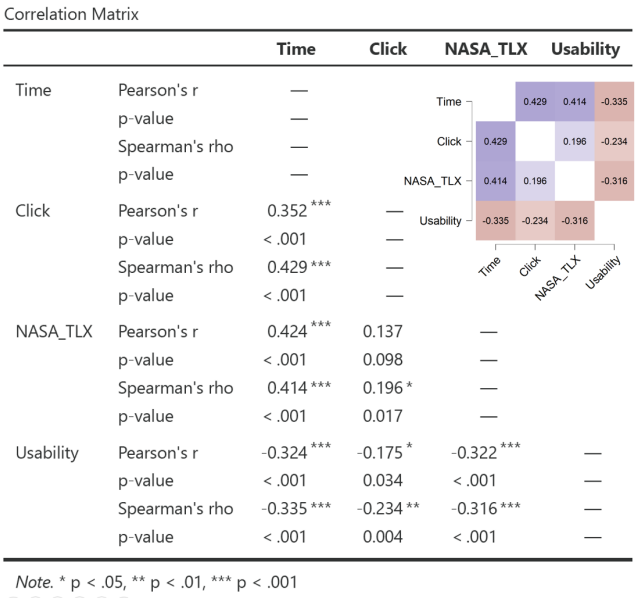


Figure 8. Correlation



Correlation Matrix

		Time	Click	NASA_TLX	Usability
Time	Pearson's r	—			
	p-value	—			
	Spearman's rho	—			
	p-value	—			
Click	Pearson's r	0.352 ***	—		
	p-value	< .001	—		
	Spearman's rho	0.429 ***	—		
	p-value	< .001	—		
NASA_TLX	Pearson's r	0.424 ***	0.137	—	
	p-value	< .001	0.098	—	
	Spearman's rho	0.414 ***	0.196 *	—	
	p-value	< .001	0.017	—	
Usability	Pearson's r	-0.324 ***	-0.175 *	-0.322 ***	—
	p-value	< .001	0.034	< .001	—
	Spearman's rho	-0.335 ***	-0.234 **	-0.316 ***	—
	p-value	< .001	0.004	< .001	—

Note. * p < .05, ** p < .01, *** p < .001

Figure 9. Correlation Matrix with p-value and ρ-Heatmap (inset)

To test the correlation, we draw the scatter plots in the correlation matrix format, in Figure 8, we saw that, the regression line shows positive correlation between Time, Click, NASA-TLX but negative with usability. To test the significance further, we created the correlation matrix, and the null hypothesis (H_0) was "There is no correlation among them", that is $r = \rho = 0$, but as we see in the matrix (Figure 9) p-value is less than 0.05 that means we can reject the null hypothesis, that means, we can accept alternative hypothesis (H_a), "There is a correlation". We verified it with both the Pearson Correlation Coefficient r and Spearman's ρ, and in both the cases p-values were less than 0.05 for (NASA-TLX and Usability) and with (NASA-TLX and Time) but exception was NASA-TLX with Clicks, which was a weak correlation. In our test, we considered, $p < 0.05$ = Weak Correlation, $p < 0.01$ = Moderate Correlation and $p < 0.001$ = Strong Correlation. In the heatmap of Spearman correlation coefficient (Figure 9 inset) these findings are clearly visible with intensified colors (purple for positive and brown for negative correlations).

DISCUSSION

Our initial idea was that there could be a correlation between university ranking and the usability, that is why, we picked up 5 universities at random from different rank groups: 1-100 (Stanford), 100-200 (McMaster), 200-300 (Curtin), 300-400 (Waikato) and 400-500 (Essex). This ranking was published by QS World Ranking of universities [17]. But the initial data did not support the idea. So, we ranked the universities based on our data and compared it with QS data. As we can see in the Figure 10, except Stanford university, no other university stayed in their ranks compared to the QS ranking. Then we also show here the ranking of these 5 universities based on the Usability, NASA-TLX, Learnability, Efficiency, Helpfulness, Controllability and Attractiveness. From WAMMI report,

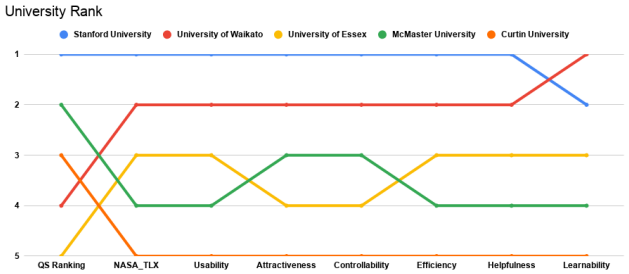


Figure 10. University Ranking in QS, NASA-TLX and WAMMI

Figure 11 shows the two extreme ranked universities and how they have been evaluated by the participants. We suggest this sort of metrics can be incorporated with university ranking data too.

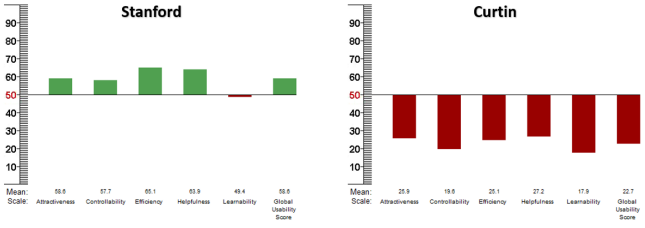


Figure 11. Comparing WAMMI Individual scores for Stanford and Curtin University

Limitations

First and foremost, this experiment is sophisticated enough to be run in the lab, but we did it during pandemic lock-down situation, all participant and researchers worked from home, so nobody could guide the users about how to use the tools in person. The instructions and video were helpful, but we observed participants ignored or missed subtle details, that resulted in some errors which we had to rectify later. Secondly,

we expected more participants but due to the lengthy procedure (30-45 min.) many people were not interested or felt bored at the middle. We also did not have video recording to verify how much distracted the participants were while conducting the experiment; that might have some affect on data.

Future Research Direction

Based on our contribution, we think, there are three ways this research can be extended:

1. Crowd-sourcing thousands of academic websites with more simplified tests to cluster academic websites based on usability and learn from the well designed websites.
2. Feasibility of common design pattern for a section of the academic websites only dedicated for the prospective students. After implementing such a prototype, there can be an experiment to verify: low scores in Average-Time, Average-Click, NASA-TLX index and high score in usability.
3. There are many tools to measure workload and UX other than what we have used for this experiment. So, a comparative research can be conducted to explore which set of tools provide effective results.

CONCLUSION

In the modern world, whether it is business or academia, designers always try to develop or improve their products or services keeping users at the center of their process, and Human Computer Interaction (HCI) research is fostering that by providing necessary tools or insights to them so that the overall user experience can be enhanced. In this research, we have explored the user experience with the university websites when prospective students are the end users. Around the world, students who are willing to pursue higher studies abroad but not taking any professional services, are highly dependent on the university websites for any sort of information exchange regarding their admissions. We found that information about scholarships or funding, appropriate supervisor or lab are very crucial in their decision making process to choose the right program in any university. As these are the factors they keep in mind while searching university websites, we defined the experimental tasks based on these and analyzed how they perform it, how demanding it was or how much effort it required. To do this quantitative study we have utilized the NASA-TLX tool that takes into account any person's mental, physical, temporal demand, performance, effort and frustration, and produces the task load index. After obtaining this task-load index for each of the sampled websites, we compared those with the usability index of the same sites provided by WAMMI Web-UX analytics tool, and found positive correlations. That means, for the regular tasks the prospective students are doing on the university websites, if they find it more demanding or needs more effort or frustrating, they will think the usability of the websites are low which will also be reflected in WAMMI scores. WAMMI also calculates other fragments of usability like Learnability, Efficiency, Helpfulness, Controllability and Attractiveness. We also ranked the sampled universities according to this parameters. These prove that, well designed websites, where users can find required information with ease, faster, recognizable way, without complicate UI, are highly likely to provide superior user experience. Hence, we emphasize that, the overall analysis and outcome of this research, provide good insights into this area and can contribute highly to the academic website design perspective.

ACKNOWLEDGMENTS

We thank all the volunteers, survey participants, class-mates and Prof. Edward Lank for providing helpful comments on this research. Last but not the least, special thanks to Dr. Jurek Kirakowski, Founder, WAMMI, Ireland for granting us academic license of WAMMI tools to measure web usability of the 5 university websites.

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