

Usability Evaluation of Prototypes Designed for a Saudi University Website

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Abstract: Usability testing is becoming an essential stage throughout the web development cycle. There's a need for academic sector to consider the potential of user experience. In order to enhance Prince Sultan University College of Computer and Information Sciences (CCIS), three steps of the design interaction process were followed which are understanding requirements, producing a design that satisfies those requirements and finally, evaluating the design. This paper emphasizes on examining and evaluating high and low-fidelity prototypes of CCIS website through three evaluation methods including user testing, expert reviews, and System Usability Scale (SUS). User testing of the prototypes resulted high success rates than the existing website. Expert reviews urged the need of future improvements while SUS score shows that high fidelity prototype is convenient for the users

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1. Introduction

Over the years, the role of Human Computer Interaction (HCI) has become more vital. Ensuring an optimized interaction experience is no longer favorable but mandatory. Providing an ultimate user experience has emerged to be one of the main considerations in web development. Many scholars have proposed different methodologies for evaluating usability and each method has its own advantages and disadvantages.

Education sector seems slowly adapting to these advances in comparison to other sectors. However, some educational institutions recently realized the importance of having a well-constructed website to reach their targeted users [1]. Websites which establish usability practices enhance the user, students in specific, academic experience and encourage the use of the website [1]. Therefore, there's a need for academic institutions to pay more attention to providing better user experience by applying usability studies. There are three main steps for interaction design including understanding requirements, producing a design that satisfies those requirements and finally, evaluating the design [2].

Rather than following one evaluation method, in this paper, a combination of three methods which are Expert Review, User Testing and System Usability Scale (SUS) have been followed to evaluate the usability of an educational website. This research paper consists of five main sections. Section I presents an

introduction. Literature review is discussed in section II. Requirement gathering is described in section III. Low and high fidelity prototypes designing stages and evaluation process are presented in section IV. Discussion is examined in section V. Section VI sums up the research parts in a conclusion.

2. Literature Review

Usability refers to how effective, efficient and satisfactory a product can be used to achieve specific goals within a specified context [3]. An expert in the field of usability, Nielson J, associate usability with five main components which are learnability, memorability, efficiency, error and satisfaction [4] According to him, learnability is defined by success of accomplishing the tasks the first time a design is encountered while efficacy is defining by the time taken to accomplish the task after becoming familiar with the design [4].

To assess the evaluation of usability, many methods have been introduced. Each method focuses in uncovering specific usability problems and uses different techniques [5]. User-testing method is the most commonly used method [6]. In user-testing, users are recruited to test the design following specific tasks and observe their trials [7]. One way to measure their performance to evaluate the usability of the product is Nielson's Success Rate metrics where the number of successful trails is calculated [7].

Another usability evaluation method is the Expert Review method. As the name stated, expert review method is based on recruiting expert to evaluate the product based on known guidelines related to the context of the product [8]. In 1986, a new method has been created by John Brooke called System Usability Scale. The method consists on 10-item based questioner that is forces to evaluate usability in general and learnability in specific [9]. The standardized questions are:

1. I think that I would like to use this system frequently.
2. I found the system unnecessarily complex.
3. I thought the system was easy to use.
4. I think that I would need the support of a technical person to be able to use this system.
6. I found the various functions in this system were well integrated.
7. I thought there was too much inconsistency in this system.
8. I would imagine that most people would learn to use this system very quickly.
9. I found the system very cumbersome to use.
10. I felt very confident using the system.
11. I needed to learn a lot of things before I could get going with this system.

Odd items add points to the total and even items deduct from the total [9]

According to [10] Nilesen proposed 10 design guidelines which are dedicated to university websites. These guidelines consist of: (1) University logo must exist in every page; (2) university values and visions must be reflected on the pictures used in the website; (3) there should be an emphasis on about us page content representation; (4) programs can be easily found and navigable ; (5) achievements, statistic and awards of the university must be highlighted in an attractive way; (6) alumni and job opportunities is an important feature in university websites; (7) application deadline as well as a step-by-step guide through the application must be identified; (8) different user navigation through the website must be studied; (9) make sure the website design and content is mature and formal; (10) the developer must make sure that the website is informative and does not mandate users to use external websites.

Recently, the educational sector has been moving slowly toward improving the usability in educational website. Several attempts have been made by different scholars to study the possibility of evaluating and enhancing the usability. Hasan and Abuelrub [1], conducted a heuristics evaluation to determine the usability issues facing the Educational websites particularly in Jordan. The evaluation resulted in four main problems themes where each has several sub-problems. First problem theme was navigational problems such as weak navigational support, misleading links, and broken links. Second, design problems. The study found four main problems in the design of the website which are: inconsistency, inappropriate design, and inappropriate use of images

and choice of color. The third problem found was regarding the content e.g. old information, incomplete information and empty pages. Finally, ease of use and communication problems which include difficulty when interacting with the websites and not supporting more than one language.

The research article "A User-Centered Evaluation of a University Website" focused on the process of assessing and highlighting existing yet still unknown usability problems of Mindanao State University – Iligan Institute of Technology Website [11]. In order to obtain the general purpose of this paper, five staged approach was performed to test the usability of Mindanao State University Website as a test subject using fifty participants [11].

Hasan, L. [12] highlighted the usability issues concerning three university websites in Jordan by following user testing approach. Thirty students were involved an observation session which was carried out with a pre-test questionnaire as well as a post-test questionnaire. The students' interactions with the website have been observed and recorded. The tasks of measuring the users' performance were assigned based on the time and the accuracy of accomplishing these certain tasks by the students. The results show that all of the students couldn't accomplish a single task within the specific time frame on all of the three websites. The minimum task accuracy scores belong to website 1 and website 2. The majority of the students did the tasks assigned for website 3. There were 26 usability problems identified such as ambiguous links, old content, and lack of Arabic language support. Based on questionnaire answers, students were satisfied with Website 3. Eventually, the study is complemented by finding the common usability issues among the study and other related studies. These identified issues provide an insight in improving the usability for university websites.

3. Requirement Gathering

Understanding the expectations of the potential users by eliciting requirements from users is established prior to the design of CCIS website. This stage includes defining the users, tasks and context. The users of the website are current PSU CCIS students and prospective students applying for bachelor or master CCIS programs. All these students have experience in using computers and websites.

To generate the requirements list, several data gathering activities were performed. Current and prospective PSU students were approached to discuss and clarify the requirements using a questionnaire. In addition, the current CCIS website was thoroughly analyzed and many problems were highlighted. Other similar universities' computer college sites were carefully studied in this stage. Moreover, several research paper in the field of usability evaluation for university websites were summarized and evaluated. The questionnaire was created using SurveyMonkey tool and was distributed online over 27 current PSU students taking master or bachelor in the CCIS. 14

master students and 13 bachelor students. The requirement collection process used several other techniques and does not merely depend on the questionnaire. The aim of the questionnaire was used to explore the opinion and comments of the current students regarding current CCIS website.

According to the distributed survey, 70% of the students access the website. More than half the sample thinks that the web site is either poor or very poor (see Fig. 1).

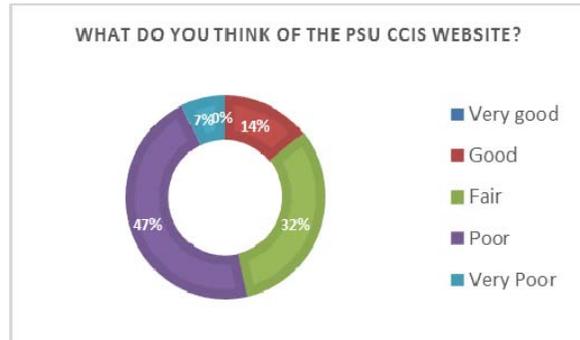


Fig. 1. Students opinion on PSU CCIS website

The results show that 29% of the student can't locate their program page easily and 37% can't find it in the first place. 40% of the students think that the navigation between pages was fair while 29% think it was poor. 40% of the students always face broken links and 40% sometimes face broken links. 55% of the students think that the web site content is outdated and 51% think it is lengthy. On the other hand, 37% think that content is readable the rest think it's fair, poor or very poor. Only 29% think that the website is aesthetically appealing. Only 11% of the students think the interactivity of the website is good.

The current CCIS website was thoroughly analyzed in order to highlight the encountered issues. One of the main issues of the CCIS website is that it only contains the Bachelor programs provided by the CCIS department although the department offers a Master's program. In fact, the Master's Program web page has completely different theme and style and can be accessed only through a rotating announcement banner in the university's main website which can be only displayed during registration phase. As a result, the program can be easily missed and the inconsistency of the theme is found to be confusing for the user.

In addition, several links in both the CCIS and Master Program pages are not functioning well. For example, "Sign to MSE" link will take you to the electronic academic portal. The academic portal can only be accessed by enrolled students while the link was mainly created for unregistered students. The sitemap link as well as few other links are not functioning.

Furthermore, students usually complain about the tiresome process of registration, the lack of information, and lack of support regarding Co-Operative (Co-Op) training program. The co-op program is offered by PSU and is mandatory for all students to undertake upon the completion of their

bachelor program. The students are required to visit Co-Op advisors' office and fill in hard copy forms to apply for Co-Op manually.

The majority of the student did not think that the design of the PSU main page and the CCIS website are aesthetically appealing. Some think that the original PSU CCIS web site has so many colors that it distracts them. The CCIS page has no special flavor that distinguishes it from other colleges, and a logo that is inspired from PSU main logo would represent the identity of PSU and would be easily distinguishable from other colleges. The sitemap is missing in CCIS pages and some pages have no date for the last updates applied to the page. The CCIS pages are merely text and buttons which lacks fundamental interactivity and discourages the users from exploring the website.

The data gathering activities highlighted the requirements are taken in consideration in this study. First, the majority of student, according to the distributed questionnaire, access the website almost monthly which is casual/infrequent usage. This requires the web site to have a high level of learnability. According to [13], learnability illustrates to which extent a new user can learn how to accomplish tasks quickly and easily. The web site should be easy to learn. The system should allow users to remember how to use it easily. The student doesn't visit the web site daily and this will cause forgetting the steps or the process of performing a task in the past. In addition, students are busy and they should not waste time on remembering where to locate a page or how to accomplish a specific task. As a result, the system should use meaningful icons and menu options. The web site should present the options and icons in relevant categories to help the user remember where to look. Using the website will not require any manuals or training sessions.

The website should provide information about Co-Op. All the organizations that CCIS recommends to apply for, all available training options must be clearly stated. The web site should provide a form to be submitted online that includes transcript and CV upload options. The web site links must all be accessible and link to the correct pages. The web site should have a consistent experience across the entire pages to keep users' mind at ease.

The web site should have Simplicity. This means to concentrate on what is important and don't distract the user. The web site should have Familiarity, meaning that it will stick to what users already know and what they had experienced before. The web site should use text that is understandable by the students and that takes in consideration their educational level. The text of PSU CCIS current website must be readable and understandable. The second step is producing a design that satisfies those requirements. Both high and low-fidelity mockups were designed and created based on the gathered requirements. In the next section, more details will be provided.

4. Prototype Design and Evaluation

The CCIS home page is the focus of this study. The home page of CCIS website contains information about programs, prospective students, research, faculty, events and news about the CCIS department for students and interested visitors. It generally contains a news viewer, two navigational bars, one is horizontal and the other is vertical, quick links, and several icons. This section explores the design and evaluation process for low fidelity and high fidelity prototypes for CCIS department.

4.1 Study 1: Low Fidelity Prototype

Taking the requirement gathered as an input, a low fidelity design was developed that reflects the suggested enhancement to the website including a restructure website. The proposed design divides the website contents into Homepage, About us, Programs, Current Student and Researches. This modification reflects the different users views of the website and allow them a quick access to the information needed. The design also focuses in increasing interactivity by adding features that answers to actual student needs e.g. book swapping feature and Co-Op training forum page.

In order to evaluate the low fidelity prototype, user testing method was followed. Participants, settings, materials, procedures, and data analysis for prototype are discussed in this section.

Participants

Six participants were recruited to conduct the user-testing evaluation. Four participants are high school students who are considered to be prospective students and two participants are current students. All participants are females in the age range of 16 to 21.

Settings

User evaluation was recorded using a mobile phone video camera or through screen recording tools and each test has been conducted individually with each participant. The study was conducted within the household of the three evaluators.

Materials

The material used for the evaluation is the fidelity prototype, and a laptop to display the prototype. The low fidelity prototype has been developed using Balsamiq Mockups software (fig. 2). The mockup contains hyperlinks to allow navigation between pages. The mock-ups were displayed on computer screen through Balsamiq.

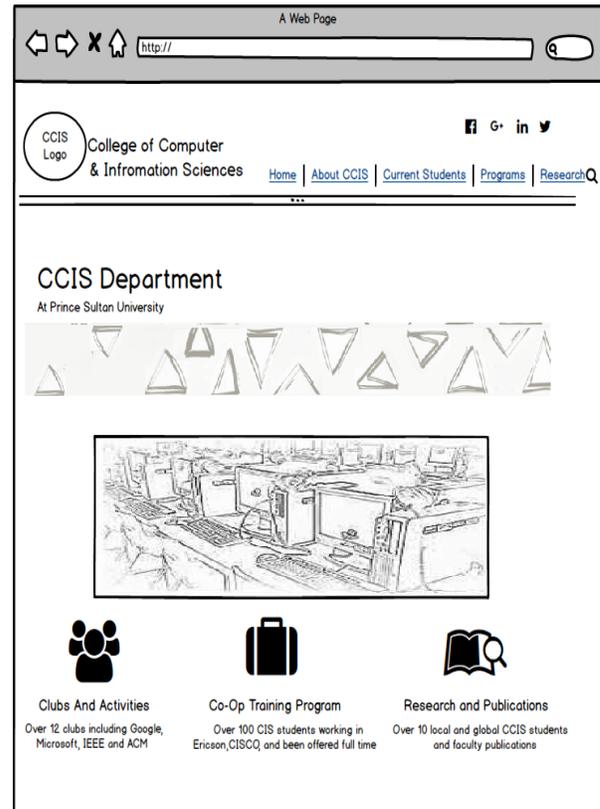


Fig. 2. Low fidelity prototype home page

Procedures

In order to conduct the user-testing evaluation participants were given a consent form to ensure their willingness to participate in the evaluation. A list of tasks is created based on Nieslen's usability testing guidelines [4]. Each participant has been given the list of tasks to perform and has been explained the procedures of the evaluation. In order to evaluate the efficiency of the design, the participants have been asked to repeat five tasks and each participant's duration time to complete the task has been recorded the first time they encounter the design (learnability testing) and the second time they encounter the design (the efficiency testing). Table 1 represents the learnability and efficiency tasks given to users and their corresponding objectives. Only questions regarding the terms used in the tasks list were explained considering the perspective student lack of university-related terms knowledge such as "Co-Op Program".

Table 1: Low fidelity evaluation task list

No	Corresponding Objective	Task
Learnability (First time the users encounter the website)		
1	Learn an overview about the college	View the vision statement
2	View the offered programs	Explore information about the MSE program.
3	Apply for a program	Apply for Computer Science program
4	Contact the college	Send a question to the website
5	Check grades	Student can check through Academic Portal. Go to the link where you can visit the Academic Portal
6	Check the LMS	Go to the link where you can check your WLMS account
7	Learn about the Coop opportunities	Name one company that offers Coop program for CCIS student
8	Apply for a coop	Register for Co-Op Program
9	Offer a book for swap	Submit a book for swapping
10	Explore available books for swap	Find the book offered for swap with the name "Code Complete" under "Programming" Category
11	View college activities	name one of the collage clubs available.
12	Explore Social Media	Visit the University Facebook page.
13	Explore University Research news letter	Download the CCIS Research Newsletter 2009
Efficiency (Once users have learned the design, how quickly can they perform tasks again?)		
5	Check grades	Go to the link where you can check your grades
9	Offer a book for swap	Submit a book for swapping
2	View the offered programs	Explore information about the MSE program.
11	View college activities	name one of the college clubs available.
13	Explore University Research news letter	Download the CCIS Research Newsletter 2009

Data Analysis

Nielsen's Success Rate metrics is followed when measuring the success status of the users [7]. The tasks are scored as following, S for successfully completed tasks, P for partially completed tasks where the participant completed more than half of the task and finally F for failure tasks. Each task's success status as well as the task duration from reading the question until finishing the tasks has been recorded in seconds. After completing the tasks, the participants were asked to give their overall opinion and suggestions. The data is computed and further analysis of total success rate, average time of each task and average time of all tasks was presented.

Results

The result shows that a total of 78 tasks are done by all participants. The participants' evaluation success score is recorded and shown in table 2. It's shown that all users succeeded in locating task 2, 3, and 11.

Table 2: Participants' task scores

Participant	1	2	3	4	5	6
Task 1	P	S	S	S	S	S
Task 2	S	S	S	S	S	S
Task 3	S	S	S	S	S	S
Task 4	F	S	S	S	P	S
Task 5	S	S	S	S	S	F
Task 6	S	S	S	S	S	F
Task 7	F	S	S	S	P	S
Task 8	P	F	S	S	F	S
Task 9	S	S	S	S	F	S
Task 10	S	F	S	S	S	S
Task 11	S	S	S	S	S	S
Task 12	P	S	S	S	S	S
Task 13	P	S	S	S	S	S

The recorded duration for each task is displayed in table 3. The total average success rate for learnability test is 19.09 and efficiency total of average time is 8.93.

Table 3: Participant duration time to complete each task

	Users/ Tasks	task						Average of each task
		1	2	3	4	5	6	
Learnability duration(s)	Task 2	10	13	8	9	40	12	15.33333
	Task 5	25	16	9	43	22	120	39.16667
	Task 9	16	7	14	10	23	16	14.33333
	Task 11	12	10	8	11	8	22	11.83333
	Task 13	25	25	7	5	9	18	14.83333
Efficiency Test duration(s)	Task 2	32	17	12	10	14	12	16.16667
	Task 5	8	2	7	6	5	5	5.5
	Task 9	4	5	7	8	6	6	6
	Task 11	12	5	11	3	8	10	8.16667
	Task 13	20	3	9	5	5	11	8.83333

Looking at the data collected from the evaluation, the total of tasks scoring S is 64 tasks out of 78 tasks while six tasks scored P and eight tasks scored F. Following Nielsen success rate metrics, one point has been giving to each successfully completed task, 0.5 has been given to each task partially completed. The success rate resulted is 85% successfully completed task. Summary of the evaluation result is displayed in table 4.

Table 4: Task completion scores

Scores	Total
S	34
P	3
F	1
Completed tasks	78
Success Rate	85.80%

The results indicate that the participants' duration time needed to complete each task decreases when they become familiar with design. The only exception was for the second task where the average time increases by almost one second. The average time to complete all tasks by all participants was 19.1 s the first time they encountered the design and 8.9 s after becoming familiar with design.

4.1 Study 1: High Fidelity Prototype

After obtaining the low fidelity result, users' feedback in addition to the evaluation observation were input to develop the high fidelity prototype.

Participants, settings, materials, procedures, and data analysis for high fidelity prototype evaluation are discussed in this section. There are three types of evaluation conducted in this study which are user testing, expert review and System Usability Scale (SUS).

Participants

The user-testing evaluation for high fidelity prototype was conducted based on the feedback of six participants. Four participants are high school students who are considered to be prospective students and two participants are current students. All participants are females in the age range of 16 to 21. In high fidelity prototype study, three web developers and HCI experts were requested to evaluate the high fidelity prototype following Nielsen's guidelines for university websites [10]. For the System Usability Scale (SUS), a sample size of 14, which is an acceptable size [14], were randomly selected. The age was ranging from 16-23. These participants were requested to fill the SUS evaluation.

Settings

For user testing and expert evaluation, all feedback is recorded. User testing feedback and one expert review is video recorder while the other is audio recorded. User testing is conducted in the household of the evaluators.

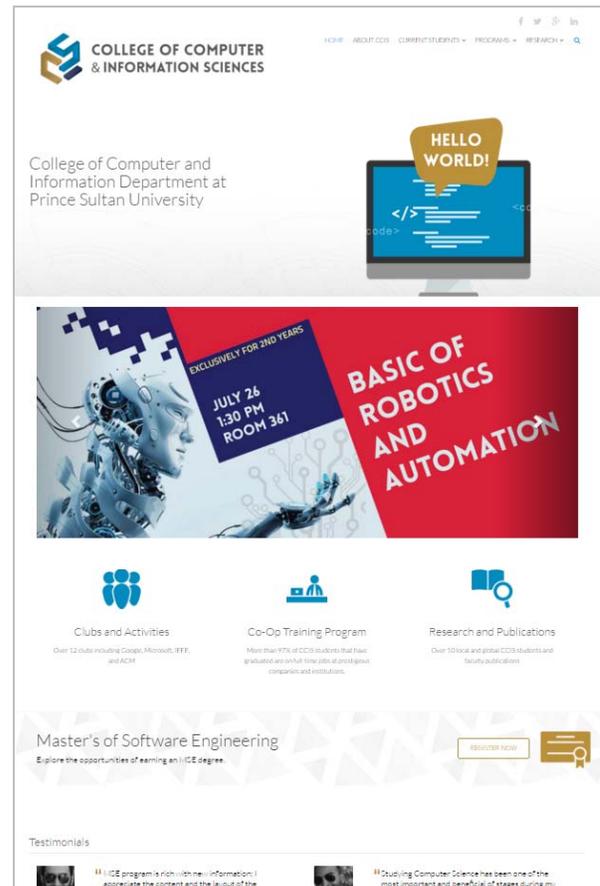
One expert review evaluation was recorded within the household of the reviewer and the other review evaluations were conducted in the office of the expert reviewer. SUS evaluation took place within Prince Sultan University premises.

Materials

Study 2 is similar to study 1, which both serve as the enhancement of CCIS website. The high fidelity prototype in study 2 is developed in HTML5 using Adobe DreamWeaver. It is responsive and mobile

friendly, and can be viewed through web browsers, tablets and mobile phones (fig. 3). The aim of the high fidelity prototype evaluation is to provide a closely related view to the final version of the website. The website followed the same structure designed in the low fidelity with enhancement. The design focuses in increasing findability and decreases the number of action taken by the user to perform a task such as adding Breadcrumb navigation which is a secondary navigation bar that informs the user about their exact location. Usability concepts are taken into consideration when developing the prototype such as affordance in buttons by having dominant colors for submit button and background colors for cancel buttons. Logo has similar colors of PSU logo and it follows closure principle for perceiving the different shapes into one complete cube [15].

Microsoft Excel was used for the SUS calculations and Google Forms for questionnaire distribution.

**Fig. 3** High fidelity prototype

Procedures

User testing in study 2 performs almost the same procedure in study 1 (table I). To ensure more effective results, user evaluation is conducted on the existing CCIS website as well. Participants were given a consent form to ensure their willingness to participate in the evaluation. Fig. 4 shows one of the participants navigating vision statement for task 1.

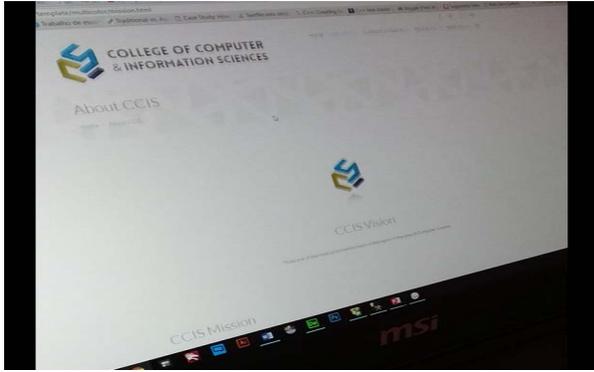


Fig. 4. User testing for task 1

Expert review in this study is consisted of a combination of an interview session and a questionnaire which designed based on Nielsen's usability 10 guidelines, but one of the guidelines are excluded due to irrelevancy [14] The questionnaire is designed using 5-Likert scale. The guidelines are as follows: (1) university is clearly identified; (2) images used reflect university's values and priorities; (3) about Us page is informative and satisfying; (4) strengths and achievements of CCIS are simply presented and easily found; (5) users can easily view the list of majors and programs; (6) job placement after graduation is identified and linked to the alumni section of the website; (7) application deadlines and a step-by-step description of the application process is clearly shown; (8) the website is using a respectful and age appropriate language; and (9) website content is easily understood and doesn't drive users to search for information about CCIS on external sites.

Expert reviewers scanned through Nilesen's guidelines for university websites and then audio or video recording session began. Two reviewers provided feedback and answered the survey while other preferred only expressing her opinion through a video recording session.

In SUS, the randomly chosen participants were asked to interact and explore the high fidelity prototype. Then they were asked to fill a SUS specific questionnaire. It is made up of ten statements that rate the level of the user agreement [16]. Half of the statements are worded negatively while the other half is worded positively [16]. A five-point scale is used by the users to express their opinion and experience. This scale is transformed to another scale. Then the total for each user is calculated. The SUS average score is then calculated.

Data Analysis

Data analysis for user evaluation is computed similarly as in study 1. User evaluation results on low fidelity prototype, high fidelity prototype and the existing CCIS website were recorded and analyzed. Each task's accomplishment status as well as the task duration from the second the participant starts reading

the question until finishing the tasks has been recorded in seconds. The total success rate, average time of each task and average time of all tasks were presented. The results are compared to the user testing of the existing CCIS website.

The data analysis for expert review is done using video transcription method Expert review is transcribed and survey analysis is conducted. All expert review feedback is then visualized using word cloud generator [17].

Regarding SUS analysis, all the answers of the participants were given appropriate weight as the SUS approach specified [14] and then calculated on a scale from 0-40 and then transformed on a scale from 0-100. The average for all SUS scores was calculated and the average grade was assigned accordingly.

Results

The result shows that a total of 84 tasks were performed by all participants. The participants' evaluation success scores were recorded and are displayed in table 5 It's shown that all users successfully located task 1, 4, 8, 11, and 13. On the other hand, most of the participants found difficulty in task 9.

Table 5: Participants high fidelity test scores

Participants	1	2	3	4	5	6
Task 1	S	S	S	S	S	S
Task 2	S	S	S	S	P	S
Task 3	S	S	S	S	P	S
Task 4	S	S	S	S	S	S
Task 5	S	S	S	S	S	S
Task 6	S	S	F	F	S	F
Task 7	S	S	S	S	S	F
Task 8	S	S	S	S	S	S
Task 9	F	F	F	F	S	F
Task 10	S	S	S	S	F	F
Task 11	S	S	S	S	S	S
Task 12	S	F	F	S	S	S
Task 13	S	S	S	S	S	S
Task 14	F	S	S	S	S	S

For each one of these tasks the time was recorded in seconds. Then the average time for each task was calculated as displayed in table 6.

Table 6: Participant duration time to complete each task for high fidelity prototype

	Users/ Tasks	1	2	3	4	5	6	Average of all tasks
Learnability test duration(s)	Task 2	5	9	9	10	8	17	26.7
	Task 5	22	6	20	26	13	46	
	Task 9	46	50	184	131	19	56	
	Task 11	21	11	21	12	12	20	
	Task 13	7	2	6	2	5	5	
Efficiency test duration(s)	Task 2	4	5	17	18	28	10	14.3
	Task 5	32	17	12	5	11	10	
	Task 9	8	2	68	40	10	17	
	Task 11	12	5	14	7	9	7	
	Task 13	20	3	9	7	10	12	

Looking at the data collected from the evaluation, the total of tasks scoring S is 67 tasks out of 84 tasks while two tasks scored P and 12 tasks scored F. Following Nielsen success rate metrics, one point has been given to each successfully completed task, 0.5 has been given to each task partially completed. The success rate resulted is 80% successfully completed task. Summary of the evaluation result is displayed in table 7.

Table 7: Task completion scores for high fidelity

Status	Total
S	67
P	2
F	12
Number of attempts	84
Success Rate	80.00%

The results indicate that the average duration of the tasks performed for the first time (learnability) dropped from 26.7 second to 14.3 seconds when participants performed the tasks for the second time. This indicates that the participants' required duration decreases after using it for the first time.

A comparison between the success rate for the existing website scores are represented in table 8.

Table 8: Learnability and efficiency scores comparison

	Participants	1	2	3	4	5	6
Original CCIS website	Task 1	S	S	S	S	S	F
	Task 2	F	S	S	S	F	F
	Task 3	S	S	P	P	S	S
	Task 4	S	S	S	S	P	S
	Task 5	S	F	S	S	P	P
High fidelity prototype	Task 1	S	S	S	S	S	S
	Task 2	S	S	S	S	P	S
	Task 3	S	S	S	S	S	S
	Task 4	S	S	F	F	S	F
	Task 5	S	S	S	S	S	S

Table 9 shows the success rate score of the existing CCIS website in comparison with high fidelity prototype. The results are in favor with the prototype

Table 9: Comparison of success scores of original and high fidelity prototypes

Status	Total score of existing CCIS site	Total score of high fidelity
S	18	26
P	4	1
F	8	3
Number of attempts	30	30
Success Rate	66.66%	88.33%

In the second evaluation method, two experts' guidelines evaluation was analyzed in fig. 5 which displays the guidelines and each reviewer scale from strongly agreed = 5 to strongly disagree = 1. Guideline 1 and guideline 2 scored the lowest which indicated the website doesn't clearly identify the main university website identity. Also, there was a lack of pictures that reflect the university's values and priorities. Expert one agreed the most on the statement that programs can be easily located. Expert two strongly agreed on guideline 8 and 9 which are the website is age appropriate and clear.



Fig. 5. Expert review response where g stands for guideline

Other comments of reviewers are transcribed and documented. Reviewer 1 mentioned that the academic part is presented, yet culture and environment are missing. According to the reviewer, the font is too small while there are big spacing issues which make the content disconnected especially in home page. Reviewer 2 mentioned that the first section in homepage should be excluded. On the other hand, the reviewer liked testimonial of students and she mentioned these students' achievements would attract the attention of the viewer since it sums up the experience of students. Reviewer 3 found transition in the first section to be distracting and

saw the prototype and how they liked to interact with it.

In [1], Hasan and Abuelrub followed heuristics evaluation approach. One main drawback of the methodology followed by the authors is that the actual users' feedback is missed. Some components of usability cannot be measured including user satisfaction and learnability. By following three different methods, different usability issues from different perspectives are uncovered and no stakeholders are neglected.

The use of an approach that combines three different methodologies can take an advantage of the comprehensive problem description that the expert review method provides, the real life problem reflection that user testing method provides by involving real user, and the quantification and standardization that the SUS provides. Such approach could be extensive and time consuming but will give a solid evaluation that fully addresses usability problems and support establishing a clear guideline for future designs. In addition, the approach can be simply conducted by students using widely used tools such as Microsoft excel and Balsamiq therefore it can be easily followed by any educational institution seeking to improve the usability of its website.

6. Conclusion

Usability is a quality attribute which provides better solutions for web applications by reflecting real user experience and expert reviews. Usability testing remains a quite neglected aspect in the web application domain for university websites.

In this report, a usability evaluation study is conducted for CCIC department website for PSU. The paper consists of three steps followed which are requirements, design of two distinct prototypes, and prototype evaluation. The evaluation followed two different partial studies which evaluate low fidelity prototype and high-fidelity prototype. Low fidelity prototype evaluation was based on user testing. High fidelity prototype was evaluated by users testing, expert review, and SUS.

User evaluation success rates of the prototypes are higher than the success rate for the existing website. Expert review comments suggested that the prototype needs more enhancements to follow usability guidelines. SUS results indicate that the high-fidelity prototype is promising.

The use of three different methodologies compensate for the drawbacks each one has and takes best advantages of them.

The next prototype will take into consideration the findings and expert review comments. These comments include having content about life, culture, and accommodation information for faculty and students. Another work may include enhancing content which reflect the image of the university. By enhancing the usability of CCIS website, this may reflect the image

and the experience the CCIS department is aiming to deliver.

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