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USER EXPERIENCE EVALUATION TOWARDS INTERFACE DESIGN OF DIGITAL FOOTPRINT AWARENESS APPLICATION

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ABSTRACT

User experience (UX) towards designs of an application or product affects the way such user receives the product. UX also becomes increasingly crucial as users obtain a rating of downloaded app experience that may affect sales and improve the application performance expectations. This study aims to evaluate user experience in order to validate user needs on digital footprint awareness applications that have been developed through the triangulation technique that involves three user experience testing methods which are guessability, think aloud and observation to acquire feedback and suggestions from experts and end users for the application development. The findings indicate that an important aspect of user satisfaction within this app is the use of attractive colours, clear and appropriate texts and clear and systematic guidelines to reduce the user's cognitive strains. In addition, the emphasis is on enhancing the fun, entertaining and interface design based on using different perspectives of its use in fun, motivational challenges and skills to enhance the application usability and learning ability.

Keywords: user experience evaluation, mobile app, triangulation method, guessability, think aloud, observation

INTRODUCTION

A good user experience (UX) is currently the ultimate goal of most products and services geared towards consumers in the market. The term "user experience" was created by Don Norman (Norman, 1988) which describes the importance of user-centered designs in which design concepts are solely based on user needs and desires. In technical terms, UX possesses practicality, experience, meaning, affectiveness and valuable features of interactions between user and machine. The UX design basically assists users to perform tasks across platforms and services compared to the User Interface (UI) design that comprises of attractive and aesthetically pleasing interface for fun user interaction (Frith, 2019). Mobile UX on the other hand, refers to the design of positive experiences, perceptions and user feelings before, during and after their interaction with the mobile device application. According to Dossey (2019) mobile markets specifically whereby mobile devices are used, places unique requirements on the design of user experience. Mobile applications are used from the start to achieve general functionality and retrieval of data, such as email, contacts, calendar, and weather information. But the development of developer tools and public demands have led to rapid expansion into other categories (Bao et al, 2017). UX design in this context, focuses more towards efficiency and discovery. This is because mobile users engage their devices at crucial moments and only for a short period of time. Furthermore, interface design for each type of users is different because of the level of cognitive, physiological and different perceptions. The user interface

with high usability is crucial in the search process (Nurul Nadia Ab Rahaman et al, 2013). Therefore, their experience needs to be customizable, efficient and fun to ensure a continuous use. UX design on mobile devices focuses on the delivery of customized devices and services to meet the user's changing and spontaneous needs while maintaining the lowest level of interaction as possible. (Park et al, 2011).

Digital Footprint Awareness Application, known as e-Step, is a mobile application system built based on user experience design to increase netizens awareness in managing digital footprint in the realm of cyberspace. This is because the traces that users leave behind when they visit the web have many benefits to individuals or organizations operating on social networks to gather personal information, habits, likes, tendencies and shopping patterns. All information obtained from digital footprint can be manipulated or passed on to third parties for profit. Therefore, the challenge of today is to guide and educate youth in particular on how to manage their digital footprint wisely and guide them to recognize the negative implications that may impact their future.

In order to make sure that the application will be effectively used in educating youth on digital footprint, the aim of this study is to evaluate the user experience to verify the user's needs in this application. UX testing towards interface design of the application is conducted to acquire direct feedback from users by using observation and user surveys while they are using the application (Sivaji & Tzuaan, 2012). The ISO 9241-210 standard on user-driven design explains the concept of UX, inquiring into all aspects of user experience when interacting with the product and should cover all aspects of consumerism and product desires from a user's perspective (ISO / DIN CD 9241). Peter Morville from Semantic Studio has developed a honeycomb user experience to encompass 7 aspects of user experience (Nielson et al, 2014):

1. *Functionality*: Do developed websites, products, services have practical goals?
2. *Usability*: Can the website, product and service be used for its purpose? Is it complication and confusing or easy to understand?
3. *Desire*: Increases emotional aspects in designs using images, identities, branding and other elements of designs that trigger the emotions.
4. *Retrievability*: Can users attain what they were looking for? Regardless of information or product, every bit of information and object must be achieved.
5. *Accessibility*: The use of alt text for images, organized titles and structured content, properly labelled forms and others.
6. *Reliability*: Do users believe in the developed product or services? The interface design and the product design influence reliability and trust towards developers.
7. *Value*: Do users gain additional value from the website, product or service provided? Does it enhance user satisfaction?

Based on these aspects of user experience, testing using the triangulation method consists of guessability, think aloud and observation that has been conducted on the digital footprint awareness applications user interface to test user experience levels and improve design in order to ensure that users can use the application at their utmost best. Section 2 will describe the background of the e-Step application development and the triangulation method will be explained in more detail in section 3. Section 4 discusses the usability assessment of applications by using the triangulation technique while the results are discussed in section 5 and summarized in section 6.

DIGITAL FOOTPRINT AWARENESS APPLICATION BACKGROUND

Results from the development research on digital footprint awareness designates that respondents agree that they are not fully aware and exposed to digital footprints left behind in the cyberspace. Based on analysis and literature review, the researchers have devised a conceptual model for a mobile digital footprint awareness application to ensure that the significance and information of digital footprints can be delivered clearly and easily understood.

In order to solve issues that arose in an interactive manner, the management of the digital footprint app is developed based on a serious game technique. Serious game techniques or learning-based games that are educational influence learning in two ways, firstly through a direct change of the cognitive process and indirectly, by way of giving motivation (Wouters et al, 2013). To maximize learning, both methods needs to be used in collectively. Playing games in education is generally known to improve motor skills or acquire knowledge on specific topics. In addition, serious games can also encourage the acquisition of more complex cognitive skills such as problem solving and communication between cultures (Guillen-Nieto et al, 2012; Yang, 2012). Cognitive performance is enhanced through action or gestures that facilitate aspects of cognitive tasks (Mohd Salihin Ab Rahman et al, 2017). The findings on the empirical evidence of the positive potential impact of the game shows that playing computer games is associated with various perceptions, cognitive, behavioral, effectiveness, impact and motivational outcomes (Connoly et al, 2012). The main focus of the game is not limited to entertainment even though it has both the educational and entertainment aspects. This technique is also often used in unison to other learning tools and environments such as lectures, e-learning forums and simulators.

Therefore, serious game techniques are selected in designing the application aimed to encourage the users' motivation in order to acquire information on digital footprint in a fun way. Figure 1 shows the conceptual model design of the digital footprint awareness application.

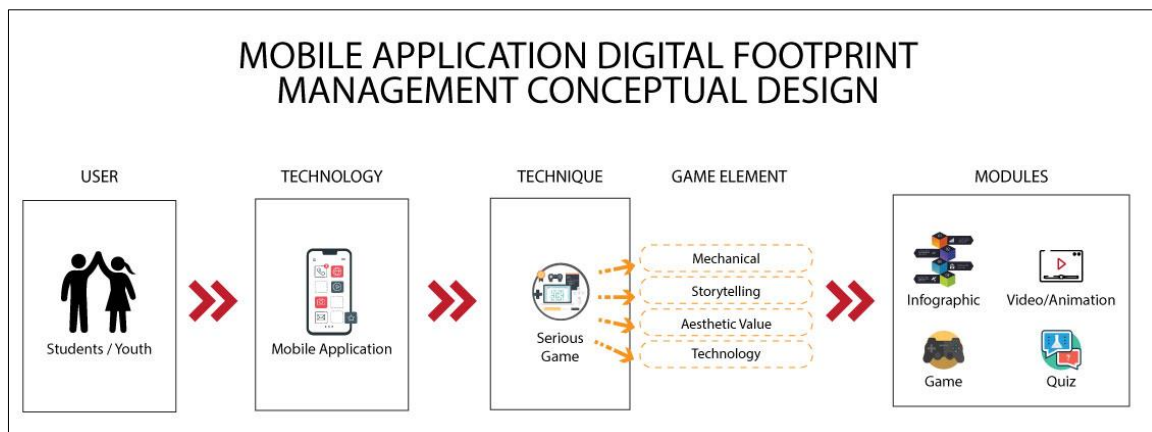


FIGURE 1. A Conceptual Model of Digital Footprint Awareness Mobile Application (e-Step)

The high-fidelity prototype is then developed based on the conceptual model that has been designed previously. The end results of this prototype development can be referred to in Figure 2.



FIGURE 2. Prototype of Mobile Digital Footprint Awareness Application

TRIANGULATION METHOD

The prototype application of the built-in digital footprint is then evaluated using the triangulation method, also known as a mixed method, that combines several research methods to study a matter (Petterson et al, 2018). Three methods have been used through the triangulation method, which is guessability, think aloud and observation. The guessability's evaluation technique is used to evaluate the user experience using the new interface (Abadi & Lim, 2012) that were analyzed in terms of navigation, input, color, menu layout/instructions/icon, and text display (size, color and text type). Meanwhile, think aloud technique relies on verbal thinking as data (Kumar, 2017), in which participants are asked to speak and deliver what they think while performing the interface-related tasks and each of these processes were recorded through observation.

GUESSABILITY

Guessability is one of the most widely used user experience testing methods to evaluate applications or systems on mobile devices that have limited screen size and can reduce the length of time users learn to use them (Abadi & Lim, 2012). In the same study, it is stated that this method is necessary to specify any symbolic input, in which the user used includes gestures or keywords to indicate characters or commands, depending on the label or icon to access the features or functions of the application. Furthermore, it also be used by anyone who wishes to design a set of symbols that have a high guessability level, or to evaluate the level of guessability of existing symbols.

The guessability of a system determines the user's initial experience including the user's initial attempt to gesture, type commands or use the button or menu item successfully even if the user lacks knowledge of the relevant symbols. Furthermore, a higher predictability level is more important when using small devices for computing other than desktops. This is because users have a limited time to learn to use application or systems on mobile devices (Wobbrock et al, 2005). Previous research conducted also demonstrates a user-based design approach that is used to maximize symbolic inputs because the quality of symbols allows users to access through these symbols even if they lack common knowledge of the symbols. In addition, the systematic and accuracy of the learning system is also refined when this technique is applied to multiple domains. They consist of gestures, command keywords, voice commands, text labels and icon designs. (Wobbrock et al, 2009)

The guessability procedure for testing of user experience on digital footprint awareness application also involves symbolic input designs such as its positioning and icon designs, links, labels, and image usage on the application. The task list is given to participants and

asked to evaluate each symbolic input associated with the evaluation. Each comment and suggestion from the participant is noted and recorded to be used as a guide to improve the application interface design and functionality.

THINK ALOUD

Throughout the guessability session, participants are also required to voice out and communicate what is in their minds as in the form of suggestions or comments related to interface functions and designs by using think aloud method. The instrument used involves participants who interact with the application interface. Thinking aloud is a direct observation tool for testing participants that requires the users to think verbally during the evaluation (Zan Azma Nasruddin et al, 2018). Its purpose is to determine the user's expectations and to identify the confusing aspects of the system as well as problems in the system that can hinder the user experience.

According to Kumar(2017), there are two types of verbalization procedures namely Retrospective Think Aloud (RTA) and Concurrent Protocols (CP). For RTA, participants are required to explain and enlighten their cognitive process after the main task of writing was conducted. The validity of the information acquired using retrospective verbalization depends on whether the report is promptly requested or after a period of time after completing the test. Should a participant give immediate feedback, they are likely to give information stored on short term memory. Whereas the retrospective postpones it, resulting in the Zeigamik effect, that is, participants having a tendency to forget goals once they have been accomplished. The lack of this procedure is a retrospective report having no legitimate view of the cognitive process that is denied by short-term memory throughout the writing evaluation.

Compared to the RTA, CP helps resolving the retrospective procedure flaws. This is because the participants need to communicate and voice out everything that they are thinking of while writing as well as to give a password to the sequence of events that enters their train of thought when performing the task. CP focuses more on the decision-making process while retrospective focuses on decision results (Kuusela & Paul, 2000). This process also requires researchers to record audio for analysis and track processes and decision-making patterns. Since verbalization is simultaneously collected during the assessment, participants can remember the information as well as verbalize it directly.

OBSERVATION

The observation session also has been added and conduct on user experience testing for this application. Observation method is an evaluation method aiming to collect data by scrutinizing user experience with the product (Barendregt et al, 2003). This is done to determine the quantitative measures such as efficiency, effectiveness and overall satisfaction of the application (ISO 9241-11). The approach is to have a session with end users to observe them during the course of assignment. During observation, the users are required to perform a few tasks using the prototype application. Every action, interaction, in-application navigations as well as comments when interacting with the application is recorded. An extra video camera also used to record facial expressions, body language, keyboards, mouse or other parts of the external user environment. Lastly, users are required to answer a survey concerning other subjective inputs with products such as easy use and level of satisfaction.

e-STEP USER EXPERIENCE EVALUATION

User testing has been carried out in order to meet the stated objective. User testing is one of the analysis approaches that are known as test methods to assess usability. The aim is to analyze the behavior and reactions of actual users when performing specific tasks (Barnum, 2011). Then it is possible to examine the way they communicate, and recognize any problems in this interaction. In the study, the three test methods namely guessability, think aloud and observation has been conducted simultaneously for two main purpose which are a) to test the user experience on the digital footprint awareness application and b) to determine the validity of content and context of media in the application. Among the modules involved are a) Main Menu; b) Side Menu; c) About e-Step; d) Let's Read the Tips; e) Let's Watch Video; f) Let's Play Game; g) Quiz and h) Exit. Each participant was asked to evaluate each design element including the color, size and font/text style, icon, button and links used while testing the usability level of every function and in-application navigation. This is a concurrent methodological approach based on triangulation as it included the gathering of quantitative data analysis of user satisfaction, as explained below.

SAMPLE SELECTION

A total of 14 participants consisting of polytechnic students aged 18 to 25 were randomly selected to involve in this session. Participants are selected based on user target of this application development that was set for youth user at the beginning of the development phase. According to the Youth Organization and Youth Development Act 2019, youth groups are at least 18 years of age and no more than 30 years in the current year. Therefore, the characteristics of the evaluation participants must be within the target user group for the testing to be effective. In addition, there were seven researchers also involved as facilitators to assist throughout the evaluation session. A facilitator is responsible for assisting, observing and recording observation during the session.

TRIANGULATION USER EXPERIENCE TESTING PROCESS

User experience testing session via triangulation techniques such as guessability, think aloud and observation are carried out simultaneously and consist of several steps such as below:

1. A facilitator chooses two participators to browse the digital footprint awareness app (5-10 minutes)
2. Participants are given a brief explanation of each evaluation, the usability concept and the task scenarios that needs to be solved. The task scenario is designed by researchers to ensure that each feature, function and symbolic input design can be evaluated
3. The facilitator asks a simple question to stimulate what opinions the audience is thinking about to be heard by the observer (researcher).
4. Participants are allowed to speak out on any flaws, defects or aspects of the application regardless of design or function.
5. The researcher records the answers given by the participants and jots down the information, either comments or suggestions.

RESULT AND ANALYSIS

The test results of user experience using three methods specifically the guessability, think aloud and observation has been recorded and evaluated by the researcher. The following is an analysis of the information obtained from the respondents based on the digital footprint awareness application to view the suitability between application interface and the respondent.

TABLE 1. Test Results of UX Digital Footprint Awareness Application

Feature/ Function	Test Results
Symbolic Input	<ul style="list-style-type: none"> Icon Uses more colours Increase icon space for easier understanding (side menu) Text space to icon too close No clear guideline Text Text size too small, difficult to decipher Spacing too close to each other Too much use of text Use of font not suitable and unattractive Inconsistent size and type of text Choice of words and sentences that are difficult to understand (Quiz)
Page Layout	<ul style="list-style-type: none"> Screen space not fully utilized Dull order of information Infographic poster cannot be read fully (no function of scroll/zoom)
Navigation	<ul style="list-style-type: none"> There are some navigation links that do not work as they should There are some pages that do not have navigation links to previous or next page Unclear usage of navigation, no feedback available
Feedback	<ul style="list-style-type: none"> No feedback available (Quiz) Too firm of a feedback (“Exit”)
Game	<ul style="list-style-type: none"> No navigation provided to enable users to return to main menu Guideline for the activity is not understood Existing guide is in text form, not particularly interesting Unsuitable choice of games

Table 1 shows the results of user experience from testing that has been conducted. Based on the eight tasks performed by users, the feature and function that are need to be improved in terms of user experience are as below:

SYMBOLIC INPUT

1. **Icon:** The designed icons are not particularly eye-catching in terms of color and tight space between each icon. This results in difficulty for the user to comprehend the page and in turn takes a long time in searching the related icon.
2. **Text:** Text size used is rather small and its spacing is too close to one another, which causes trouble understanding in the user. The consistency and selection of text types also does not make it comfortable for users to read and so they tend to skip the page. Besides, the use of long sentences and words on the Quiz page also renders boredom in users and as a result they do not focus in completing tasks. This response defeats the objective of the application, that is to give awareness of the digital footprint.

PAGE LAYOUT

Screen space is not fully utilized, and the order of information is organized in a dull manner. This will lead to user failure in focusing on the page and information over a long period of

time. Therefore, it should be consistently organized to make it easier for users to find desired information on the device screen.

NAVIGATION

There are some navigation links that do not work as they are supposed to. For example, when the user presses the "Back" button on the Let's Read the Tips Page, the user will return to the main menu instead. Additionally, some pages do not have links to return or go to the next page and users are not provided any feedback on what to do next.

FEEDBACK

There is no feedback on the Quiz that stipulates or notifies the user whether their selected answers were correct or false. One suggestion is to incorporate colors or sounds to make the quiz session more interesting and interactive.

GAME

Users have a tendency to give up because they do not understand the game. Even though a guide has been provided, most players rarely read the guide beforehand which leads to inability to grasp how to play. This is due to the fact that the guide provided is in text form, thus not pleasing to the eye because of its dull design. This causes the user to skip a move. Some suggestions include guiding through short and interactive videos before playing to tackle this issue.

In addition to the observations made by the facilitator, some ideas and suggestions were put forward by the participants during the testing. These ideas and suggestions are classified according to the features of the page design that include text type, use of color, navigation, icon selection and interface layout and in-game game functionality. The list and details of these proposed improvements can be found in Table 2 below.

TABLE 2. Recommendation for Improvements in Digital Footprint Awareness Application

Feature	Recommendations
Text	Choice of text colour must be consistent with page and its function Use appropriate spacing between text Add a video as an explanation/guideline
Colour	Choice of bright colours that are appropriate with each function Use a systematic colour palette
Navigation	Acknowledges the user when leaving the app Navigation for every menu should be clear, accurate, well-functioned and available in every page
Icon	Icon design should be clear and font type serif should be used to appear interesting Use bright colours
Page Layout	Ensure space between text and icon to be suitable and appropriate Structure and reorganize every feature and function well to maximise screen space Menu Bar position should be consistent Add the <i>scroll</i> , <i>zoom</i> functions for the infographic display
Game	The quiz should be based on riddles to make it more interesting and interactive Difficulty of the game must be checked accordingly Instructions of the game must be provided and displayed in an interesting way Game navigation must be clear

Feature	Recommendations
	Reduce the use of text and add elements of videos and images

CONCLUSION

UX testing conducted at this stage provides reliable and meaningful feedback as the participant agree with the importance of the e-Step application development in education youth about digital footprint in the cyber world but there are some usability issues that need to be improved in order to ensure that important information can be delivered to the user effectively. The UX testing process for this application uses triangulation techniques consisting of three different methods namely guessability, think aloud and observation. From the UX perspective, triangulation methods bring together a multi-faceted approach to obtaining as many views as possible from multiple perspectives to obtain the most accurate representation and user needs. While there is some negative feedback that needs more attention either from a usability or implementation perspective, it can help in terms of better application development. One of the implications of this study is the importance of evaluating the user experience to validate user needs while providing an overview of the usability of the e-Step application as well as discussing the solution methods for system improvement.

Among the limitations of this study are the time commitment required by participants and facilitators as well as the need to bring them together to conduct this testing more effectively. In addition, the lack of affordability to the wider population is due to the specific characteristics of the participants and lastly is the limited nature of the data in that the number of respondents often requires follow-up surveys or other quantitative methodologies before making final decisions on the usability issue.

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