

Usability Evaluation of Confirm-A Learning Tool towards Education 4.0

Hidayah Sulaiman
Information Systems Department
College of Computer Science &
Information Technology
Universiti Tenaga Nasional
Putrajaya Campus
Malaysia
hidayah@uniten.edu.my

Nurdiyanah Suid
Information Systems Department
College of Computer Science &
Information Technology
Universiti Tenaga Nasional
Putrajaya Campus
Malaysia
nurdiyanahsuid@gmail.com

Mohd. Azree Bin Idris
Teaching & Learning Centre
Universiti Tenaga Nasional
Putrajaya Campus
Malaysia
Azree@uniten.edu.my

Abstract— In the advent of the emerging technologies, globalization and innovation, traditional way of learning may not keep up with the needs of the current digital natives. The evolution of education from Education 1.0 to Education 4.0 can be seen to have significant differences in terms of curriculum and infrastructure. Education 4.0 emphasizes more on the self-directed learning assisted by the use of technology. This heutagogical approach may still use the technology of E-learning in improving the learning mechanism. This study focuses on a specific educational tool to assist primary school children in self-directed learning according to their own pace and levels of learning. The features of the web educational tool is observed and assessment questions were distributed to a number of respondents as a preliminary test. The preliminary testing was done to five respondents from different background. Think aloud technique was used to observe and the feedback is recorded for further analysis. Outcome of the usability test proves that different background of respondents have different levels of difficulty. School children that rarely use the Internet was having more difficulties to use the tool as compared to other children who frequently use the Internet. Results of this study will also serve as a guide to the Education 4.0 developers in understanding the needs of the targeted user whilst providing a better platform for self-directed learning.

Keywords—*e-learning, education 4.0, primary education, usability*

I. INTRODUCTION

The education industry has evolved from the common traditional face-to-face learning to a more technology based learning method in moving towards a more self-directed learning approach. The needs and requirements of the upcoming digital native generation is far more complicated and demanding from the way it was 10 or 20 years ago. Digital native is a person who grows-up or born in the digital age, rather than being familiar with the digital systems as an adult [1]. These digital natives are exposed to technology since they were young, hence changed the way they interact

and respond to digital devices namely the ones used for educational purposes [1]. In meeting this unique learning needs of digital natives, educators require a paradigm shift from traditional teaching methods, which require an immense amount of attention span by these digital natives that they are not able to provide [2]. Hence, the use of E-Learning tools that is supposedly able to provide a more familiar and interesting environment for these students. Teachers now not only struggle with their own proficiency levels with technology but also try as best as they can to integrate technology into the learning approach. However, not all educators are ready towards this paradigm shift, where some show immediate resistance towards the integration of digital tools especially when the tools are not designed in an acceptable and usable manner [2]. Although there are challenges to incorporate technology in the learning processes, however, it is very important for teachers to understand that these tools are natural and useful for these digital natives [2]. These tools provide a self-directed approach that has evolved beyond the traditional pedagogical concept. This approach is also known as heutagogy. Heutagogy is an approach to teaching and learning, where learners are independent and the emphasis is on the development of learner capacity and capability [3]. This is to ensure that the learners are well-prepared for the complexities of today's challenging environment. The heutagogy approach sets as a theoretical underpinning in applying emerging technologies for distance education and guiding learners through a distance education practice [3]. Some of the applied approach for heutagogy have evolved to the use of advanced platforms such as the social media. Nevertheless, in the context of a developing nation such as Malaysia where not every learner has an experience using the computers and furthermore the Internet, hence the use of advanced E-Learning tools is still applicable.

The purpose of this study is to provide a usability analysis on an interactive web-based e-learning tool to improve learning in primary education. In the Malaysian education system, the existence of major examinations in

selected year of education is still prevalent. In order to best serve and support the effective learnability amongst these examination candidates, school teachers are doing their best in trying to provide extra practices and assignments where students may attempt by themselves afterschool. Among the initiatives that was introduced is to enroll students in E-Learning platforms created by various Malaysian developers with some charging minimal fees and some are accessible freely through the subscription of the school. E-learning have been found to be the most effective to attract school learners namely the digital natives in primary schools. Hence, it is important that the developers understand and equip the students with suitable learning facilities through the utilization of flexible and high quality technology. E-learning is still seen to be in line with the theoretical concept of heutagogy where it is able to provide flexibility in how and where students choose to learn. Thus, allowing students to learn in their pace in accordance to their level of learnability while simultaneously remain consistent with the syllabus provided at school [5]. The use of multimedia features, such as videos, games and interactive quizzes has been suggested to promote effective means of education [6]. Although e-learning have been implemented in many primary school settings, the usability of these e-learning tools requires further exploration.

The main expected outcome of the usability testing is to ensure that the students are comfortable and able to use the tool with very minimal instruction [10]. Usability evaluation is an analysis of a prototype or system where the aim is to provide feedback in the iterative development process or further improvement of computer applications [9]. Usability evaluation guides in the development process to recognize and understand problems faced by users. It helps to understand the underlying causes of problems and plan the changes to rectify the problems [11][12]. Hence, it is imperative for every educational E-Learning tool to undergo usability evaluation in ensuring that the results would help to redesign the tool in order to increase the interest, motivation, and provide active participation among the users.

II. EVOLUTION OF EDUCATION

Traditional learning is the usual in-class learning where teachers or instructors teach and guide students through the subject. Traditional learning is the learning under the scope of classroom, viewed as teacher-center and static. This is traditionally inherited from Education 1.0 where in the early years education was limited to few privileged people. The learning content were largely influenced by religious teachings and executed through very informal methods [13]. Moving forward beyond the Industrial Revolution, the concept of education changed towards the development of people and providing them with basic learning and skills [13]. This is where education began to be the primary responsibility of the state government. It was encouraged that enrollments

across all ages and levels of society. With the success of understanding the value of knowledge that could change people's lives and way of living, this promoted Education 2.0, with the beginning of printing materials and establishment of higher education. The process of teaching concentrated more on a formal higher education concept where both academics and research have started to influence the way of learning [13]. In this era, well established universities were formed to produce new age scholars who developed practical learning to prepare students to manage their social, economic, and political affairs [14]. This concept of learning went on for a few decades and was adopted by many other countries around the world. With the advent of the Internet, high-end computers by giant tech companies such as Microsoft and Apple, the technology has impacted almost every aspect of our lives including the education industry. This sparked the evolution of Education 3.0 where technology is used as a platform to access education and changed the ways of learning [15]. The traditional learning styles of lecturer as the sage on the stage has been transformed with the integration of new tools and technologies in teaching [4]. This mechanism has allowed students to learn virtually whilst having the targeted information delivered to them effectively. With the ever increasing ways of innovating technologies in making access better, cheaper and effortless, the education industry faces a new set of challenges in keeping up with the technology and the assimilated digital learners [8]. Students are now the center of the new Education 4.0 concept. Education 4.0 provides empowerment to students in structuring their learning styles and pace [7][15]. It is also known as learning personalization to provide better learning experience. Students will have complete flexibility to design their own learning goals. The differences between Education 1.0, Education 2.0, Education 3.0 and Education 4.0 in terms of curriculum, pedagogy and infrastructure are summarized as per Table 1.

TABLE I. LEARNING EVOLUTION

Stages	Curriculum & Pedagogy	Infrastructure
Education 1.0	Unstructured and undocumented, Person to Person	Adjacent to religious regions, in gurukul, church, or mosque – with strong connects with the society
Education 2.0	Structured and rigid in class teaching One-to-many mass teaching systems with a fixed curriculum	Evolution of university campus - large physical spaces with study halls, residences and recreation areas

Education 3.0	Rigid curriculum but some flexibility through online modes of learning	Some investments in technology infrastructure in addition to the physical campus based infrastructure
Education 4.0	Increased innovation in teaching methods, demand for an improved learning experience, availability and personalization	Technology has been the major impetus for this shift toward personalization. Learning tools to be available at anytime, anywhere

III. RESEARCH METHODOLOGY

This study has conducted a usability evaluation on web based E-Learning tool that is known as Confirm-A. This tool is created for primary and secondary students to have additional practices for all subjects required in major examination. Although the major examination will only be for students of Year 6 (12 years old) in primary schools, Form 3 (15 years old) and Form 5 (17 years old) of secondary schools, the access to Confirm-A is still provided to all years of primary and secondary education. The question bank created is also tailored to every level of the schooling years. The usability evaluation was conducted to end users of Confirm-A as a preliminary test. A set of tasks was created as an instruction to the users in using the tool. Limited assistance was provided and users had to maneuver the tool on their own based on the task given. Think aloud protocol is used in the usability test of the Confirm-A tool in obtaining direct feedback from the end users. The feedback from the think aloud protocol will provide a better idea on the usability aspects. The think aloud protocol is analyzed through a basic qualitative content analysis approach. The researcher also evaluated the behavior of the user while they are using the system to complete the tasks given. The preliminary test was done to four end users who can be categorized as experts, experienced users and primary school users. Experienced users are adults who have familiarity with the Human Computer Interaction concept, primary school users are actual end user that use the system, while the expert is a person with professional experience in the area of interactive design. All users from the different categories are first time users or the Confirm-A tool. Figure 1 below illustrates the design of the usability evaluation.

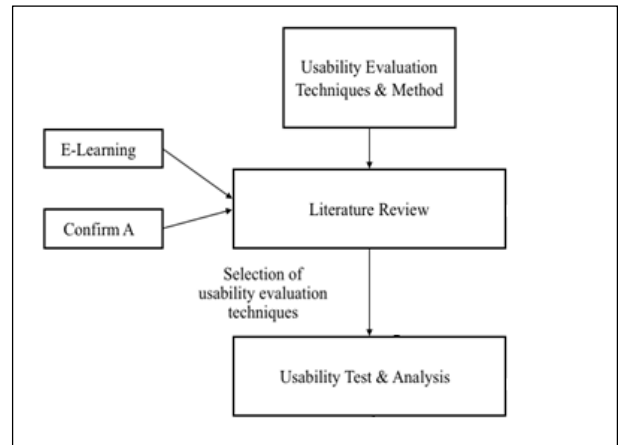


Fig 1. Research design for the usability evaluation

The tasks created for the evaluation was organised in a structured manner on how a user is supposed to use the system. It is to provide precise and accurate instruction on the tool. Prior to the evaluation, users were briefed about the system and the tasks given. The first test was conducted with the experienced users. Two users were selected and conduct the tasks individually. This was to obtain feedback from the perspective of someone who was already familiar with the usability and interface design of a system. Their feedback is observed and recorded for further analysis. The second test was conducted with the primary school children. Two of them were selected and will also conduct the tasks individually. Explanations were given on the tasks to provide more detail as they were first time user of the system and are at the age of 12 years old. However, they would have to find and carry out the tasks by themselves. Their feedback will be more crucial as they are the ones who will use the system. All of their feedbacks is gathered for further analysis. The third test was conducted with an expert, who had a broad knowledge usability, HCI and interactive design. The method of evaluation is the same as the other groups, using tasks and think aloud protocol. Table 2 illustrates the tasks given to all groups of users.

TABLE 2. USABILITY EVALUATION TASK LISTS

Task No.	Task descriptions
1	Login
	1. Login to enter the system,
2	Finding the guest username and password
3	Login with the given guest username and password

4	Find the page to do the exam practices (Question Bank)
	1. Click Question Bank 2. Choose subject to be done 3. Click Do Question
5	Answering the question (random questions)
	1. Read the instruction of the question 2. Give an answer to the question in the space provided
6	Submitting the answer
	1. Click the Submit button
7	Finding the feedback for the answer
	1. Locating the feedback given for each question answered
8	Find the record page for the answer answered (Progress)
	1. Click Progress
9	View the ranking of another users
	1. Click Ranking 2. Choose to view the ranking according to: • No. of question done • Percentage • School (Taman Bukit Indah) 3. Click View Ranking
10	EXTRA: View the progress of a friend named 'Daniel'
	1. Click My Friends 2. Find friend named 'Daniel' from the list of friends OR using the search bar option.
11	Logout

IV. ANALYSIS & RESULTS

A total of five users are selected from three groups of users. Results indicate that the primary school children had different difficulties in using the system as one of them had no experience using an e-learning system, but are familiar with using normal webpages and good with technologies.

Whereas the other who also never used an e-learning system before, but had an average skill with technologies.

A. Confirm-A Tool

The Confirm-A tool was developed to provide a platform for digital native students to use an E-Learning tool as a motivation towards the subjects taught in school. The main page allows users to view modules available at the website. Registered students can answer quizzes and the result of the quizzes will be calculated and stored. Teachers may view their students report and manage questions at the website while the administrators manage the systems related matters such as registration and passwords. Question displayed will be based on the selected subject by the student. There are multiple choice questions and fill in the blank type of questions. Students will need to enter the answer in the space provided, and click Submit to get the feedback from the system.

B. Analysis of Usability Test

Table 3 describes the time spent by the users to complete all tasks. It is observed that experts with usability expectations struggle with using the system for the first time as the familiarity on the expected buttons, links or icons are not directly visible and familiar. As for the primary school students, it is expected that they would take some time to familiarize with the tool. Given that they have used other educational tools before, hence the time taken to familiarize is of average rate since the tool may not have similar look and feel. The average time recorded is the total time taken to do task 1 to task 11.

TABLE 3. AVERAGE TIME TAKEN BY USERS

User	Number of participants	Maximum time in minutes	Minimum time in minute	Average time in minutes
Experienced users	2	8.35	8.11	8.23
Primary school children	2	15.12	12.35	13.74
Expert	1	37.08	37.08	37.08

Table 4 below described in detail the time taken for each user to complete each tasks and the completion status.

TABLE 4. DETAIL TIME TAKEN

		Experienced user 1	Experienced user 2	Primary School Children 1	Primary School Children 2	Expert
T1	Time	1. 5 4 m	54 s	5 4s	1. 02 m	1.3 6m C
	Statu s	N C	C	N C	N C	
T2	Time	15 s	54 s	4 3s	55 s	20s
	Statu s	C	C	C	C	
T3	Time	37 s	9 s	2 9s	1. 15 m	C
	Statu s	C	C	C	PC	
T4	Time	27 s	20 s	7s	10 s	4s
	Statu s	C	C	C	C	
T5	Time	31 s	30 s	1. 2 6 m	2. 06 m	1.3 0m
	Statu s	P C	C	C	PC	
T6	Time	2 s	1 s	1s	2s	25s
	Statu s	C	C	C	C	
T7	Time	1 s	6 s	2s	30 s	7s
	Statu s	C	C	C	PC	
T8	Time	20 s	5 s	1. 2 1 m	1. 15 m	1.0 0m
	Statu s	C	C	P C	PC	
T9	Time	39 s	18 s	2 3s	36 s	1.0 4m

	Statu s	C	C	C	C	PC
T1 0	Time	23 s	32 s	3 7s	1. 24 m	1.0 4
	Statu s	P C	C	C	PC	PC
T1 1	Time	5 s	4 s	5s	7s	2s
	Statu s	C	C	C	C	C

Status reference:

T = Task

C = Completed. User is able to complete task

PC = Partially Completed. User completes the task with help of hints / User completes the task after doing some errors at first.

NC = Not Completed. User failed to do task. Need to show how to do the task.

Figure 2 illustrates the average time taken by each user in completing each of the tasks given. It can be seen that the Confirm-A tool requires some form of familiarity with using similar applications in order to be able to locate some of the basic elements in the Confirm-A tool such as Login, find questions and Logout. As for the task of answering questions, it is understandable that the two primary school children would take a longer time in solving some of the questions attempted.

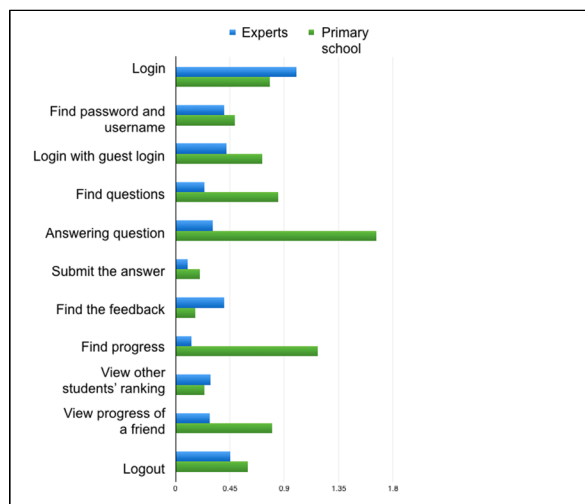


Fig 2. Tasks and time taken

V. DISCUSSION

From the preliminary evaluation results, the primary school children took longer time than the experts to answer each

question. The longest time taken to answer was during accessing the question bank. Most users were having difficulties to understand how to write the answer, how to submit and how to find for the feedback. Users also took some time to login to the system as there is no obvious password displayed or instruction to login. From the think aloud analysis, the students stated that it was quite confusing to find the progress tab, therefore explained the long time taken for them to complete the task. E-Learning web based system is an efficient tool to aid students for their revision. However, through the think aloud analysis of the expert, the tool has to be designed properly and not only for the content of exam questions. The Confirm-A tool has a lot to improve in terms of the usability aspects. The enhancement on usability will ease the learning process of the students whilst using the system. The students should feel comfortable in order for them to continuously use the system in the future [7]. Hence, the system has to be improved in order to provide a better interface and content to the students.

VI. CONCLUSION

In realizing the heutagogical concept of Education 4.0, the Confirm-A tool has been able to provide the self-learning experience in various subjects for all levels of primary and secondary education. The tool aims to contribute in enhancing the learning capability and interest among the digital native generation. The comments and feedback from the experts, experienced users and students involved the usability evaluation of this study indicate that students clearly value the effort of providing such mechanism and it is anticipated to effectively support their personal learning progression. However, learning tools are not just about ensuring that the question banks are fully accessed, answered and marks are tabulated. It requires interest and motivation for students to continuously use the platform for their learning at anytime and anywhere. Hence, the usability aspects of a good learning tool have to be addressed in ensuring not only that learning takes place but the platform is also constantly providing them with engaging interactivity to avoid abandonment of the learning tool once they have found a similar and more interesting application. Future work for this study would involve usability evaluation of a larger scale with targeted students testing the usefulness, learnability and efficiency of the learning tool.

ACKNOWLEDGMENT

The authors would like to thank the participating users with their involvement in this project.

REFERENCES

- [1] Hicks, S. D. (2011). Technology in today's classroom: Are you a tech-savvy teacher?. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 84(5), 188-191.
- [2] Morgan, H. (2014). Maximizing student success with differentiated learning. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas*, 87(1), 34-38.
- [3] Blaschke, L. (2012). Heutagogy and lifelong learning: A review of heutagogical practice and self-determined learning. *The International Review Of Research In Open And Distributed Learning*, 13(1), 56-71.
- [4] Selim, H. M. (2007). Critical success factors for e-learning acceptance: Confirmatory factor models. *Computers & Education*, 49(2), 396-413.
- [5] Sun, P. C., Tsai, R. J., Finger, G., Chen, Y. Y., & Yeh, D. (2008). What drives a successful e-Learning? An empirical investigation of the critical factors influencing learner satisfaction. *Computers & Education*, 50(4), 1183-1202.
- [6] McBrien, J. L., Cheng, R., & Jones, P. (2009). Virtual spaces: Employing a synchronous online classroom to facilitate student engagement in online learning. *The International Review of Research in Open and Distance Learning*, 10(3).
- [7] Puncreobutr, V. (2016). Education 4.0: New Challenge of Learning. *St. Theresa Journal of Humanities and Social Sciences*, 2(2).
- [8] Nichols, M. (2008). *E-Learning in Context*. P.2 Nielsen
- [9] S. Ssemugabi. (2006). *Usability Evaluation of Web-based e-learning Applications: A Study of two Evaluation Methods*. University of South Africa.
- [10] Fitzpatrick, J. (2015). *A Usability Evaluation Research of a Web based E-Learning Application*. National College of Ireland
- [11] Rosson, M. B., & Carroll, J. M. (2002). *Usability engineering: Scenario-based development of human computer interaction*. San Francisco, USA: Morgan Kaufmann Publishers.
- [12] K. Qureshi, M.Irfan. (2009). Usability evaluation of e-learning applications, A case study of It's Learning from a student's perspective. School of Computing, Blekinge Institute of Technology.
- [13] JGerstein, J. (2014). Moving from education 1.0 through education 2.0 towards education 3.0.
- [14] Govindasamy, T. (2002). Successful Implementation of e-Learning Pedagogical Considerations. *The Internet and Higher Education*, 4(4): 287-299.
- [15] Harkins, A. M. (2008). Leapfrog principles and practices: Core components of education 3.0 and 4.0. *Futures Research Quarterly*, 24(1), 19-31.