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Developing and Assessing a Tool for the Evaluation of College Students' Digital Literacy: A Case Study of Khon Kean University

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Abstract: Digital literacy is imperative for digital citizens to live in a world full of information and ever-changing tools. College students need digital literacy skills to live and work in the future. It is necessary to develop a digital literacy evaluation tool that is consistent with an international conceptual framework, and to assess such a tool. The present study aimed to develop a mobile application for evaluation of college students' digital literacy. We first synthesized various conceptual frameworks for developing a mobile application and, subsequently, a mobile application was designed and created. Internal validity of the mobile application was established by experts investigating consistency between the developed mobile application and the conceptual frameworks, and external validity was ensured via a survey of students' opinions on using the mobile application. The developed mobile application was consisted of the following assessment components: find and use, create and innovate, identity and wellbeing, teach and learn, tools and technologies, and communicate and collaborate. It was also composed of three levels of assessment: beginner, intermediate, and advanced. Regarding student's digital literacy assessment, findings indicate that most of them have a high level of digital literacy.

Keywords: Digital literacy, mobile application, global citizenship, emerging skills

1. Introduction

Technology is now part of world citizens' everyday lives – from teachers to students, from farmers to traders. The pace in which new technologies emerge from their initial concept to widespread adoption is also much faster than ever before. New technology-related words are being added to the dictionary each year (All Aboard, n.d.). There are ever increasing tons of new websites and mobile applications that facilitate our everyday lives: from paying bills to ordering meals; from watching the latest movies to speaking with distant relatives; or for learning a new skill and collaborating with others (Organisation for Economic Co-operation and Development, 2011).

There is also no shortage of hype, with the pitch for new systems often becoming quite extravagant in their claims: some of these claims might be justified, but many might not. Somehow, we are to make sense of all this – judging claims, looking at what might or might not work in our context or what hybrid mixtures of approaches can bring to addressing some long-standing challenges we have faced as learners or teachers (Ng, 2012). Keeping up to date is not always easy, nor is feeling confident that one has really grasped the limitations as well as the capabilities of each system or each device. For the great majority of people, it is difficult to be aware of what kind of information out there that might be relevant or useful to their work, study, or lives (Digital Literacy European Commission, 2015).

Therefore, technology learning management is crucial. Students must improve their technological knowledge, skill, and literacy, i.e., their "digital literacy." Digital literacy has been taught as a separate subject or been integrated in other subjects in order to make sure that students possess sufficient digital literacy skills, including: finding and using, creating and innovating, identity and wellbeing, teaching and learning, using tools and technologies, and communicating and collaborating

(Mackey & Jacobson, 2011), as well as problem solving and innovation creating (Organization for Economic Co-operation and Development, 2011).

Based on a study by Tuamsuk (2017), 66.28 percent of high education institutions in Thailand had stipulated information literacy as a desirable characteristic of their graduates, and 79.07 percent had offered information literacy as a general education course or an elective course. However, no institution has initiated a concrete and inclusive set of goals for advancing students' digital literacy. There are merely schemes that aim to partially develop students' digital literacy in some limited aspects, e.g., information literacy, communication literacy, or collaboration literacy. The study argued for a comprehensive framework for digital literacy advancement as well as the development of digital literacy evaluation tool.

The present study aimed to develop a mobile application for the evaluation of college students' digital literacy (New Media Consortium, 2015). In addressing the objective, we synthesized various conceptual frameworks for developing a mobile application and, subsequently, a mobile application was designed and created (Johnson, 2012).

2. Definitions of Digital Literacy in Key Frameworks

Digital literacy involves obtaining, understanding, evaluating, and using information in a variety of digital technology contexts. Extending beyond traditional definitions of "mere literacy" (JISC, 2012) as a set of linguistic skills enabling reading (i.e., decoding and comprehension) and writing (i.e., transcription, composition) to build knowledge and communicate with others, digital literacy encompasses the knowledge and skills required for critically and effectively using digital information to achieve personal, civic, or workplace goals (Petronzio, 2013). However, the definitions of this construct vary depending on the extent to which they emphasize particular dimensions of proficiency within Digital Literacy, such as a focus on the use of specific technologies (e.g. the use of e-mail or web browsers) versus the ability to critically evaluate and apply specific information contents to answer questions or solve problems. For the purposes of designing an assessment of Digital Literacy as an SLO, examining the points of consistency and discrepancy among the definitions or frameworks for Digital Literacy helps ensure that the assessment will provide evidence of valued aspects of the construct (i.e. construct validity). The definitions of Digital Literacy were drawn from frameworks developed at state, national, and international levels. These frameworks serve as a basis for our proposed operational definition of Digital Literacy to propose a Digital Literacy assessment that serves the needs of higher education institutions (Mackey & Jacobson, 2011).

Based on the previous synthesis of existing definitions of Digital Literacy, we propose that Digital Literacy is defined as the ability to function in a knowledge society through the appropriate use of information and communication technologies to solve information problems, including the ability to research, organize, and synthesize information through digital technologies (New Media Consortium, 2015) and have a fundamental understanding of the ethical/legal issues surrounding the use of such information (Johnson, 2012).

Based on the synthesis of digital literacy frameworks from JISC, SCONUL, UNESCO and OECD as well as the contextual analysis of the performance of higher education students, Digital Literacy can be summarized into six domains as follows (OECD, 2005).

First, Information Literacy Skills: These refer to skills needed to find relevant information and data and how to apply such information in an effective way and subject it to scrutiny, whether for effective learning or for research, scholarship and professional purposes. Second, Creation and Innovation Skills: Being confident and empowered over the use of technologies to make new resource, express yourself, and take the opportunities to develop new approaches and ways of interpreting ideas and the world around us (SCONUL, 2011). Third, Communication and Collaboration Skills: Connecting with each other and sharing, regardless of distance or time. Fourth, Digital Technology Skills: The technical and practical aspects of the range of tools and technologies available and useful in the support of learning, teaching, research, managing and thriving in the digital age (UNESCO, 2006). Fifth, Digital Learning Skills: How to get the most out of technologies and materials to encourage engaged learning and make sense of new knowledge. Sixth, Ethical and Social Skills: understanding the nature of your online self, data and information, privacy and protection, and taking care of yourself, others and information, in ways that are ethical and respectful (JISC, 2012).

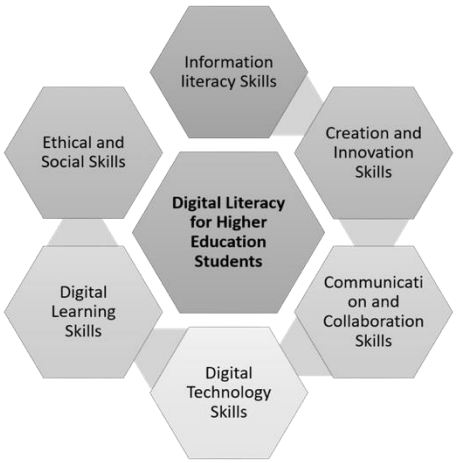


Figure 1. Framework of digital literacy for higher education students.

3. Methodology for the Design and Development;

The research team synthesized digital literacy evaluation frameworks from related studies and papers involving digital literacy learning management. Digital literacy evaluation frameworks were utilized to create Android mobile application evaluation tools. In terms of internal validity, the application was sent to expert application developers who are in the field of technology teaching management and instructional design in order to assess the application comparing to digital literacy evaluation framework. External validity, participants, who were 93 teachers and 218 students, were interviewed and answered questionnaires in order to evaluate the external validity.

4. Evaluating Internal and External Validity of the Mobile Application Development

4.1 Internal validity

Internal validity of the mobile application development was examined to assess the created mobile application in comparison with the framework by presenting the conceptual framework of design of assessment and the mobile application to seven experts in the fields of mobile application development, technology-based instruction and instructional design. Based on all experts' assessment, it was discovered that the framework of design of Digital Literacy assessment was consistent with the developed mobile application. Moreover, they offered some recommendations to enhance its efficiency and functionality such as enlarging the font size for better readability, designing the application with the same color scheme and using language and words to closely match international contexts.

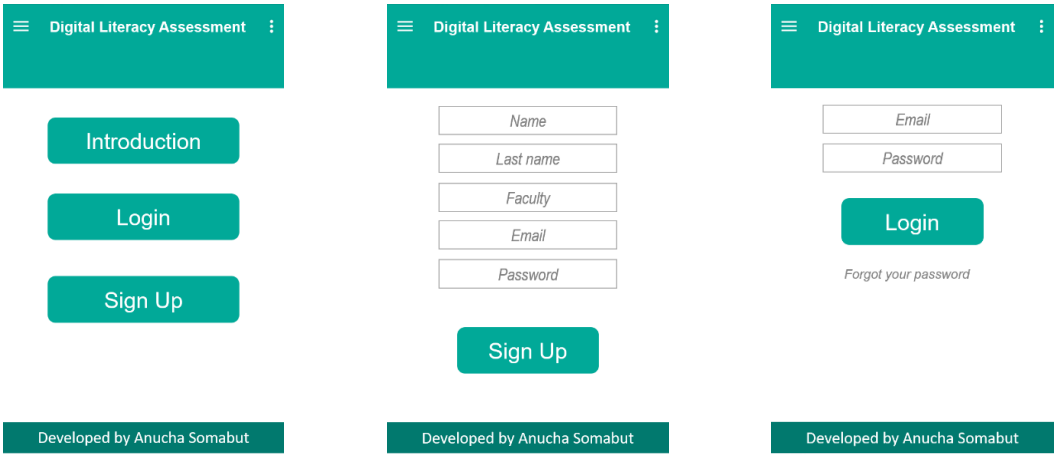
4.2 External validity

External validity of the mobile application development was investigated through a survey on students' opinions about using the mobile application. The results are as follows:

- Its interface was suitable in all aspects, namely font size, font colors, the background of the application and the menu position.
- In terms of its speed and interaction, the application could be used effectively, despite the slow internet speed, while its menus could interact with each other and function well.
- Finally, in respect of its language use, some words were academic and technical, so it may cause students' misunderstanding about the assessment. However, most students were able to read and understand the language used in the application.

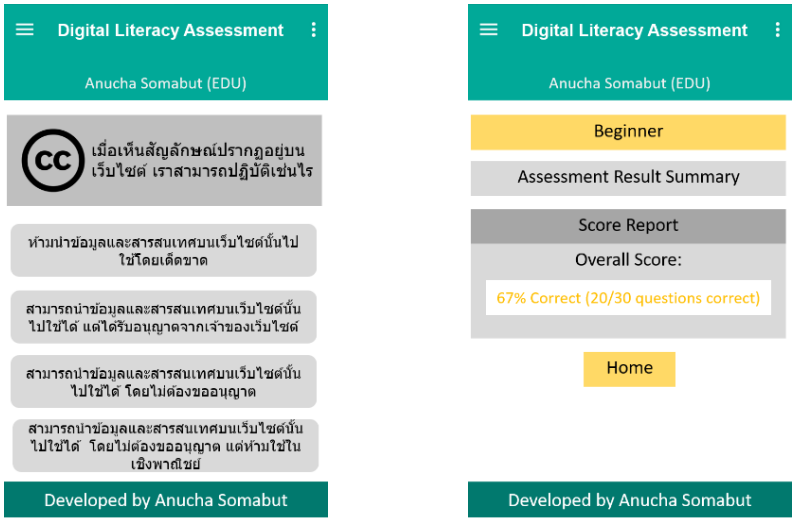
5. Designing Mobile Application for Assessment Digital Literacy

The developed application comprises a number of pages and functions: introduction, sign up or login, test, questions and choices, and result of the test. Figures 2 and 3 exhibited the components of the application.



(a) *(b)* *(c)*

Figure 2. (a) The 'Home' page of the application is composed of Introduction, Login, and Sign Up menus. (b) On the 'Sign Up' page, on their first use, students have to sign up to create their accounts by entering their email, password, and their basic information including name, last name, and faculty affiliation. (c) On the 'Log in' page, students have to log in using their registered email and password.



(a) *(b)*

Figure 3. (a) On the 'Test' page of the application is composed of a questionnaire and related choices. (b) On the 'Result' page, after students finish all the items in the test, the result will be presented. Students who pass the Beginner Level will gain access to the Intermediate and Advanced Levels. On the other hand, if students do not pass the test, they have to retake the test. The application will also report the evaluated topics whether they are correct answers or incorrect answers.

The application includes questions that aim to assess students' digital literacy in the aforementioned six areas. For example:

- Your brother wants to create an online journal to document a special event so that all of your friends can view the pictures and illustrations. Which of the following online communities will help him create this online journal? (a question on digital technology skills).

- Bundi wants to understand the concept of resolution in a digital camera. He needs your help. Which of the following options will you use to define the term "resolution" to Bundi? Select two. (a question on digital learning skills).

6. The Results of Student's Digital Literacy Assessment

The analysis of data obtained from the digital literacy assessment was conducted via interpretation of means and percentages. The findings indicate that most of them have a high level of digital literacy. Table 1 exhibits the percentage of students' level of digital literacy in each of the six dimensions.

Table 1
The percentage of students' level of digital literacy.

Dimension	Percentage of students		
	Beginner	**Intermediate**	**Advanced**
Information Literacy Skills	5.02	8.22	86.76
Creation and Innovation Skills	7.95	10.65	81.4
Communication and Collaboration Skills	7.43	13.69	78.88
Digital Technology Skills	13.69	16.44	69.87
Digital Learning Skills	15.45	19.34	65.21
Ethical and Social Skills	17.24	20.11	62.65

As shown in Table 1, most students have a high level of comtetency in terms of inforation literacy skills (86.76), creation and innovation sklls (81.4), and communication and collaboration skills (78.88). These findings imply that students might be familiar with or employ these skills on their regular basis. On the contrary, students have lower competencies in terms of ethical and social skills, digital learning skills, and ditigal technology skills. Thus, it is essential for teachers to focus on the improvement of these skills via a more integrated instructional approach.

7. Discussion and Conclusion

In developing the application for assessment of students' digital literacy, conceptual frameworks of assessment and the mobile application development were reviewed and synthesized. Subsequently, the study team designed and created the mobile application for the assessment, complete with the examination of its internal and external validities. The results showed that the development of the mobile application was consisted of these assessment aspects: accessing, evaluating, managing, integrating and communicating information. In the assessment aspect, there were three levels of digital literacy, namely beginner, intermediate and advanced. The development of the mobile application corresponded to Microsoft Digital Literacy Assessment and the Northstar Digital Literacy Project and Digital Literacy Assessment by ISTE in respect of conceptual frameworks, the assessment standard, and the classification of assessment levels. More importantly, this development of the mobile application applied the mobile technology and designed the assessment to closely match students' local contexts specifically as in Thailand.

It is hoped that the development of the mobile application for assessment of students' digital literacy would serve as a guideline for teachers' instruction in order to reinforce and enhance students' Digital literacy in each subject. Moreover, it would enable students to assess themselves and set a goal of self-improvement. Using this application in a real setting would promote effective learning, operation and resolution using digital technology.

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