DEVELOPMENT AND VALIDATION OF DIGITAL LITERACY SCALE FOR PROSPECTIVE EFL TEACHERS

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ABSTRACT. Teacher's digital literacy competence is crucially important in education nowadays, and a number of scholars have measured the quality of teacher's digital literacy skills. The available instruments have been developed to assess digital literacy skills of adolescents and graduate school students, while digital literacy skills of prospective teachers have received little attention. This study aimed at developing and validating an instrument to measure digital literacy skills particular to prospective Indonesian EFL teachers. To this end, this study piloted a theoretical model based on a review of the related literature, interviews with Indonesian EFL learners majoring in English Language Education Department and EFL lecturers in East Java, North Sumatera, Central Sulawesi, West Kalimantan, West Papua, East Nusa Tenggara, and Bali. Later, the results were used to verify and develop the digital literacy scale. After developing the scale and administering it to 336 Indonesian EFL learners from seven cities in Indonesia, the researchers validated the scale through both exploratory and confirmatory factor analyses. This study exposes a comprehensive picture of prospective teachers' digital literacy skills in EFL contexts in terms of eight factors: creative skill, technological skill, personal security skill, internet safety skill, problem-solving skill, informational skill, and communication or netiquette skill. This scale is a valid and reliable tool, and will be useful as an instrument on EFL teachers' digital literacy skills. The final form of this scale can inform policy development, curriculum design, and training initiatives for prospective EFL teachers targeting digital literacy competence.

Keywords: digital literacy scale, digital literacy skills, prospective EFL teachers, digital competence

INTRODUCTION

Information is now presented digitally. Digital information floods nearly all aspects of our life, including literacy practice in our classroom activities. Its rapid growth requires us, educators or teachers, to rethink, reshape, and retool our literacy practice and hence our literacy instruction. Prospective teachers, or EFL university students majoring in English Language Education, are a valuable resource in our society. Prospective teachers who are digitally literate will become twenty-first century teachers who are ready to integrate and implement digital tools in their language learning practices later, hence ensuring the quality of online education in this digital era.

Several experts give their insights to define digital literacy. For Rivoltella (2008), digital literacy is a term used to explain that modern people are now required to become active and conscious of information presented digitally in this information era. Dowdall (2009) defines digital literacy as an individual's ability, awareness, and attitude to use digital tools and facilities. Those digital tools and facilities are used for many purposes, such as accessing information, managing information resources, and communicating with others. Simply defined, digital literacy is a reading and writing practice using letters, numbers, images, and sound electronically. Similar to Dowdall (2009), Horning (2012) also defines digital literacy as the practice of reading and writing information that is presented through electronic formats. Meanwhile, Osterman (2012) states that digital literacy is a set of habits to use internet-integrated technologies for learning, working, and having fun. Broadening this definition, Erstad, Flewitt, Kümmerling-Meibauer, & Pereira (2020) explain the skill to decipher complex images, sounds, and texts and design new information by combining those multiple modes.

Based on all those definitions explained in the preceding paragraph, in this study, digital literacy is understood as an individual's ability to use digital technologies to read, write,

manage, process, and produce new information. The goal is based on the assumption that the more skilled or digitally literate an individual is, the more fluent that individual is in using technologies to excel in his or her life. To achieve this, teachers must make sure that students have the chances they need to learn in a digital classroom environment, where internet-based tools and technological facilities are integrated into our teaching instruction and classroom practice. This study therefore focuses on how to design and validate a tool to assess prospective EFL teachers' digital literacy skills, which is potential to be used to investigate students' digital literacy skills as well as for their self-evaluation purposes.

LITERATURE REVIEW

Becoming digitally literate means possessing a set of certain competencies or skills to use digital tools and electronic facilities. The first set of digital literacy skills is extracted from Gilster (1997), namely internet searching, hypertextual navigation, content evaluation, and knowledge assembly. Someone is digitally literate if he or she is able to use the internet to search for information or use it for information-related activities (internet searching), understand how the internet works (hypertextual navigation), critically evaluate and analyze information on the internet (content evaluation), and create new meaningful and reliable information from diverse sources (knowledge assembly).

Eshet-Alkalai (2004) describes a digitally literate individual as someone who possesses at least five literacies, namely photo-visual literacy, reproduction literacy, branching literacy, information literacy, and socio-emotional literacy. People who are digitally literate understand visually represented instructions and messages (photo-visual literacy), able to integrate pieces of information together and inject new or authentic meaning into that information (reproduction literacy), and will not easily "lost on the internet" since they are able to create a new pathway of learning and construct knowledge through navigating on the internet (branching literacy). They are always ready to doubt the information they receive, not take that for granted or think that all information they find on the internet is always valid and true (information literacy). As a result, they are very critical, analytical, and mature, and able to avoid "traps" on the internet such as virus-infected email, fake donation, predators disguised as friendly strangers asks for friendship on social media, and many more (socio-emotional literacy). In addition to that, he or she is they are willing to collaborate with others from sharing data and knowledge to constructing knowledge together.

Meanwhile, Bawden (2008) uses component as a term to illustrate skills required to become digitally literate. The components are four: computer literacy, background knowledge, central competencies, and attitudes and perspectives. Bawden explains that computer literacy is the basic skill of using computers in daily and work life, and background knowledge means the ability to use a previous set of knowledge on all types of information and digital media to understand new forms of digital information encountered. Bawden also explains that central competencies mean the skills to read and understand the information in digital and non-digital formats, create and communicate digital information, evaluate information, assemble knowledge gained, and able to deal with information offered in various formats. Attitudes and perspectives are the last components, where all skills and competencies in using digital tools and technologies must be grounded in a moral framework, competent to evaluate the value of information to be used in a particular situation, behave properly and sensibly in the digital environment, and understand the issues of privacy and security.

Another education practitioner, Heick (2013), chooses digital principles as a term to illustrate the main competencies that must be mastered by people nowadays. Those principles are comprehension, interdependence, social factors, and curation. Under these principles, an individual is able to extract ideas from a media (comprehension); understand that one media form always connects with another media form (interdependence); cite the source, share, store,

and repackage all information into his or her own message through appropriately selected media (social factors), and evaluate the value of information for long-term use (curation).

Furthermore, Jenkins (2015) argues that digitally literate individuals must have basic computer literacy, information and communication literacy, digital information literacy, and internet literacy skills. Having a basic computer literacy skill means knowing how to operate a computer and do internet-related activities such as create and send emails, locate programs and applications, and troubleshoot simple issues with their gadget, while information and communication literacy skill means knowing how to use social media wisely, for instance, to communicate and sharing information in multiple modes and formats. Digital information literacy skill is shown by, at least, knowing how to search for certain information on the internet responsibly and carefully evaluate reviews of products and services. Finally, internet literacy skill is shown by for example, how someone is skilled in determining irrelevant parts of websites and avoiding trash information, and combining technological tools to research, communicate, and perform various tasks.

The last set of digital literacy skills is from Law, Woo, de la Torre, & Wong (2018). They profile a digitally literate person as someone who has information and data literacy skills, communication and collaboration skills, digital content creation skills, safety skills, and problem-solving skills. Law, Woo, de la Torre, & Wong (2018) explain that information and data literacy skills can be seen when an individual is able to perform a number of tasks such as browsing, searching, filtering, evaluating, and managing digital data, content, and information. Later, they also explain that having communication and collaboration skills means that an individual is able to interact, share, collaborate, and engage in citizenship through digital technologies, as well as showing good netiquette. Furthermore, they add that being skilled in digital content creation such as able to integrate and re-elaborate digital content, as well as understand and apply knowledge on copyright, licenses, and programming. Finally, safety skills and problem-solving skills appear, for instance, when someone understands what he or she must do to protect his or her personal data and privacy, solve technical problems, and creatively use digital technologies to be in harmony with the environment.

All performances of digital literacy skills discussed by those experts are similar in three themes: using internet-integrated technologies (Bawden, 2008; Eshet-Alkalai, 2004; Gilster, 1997; Heick, 2013; Jenkins, 2015; Law, Woo, de la Torre, & Wong, 2018), processing information in digital formats (Eshet-Alkalai, 2004; Gilster, 1997; Heick, 2013; Jenkins, 2015; Law, Woo, de la Torre, & Wong, 2018), and communicating and collaborating with others in a digital environment (Bawden, 2008; Eshet-Alkalai, 2004; Heick, 2013; Law, Woo, de la Torre, & Wong, 2018). These themes, generated from the theoretical literature, were used as a theoretical model for the purpose of this research.

The available instruments were developed either for adult (Sheng & Cheng, 2017) to assess their skills in locating digital content, creating digital content, and communicating digital content, for non EFL teachers (Ergül & Taşar, 2023) and EFL pre-service teachers (Cote & Brett, 2018; Khaira & Andriyanti, 2020; Saud, 2021) to assess their computers skill, complete computer-related tasks, question their personal and professional use of computers, enquire about their interests in computer assisted language learning or CALL, for adolescences (Yildirim & Özturk, 2023; Rodríguez-de-Dios, Igartua, & González-Vázquez, 2016) to assess their technological skill, personal security skill, critical skill, devices security skill, informational skill, and communicational skill, and even for middle schoolers (Olur, 2021) to assess their cooperation skills, emotion management, information management, and awareness in digital environments. Meanwhile, digital literacy skills of prospective teachers, particularly in the context of EFL teachers in Indonesia, have received little attention. Thus, this present study addresses this gap by aiming at developing and validating an instrument tailored specifically to measure digital literacy skills of prospective Indonesian EFL teachers.

RESEARCH METHODS

This study is part of a national research project on prospective Indonesian EFL teachers' digital literacy skills in asynchronous learning. This project involves interdisciplinary team (with three researchers located at Universitas Ciputra Surabaya and Universitas Sintuwu Maroso Poso in Indonesia), covering the fields of English language teaching, management, and financial literacy. The project includes mixed methods: face-to-face interviews with EFL lecturers in seven universities representing seven provinces in Indonesia (in East Java, North Sumatera, Central Sulawesi, West Kalimantan, West Papua, East Nusa Tenggara, and Bali), and hybrid interviews and online survey with prospective EFL teachers across seven universities. The focus of discussion in this study is the development of scale used as an instrument of this project.

This study involved 35 EFL lecturers and 336 prospective Indonesian EFL teachers across universities in Indonesia. The 35 EFL lecturers were heterogeneous in terms of their age (30 – 60), gender (25 female, 10 male) and teaching experience (5-20 years of experience), and degree (31 masters and 4 doctors). The 336 EFL students were majoring in English Language Education, mostly female (n=275, 81.8%) and their age ranged between 17 to 30 years old with 19 years old as the most dominant age group (n=121, 36%). All learners had either smartphone or laptop to facilitate them in their learning experiences (n=336, 100%).

The procedures in this study consisted of three steps: creating item pool from theoretical framework and experts opinion, piloting the items, and testing its validity and reliability (Kazykhankyzy & Alagözlü, 2019). For the first step, a pool of potential items was generated based on the theoretical framework and interviews with 35 EFL lecturers from three universities as experts. They were selected based on their expertise in EFL literacy practices and interviewed for their expert opinions and insights on the components of digital literacy skills. These interviews were video-recorded and transcribed verbatim. Later, the results were crosschecked with the theoretical framework of this study. Based on the review of theoretical references and related literature, three main themes were extracted: using internet-integrated technologies, processing information in digital formats, and communicating and collaborating with others in digital environment (Table 1).

Table 1. Digital Literacy Competencies Extracted from Theoretical Framework and Expert Opinion

Theme Extracted from Theoretical Framework		**Digital Literacy Competencies based on Expert Opinion**
Using internet-integrated technologies	Bawden, 2008; Eshet-Alkalai, 2004; Gilster, 1997; Heick, 2013; Jenkins, 2015; Law, Woo, de la Torre, & Wong, 2018	able to use computer, digital tools and internet-integrated technologies, and navigate the internet
	Bawden, 2008; Jenkins, 2015	able to use digital technologies to solve technical problems and to be in harmony with the environment
Processing information in digital formats	Heick, 2013; Law, Woo, de la Torre, & Wong, 2018	able to search for, manage, filter, and store information for long term use
	Eshet-Alkalai, 2004; ; Gilster, 1997; Law, Woo, de la Torre, & Wong, 2018	able to create new, reliable and meaningful information from internet sources to communicate and collaborate with others in digital environment
	Eshet-Alkalai, 2004; Jenkins, 2015	able to evaluate the value of information (i.e., recognizing fake news and "garbage" information, avoiding traps)
Communicating and collaborating with others in digital environment	Bawden, 2008; Eshet-Alkalai, 2004; Heick, 2013; Law, Woo, de la Torre, & Wong, 2018	able to behave properly and sensibly in digital environment (i.e., understanding and showing internet netiquette, respecting others' privacy)

After crosschecking the results of interviews with experts, there were six competencies of digital literacy generated and furthermore were used to generate a pool of 44 items for the scale (Table 2).

Table 2. Tentative Competencies of Digital Literacy Skills

	Factors of Digital Literacy Skills	Number of items
1	Creating information from internet sources	7
2	Using internet-integrated technologies	8
3	Evaluating the value of information	9
4	Solving technical problems	7
5	Managing, filtering, sharing, and storing information for long term use	6
6	Behaving properly and sensibly in digital environment	7
	Total	**44**

The second step was piloting the pool with the items were on a Likert scale of one to four. Due to the purpose of developing the scale for prospective Indonesian EFL teachers, five EFL learners majoring in English Language Education who were not the intended participants were asked to read the scale and comment on its wordings. Based on this review, two items categorized in factor no. 1 and 5 were deleted for their repetitiveness and ambiguity. The scale, now 42 items, was piloted to 147 EFL learners. Later, it was finalized to the intended 336 EFL prospective Indonesian EFL teachers for its validity and reliability through exploratory analysis and confirmatory analysis.

FINDINGS AND DISCUSSION

As previously explained, the components of digital literacy were extracted from theoretical framework and experts opinion (Table 1), resulted eight competencies that were generated into 44 items (Table 2). EFL learners who shared similar characteristics with the intended respondents reviewed the pool of 44 items, where two items were deleted. The 42-item version was then piloted with 147 EFL learners. The findings showed 40 items of the version tested were valid and reliable at 0.870, which was satisfactory.

The researchers then examined the construct validity of this newly developed scale by conducting exploratory and confirmatory factor analyses. The outcome of exploratory factor analysis (EFA) revealed the presence of eight factors, which was against the tentative six factors or components previously extracted (Table 2), so the researchers revisited the theoretical framework and the experts opinion indicated in Table 1. Table 3 indicates the modification done of the competencies of digital literacy skills.

Table 3. Modified Competencies of Digital Literacy Skills based on EFA Results

Theme Extracted from Theoretical Framework	Theoretical Review	Digital Literacy Competencies based on Expert Opinion
Using internet-integrated technologies	Bawden, 2008; Gilster, 1997; Jenkins, 2015	able to use computer, digital tools and internet-integrated technologies
	Eshet-Alkalai, 2004; Heick, 2013; Gilster, 1997; Law, Woo, de la Torre, & Wong, 2018	able to navigate the internet through hypertexts and hypermedia and create new pathway
	Bawden, 2008; Jenkins, 2015	able to use digital technologies to solve technical problems and to be in harmony with the environment

Theme Extracted from Theoretical Framework	Theoretical Review	Digital Literacy Competencies based on Expert Opinion
Processing information in digital formats	Heick, 2013; Law, Woo, de la Torre, & Wong, 2018;	able to search for, manage, filter, and store information for long term use
	Eshet-Alkalai, 2004; Gilster, 1997; Law, Woo, de la Torre, & Wong, 2018;	able to create new, reliable and meaningful information from internet sources to communicate and collaborate with others in digital environment
	Eshet-Alkalai, 2004; Jenkins, 2015	able to evaluate the value of information (i.e., recognizing fake news and "garbage" information, avoiding traps)
Communicating and collaborating with others in digital environment	Bawden, 2008; Eshet-Alkalai, 2004; Heick, 2013; Law, Woo, de la Torre, & Wong, 2018	able to behave properly and sensibly in digital environment (i.e., understanding and showing internet netiquette)
	Bawden, 2008; Law, Woo, de la Torre, & Wong, 2018	able to protect his or her personal data and respect others' privacy

Table 4 indicate the modification of the competencies of each digital literacy skill based on the EFA results.

Table 4. Competencies of Digital Literacy Skills based on EFA Results

	Factors of Digital Literacy Skills	Number of items
1	Creating information from internet sources	4
2	Using internet-integrated technologies	5
3	Being trusted and protecting personal data	4
4	Evaluating the value of information	5
5	Solving technical problems	6
6	Managing, filtering, sharing, and storing information for long term use	5
7	Behaving properly and sensibly in digital environment	5
8	Navigating the internet and creating new pathway	6
	Total	**40**

Next, on the evidences resulted through confirmatory factor analysis, The KMO and Bartlett's Test of Sphericity showed .728 (p = .000, < .05) for 40 items. However, 18 items had to be removed since their factor loadings were less than .060 (see Table 5 for details).

Table 5. Rotated Component Matrix of Factor Analysis on the Items

Item no	Gist of the Item	Factors							
		1	2	3	4	5	6	7	8
14	Creating digital content for social media by editing another content already available on the internet (adding music, images, or videos)	.817							
13	Creating digital content for social media using apps or tools	.756							
11	Confident in sharing thoughts or opinions on other's social media post	.748							
12	Creating digital content for social media from music, images, or videos available on the internet	.704							
9	Storing important information on the internet for long term use		.864						

Item no	Gist of the Item	Factors							
		1	2	3	4	5	6	7	8
8	Locating information on the internet right away		.847						
7	Setting video on social media and website (YouTube and Facebook) to autoplay mode		.802						
21	All information shared on my social media is trusted			.854					
5	Using mobile data at home instead of home internet			.834					
6	Storing private data on the Internet (Email, Drive, or other cloud storages)			.820					
17	Comparing information on different websites to verify information				.768				
19	Blocking junk emails				.764				
18	Recognizing fake information on the internet				.751				
2	Connecting my gadget to WIFI without assistance					.779			
4	Solving technical problems (i.e. troubleshooting)					.702			
15	Sharing posts on social media using existing template						.869		
16	Sharing posts on for social media using template available on apps/tools (i.e. Canva)						.840		
22	Taking into account the appropriateness of information before sharing on my social media							.812	
20	All information seen on social media and messaging can be trusted							.793	
1	Using smartphone for internet browsing								.713
10	Confident in browsing across websites to choose information that best suits my needs								.679
3	Confused of website's sudden change in appearance								.678

After removing the 18 items from the scale, it was re-calculated to test its reliability. The scale was administered to 336 prospective EFL learners and found reliable at .711, which was lower than the Cronbach Alpha of the previous scale was and still satisfactory. The finalized scale now has 22 items: 15 favorable items and 7 unfavorable items (see Table 6). The unfavorable items (Items 3, 5, 6, 7, 12, 19, and 20) were reverse scored and recoded before the CFA analysis.

Table 6. Finalized Version of Digital Literacy Skills Scale for Prospective EFL Learners

Creating information from internet sources (factor 1, items 11, 12, 13, 14)
Using internet-integrated technologies (factor 2, items 7, 8, 9)
Being trusted and protecting personal data (factor 3, items 5, 6, 21)
Evaluating the value of information (factor 4, items 17, 18, 19)
Solving technical problems (factor 5, items 2, 4)
Managing and storing information for long term use (factor 6, items 15, 16)
Behaving properly and sensibly in digital environment (factor 7, items 20, 22)
Navigating the internet and creating new pathway (factor 8, items 1, 3, 10)

This research aimed to develop and validate digital literacy scale for measuring prospective EFL teachers' literacy skills. The final version of the scale consisted of 22 items on a 4-point Likert scale with 15 favorable items and 7 unfavorable items. The findings of this research pointed out that the theoretical model of digital literacy skills in this research was meaningful to measure the performance of prospective Indonesian EFL teachers when making meaning of digital information in the online learning context. In the theoretical model of the scale proposed in this research, digital literacy skills are a prospective teacher's ability of showing various competencies when using internet-integrated technologies, processing information in digital formats, and communicating and collaborating with others in a digital environment (Gilster, 1997; Eshet-Alkalai, 2004; Bawden, 2008; Heick, 2013; Jenkins, 2015; Law, Woo, de la Torre, & Wong, 2018). Those competencies are: skilled in using computer, digital tools, and internet-integrated technologies; navigating the internet and creating new learning pathway; solving through available digital technologies and be in harmony with the environment; searching for, managing, filtering, and storing information for long term learning use; creating new, reliable and meaningful information from internet sources to communicate and collaborate with others in digital environment; evaluating the value of information; behaving properly and sensibly in digital environment, and; protecting his or her personal data and respecting others' privacy.

In comparison to the previously developed digital literacy scales (Rodríguez-de-Dios, Igartua, & González-Vázquez, 2016; Sheng & Cheng, 2017; Cote & Brett, 2018; Khaira & Andriyanti, 2020; Saud, 2021; Olur, 2021; Ergül & Taşar, 2023; Yildirim & Özturk, 2023), this scale is more comprehensive as it is specifically designed to measure the digital literacy skills of prospective EFL teachers within the Indonesian context. This scale is useful to study prospective EFL teachers' competencies or skills in integrating and implementing digital tools during learning. A prospective teacher who scored higher on any competency or skill or on the total skills is a teacher candidate with better digital literacy skills than the others. To be specific, a prospective teacher who scored 1220 on navigating the internet and creating new learning pathway was considered a prospective teacher who was more ready in integrating and implementing digital tools in learning than a prospective teacher who scored 1062 on the same competency. The application of this scale is also useful to detect the areas of prospective EFL teacher's digital literacy skills that need improvement or intensive trainings.

CONCLUSION

The findings and discussion show that the digital literacy skills scale developed and proposed in this research is a reliable instrument for measuring EFL candidate teachers' digital literacy skills in integrating and implementing digital tools during online learning. This scale contains 22 items with competencies of creating information from internet sources (4 indicators), using internet-integrated technologies (3 indicators), being trusted and protecting personal data (3 indicators), evaluating the value of information (3 indicators), solving technical problems (3 indicators), managing and storing information for long term use (2 indicators), behaving properly and sensibly in digital environment (2 indicators), and navigating the internet and creating new pathway (3 indicators). This study contributes significantly to the field of digital literacy and EFL teacher education since the final form of the scale can be used not only to diagnose students' digital skills but also to be used in mapping students' skills that need improvement through training and therefore enhance the quality of EFL teacher education programs.

This study has several limitations. First, the respondents of this research were university students from seven universities in seven provinces in Indonesia. Second, the respondents were selected through convenience sampling method. Third, the constructs of this digital literacy skills scale have been prepared based on the theoretical framework and expert opinion

validation. Thus, it is recommended to replicate this research in a larger sample, such as teacher candidates across teaching disciplines and EFL novice teachers who teach content area courses, and educational practitioners or practicing professionals as well. Furthermore, by addressing gaps in measuring students' digital literacy for EFL contexts, the study also allows possibilities for future research to continue assessing the application of this instrument in larger samples and different learning context, and assessing its criterion validity and reliability.

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