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Design of seamless learning model to improving digital literacy skill in higher education

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Abstract

Education in the era of the industrial revolution 4.0 and society 5.0 emphasizes achieving various dimensions of life skills through digital applications and technology. One of these life skills is digital literacy. The learning model that follows the characteristics of the generation of the society 5.0 era is seamless learning. This research aims to describe the validity of the development model Seamless Learning Model for improving digital literacy skill. This research is a research and development that begins with the validity of the learning model. The subjects of this research were lecturer in ten higher educations in Indonesia, and 300 undergraduate students. The development model in this research is the Borg & Gall development model. Learning Development Model Seamless Learning has been produced has a level the validity of the model. Seamless learning provides a design that allows students to interact with various learning resources, such as peers, media, and other learning resources. This model makes students have digital skills wisely and can compare them with the natural world.

Keywords: Seamless leraning model, Digital literacy, Higher education

Introduction

We are facing the era of the industrial revolution 4.0, which highlights the development of science and technology as the basis for determining almost all aspects of people's life [1]. Success here, including in education, is determined by the extent to which the Internet and digital technology can be utilized. Education in the era of the industrial revolution 4.0 no longer sees science as an outcome or product of education; it emphasizes achieving various dimensions of life skills through digital applications and technology. One of these life skills is digital literacy [2]. Digital Literacy is one of the skills needed for living in the world in 21st-century learning [3]. This skill assesses skills based on how capable a person is of mastering information search interpreting it, and working in a digital environment [2]. Digital literacy is a skill in analyzing and understanding the information using digital tools and technology [4]. Digital literacy skills are related to how to use digital tools and how these digital tools can be utilized to improve cognitive, social, and ethical aspects to produce new knowledge [7, 6]. There are three dimensions make up digital literacy skills: the technical dimension, which is related to one's skills to use new technology in learning; the cognitive dimension, namely skills which are related to the ability to search, select and evaluate information so that it can form a complete knowledge, and social-emotional dimensions which related to skills in collaborating and interacting in forming and conveying information [5, 6].

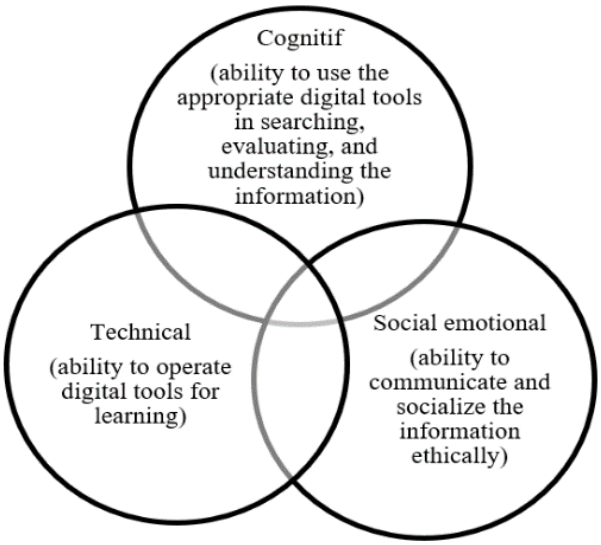

Figure 1. Digital literacy model (Ng, 2012)

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In today's educational field, it is easier for students to find information through digital means than through traditional methods or books. They spend most of their time in front of a cell phone, gadget, computer, or PC to complete learning tasks and carry out daily activities [8]. Their ways and learning styles are also different from previous generations. The era of society 5.0 makes students no longer able to determine when to study and where they study[9]. Learning in this era allows students to choose their way and learning style [10]. Emotional mood allows them to determine when and where they study. It also allows students to learn in various formal or informal settings, inside or outside the classroom, individually or in groups/socially, digital and non-digital media, and the physical and virtual environment. Continuity is the principle of this learning model. Media is needed to apply this model to connect students, material or assignments, and students. The media is in the form of digital tools or technology that can combine elements in seamless learning. This situation makes digital literacy skills compulsory for the generation of society in the 5.0 era.

The learning model that follows the characteristics of the generation of the society 5.0 era and which can

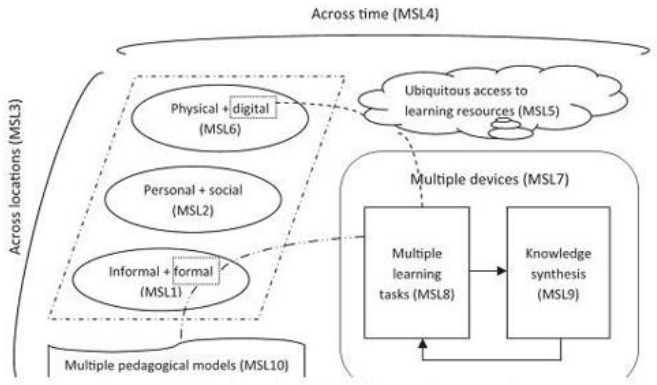

Figure 2. Seamless mobile learning visualization (Wong, 2012)

Seamless learning provides a design that allows students to interact with various learning resources, such as peers, media, and other learning resources. It includes concrete and digital experiences, both individually and socially, formally when learning takes place in lecture halls and in person and informally, outside the context of the place of learning in general [13]. This model makes students have digital skills wisely and can compare them with the improve digital literacy skills is seamless mobile learning [4 , 11]. This learning model combines 10 components: physical-digital, personal-social, and formal-informal [12]. Mobile Seamless Learning is a future learning model because learning is no longer about how content can be formed but extends to where and when learning occurs. Seamless mobile learning is a breakthrough that seeks to answer the challenges of learning in the digital era. Seamless mobile learning is a seamless learning model that uses mobile applications or mobile devices such as smartphones to be done anywhere that can connect the three. The dimensions contained in seamless mobile learning, namely: MSL.1) includes formal and informal learning, MSL.2) includes social and personal/individual learning, MSL.3) learning that crosses time, MSL.4) which comprises learning that crosses between places/locations; MSL.5) ubiquitous learning: being able to access knowledge or sources of knowledge anywhere; MSL.6) which includes digital and non-digital worlds, MSL.7) combines several devices, MSL.8) includes several learning activities starting from collecting data, analyzing and communicating the data, MSL. 9) the existence of knowledge synthesis, MSL. 10) consists of several learning activities facilitated by the learners [12].
natural world [14,26]. Based on the abovementioned account, it is important and urgent to determine how the seamless learning mobile learning model design can improve digital literacy in higher education institutions in Indonesia.

Method

This type of research is research and development (Research & Development) or (R&D), one of the research models to develop interventions to solve research problems. A series of approaches exist in development research to generate and explain potential new views/theories in the educational environment. The development model in this research is the Borg & Gall (1983) model.

Product development is a seamless learning design to improve digital literacy and its supporting components. The development of the seamless learning model design is applied to entrepreneurship courses, with research subjects: 1 content expert, 1 learning design expert, 1 media expert, 5 people for individual tests, 10 people for small group tests, and 280 people for the field test.

The field test was conducted at 7 different universities in Indonesia. Collecting data in this study uses the method of observation, interviews, and questionnaires. The eligibility criteria used in each expert validation are product effectiveness, attractiveness, and efficiency. The score obtained from expert and student validation is then converted using the formula:

$$P = \frac{\sum X}{\sum Xi} x100$$

Information:

P : Percentage

∑x : The total number of respondents' answers

∑xi : The total ideal score in one item

% : Constant

After obtaining the results from the data processed using the formula above, these results are matched with the following eligibility criteria:

Table 1. Eligibility level criteria

Category	Percentage	Qualification	Equivalent
A	76%-100%	Valid	decent
B	51%-75%	Pretty Valid	Pretty
C	25%-50%	Less Valid	Not worth it
D	0%-25%	Invalid	Not Feasible

Result and Discussion

Expert validation

a. Content validation

Content experts or material on entrepreneurship courses are permanent lecturers for entrepreneurship courses at 7 tertiary institutions that have been determined as research subjects. The following is the recapitulation of content validation:

Table 2. Recapitulation of content validation results

No.	Indicator	Average score	Maximum score
1.	Effectiveness	4,3	5
2.	Attractiveness	4,5	5
3	Efficiency	4	5
	Average	4,3 (Good)	

The score obtained from the content validation is then converted in the form of a percentage to determine the eligibility in terms of content. The percentage data obtained from content experts in terms of effectiveness, attractiveness, and efficiency of the seamless learning design in entrepreneurship courses is 86%. Furthermore, the results of 86% obtained from the content expert's assessment were converted to the conversion table (attainment and qualification level conversion table), the results obtained were that the product of seamless learning design development in entrepreneurship courses was at the qualification level "decent".

b. Media validation

The data obtained from the validation results of learning design experts are in the form of quantitative data (numeric data), and qualitative data (data of suggestions and input) on seamless learning design development products in increasing digital literacy. For this reason, it is necessary to describe the components that have been assessed by the learning design expert. The following is the result of the score recapitulation for media validation:

Table 3. Recapitulation for media validation

No.	Indicator	Average score	Maximum score
1.	Effectivenes	4	5
2.	Attractiveness	4,6	5
3	Efficiency	4,4	5
	Average	4,3 (Good)	

The score is then converted in percentage form. Percentage results data obtained from learning media experts in terms of effectiveness, attractiveness, and efficiency of the seamless learning design. The increase in digital literacy is 85%. Furthermore, the results of 85% obtained from the media expert's assessment were converted to the conversion table (attainment and qualification level

conversion table), the results obtained were that the product design development design of mobile seamless learning models in learning media courses at the "decent" qualification level.

c. Design validation

The following is the result of the recapitulation of the scores from the design validation.

Table 4. Recapitulation for design validation

No.	Indicator	Average score	Maximum score
1.	Effectiveness	4	5
2.	Attractiveness	4,6	5
3	Efficiency	4,4	5
	Average	4,3 (Good)	

The score is then converted in percentage form. Percentage results data obtained from learning design experts in terms of effectiveness, attractiveness, and efficiency of the seamless learning design in increasing digital literacy is 80%. Furthermore, the results of 80% obtained from the assessment of the learning design expert were converted to the conversion table (attainment and qualification level conversion table), the result was that the seamless learning design development product in improving digital literacy which was tested in entrepreneurship courses was at the qualification level “worthy".

Test results

The results of individual trials showed that the average percentage of product feasibility was 75%, small group trials showed that the average percentage of feasibility was 85%, and field trials showed that the average percentage of feasibility was 90%.

Increase in digital literacy

The following are the results of increasing digital literacy skills after using seamless learning.

Table 5. Digital literacy improvement data

No.	No. Components assessed	Respondent score					Test score	Maximum Score	Percentage (%)
		1	2	3	4	5			
1	I am able to solve problems related to technical devices while studying	0	0	31	102	147	1248	1400	89%
2	I am able to use new techno*l*ogy or digital media easily	0	0	10	137	133	1279	1400	91%
3	I am able to find, select, and evaluate information	0	0	5	131	144	1244	1400	88%
4	I am able to distinguish between correct and incorrect information	0	0	11	127	142	1251	1400	89%
5	I am able to collaborate and interact with other friends when learning to use technology/digital media	0	0	9	136	135	1246	1400	89%
6	I am able to convey information to others through digital	0	0	11	128	141	1250	1400	89%
	Total						2959	8400	5350%
	Total Average	5350%: 6 = 89%							

The indicators of digital literacy skills adapted from Ng’s (2012) consist of three dimensions: technical, cognitive and social emotional [6] .From the data obtained in the field which consisted of 280 students is able to increase student digital literacy. So, it can be stated based on the test results, that the design of the seamless learning model in increasing digital literacy is feasible.

from 7 tertiary institutions it can be seen that overall student’s digital literacy on the average increases by 89%. This shows that the use of seamlees learning design in the learning process

Product finalization

The following are the results of the product design finalization of the seamless learning model in improving digital literacy skills

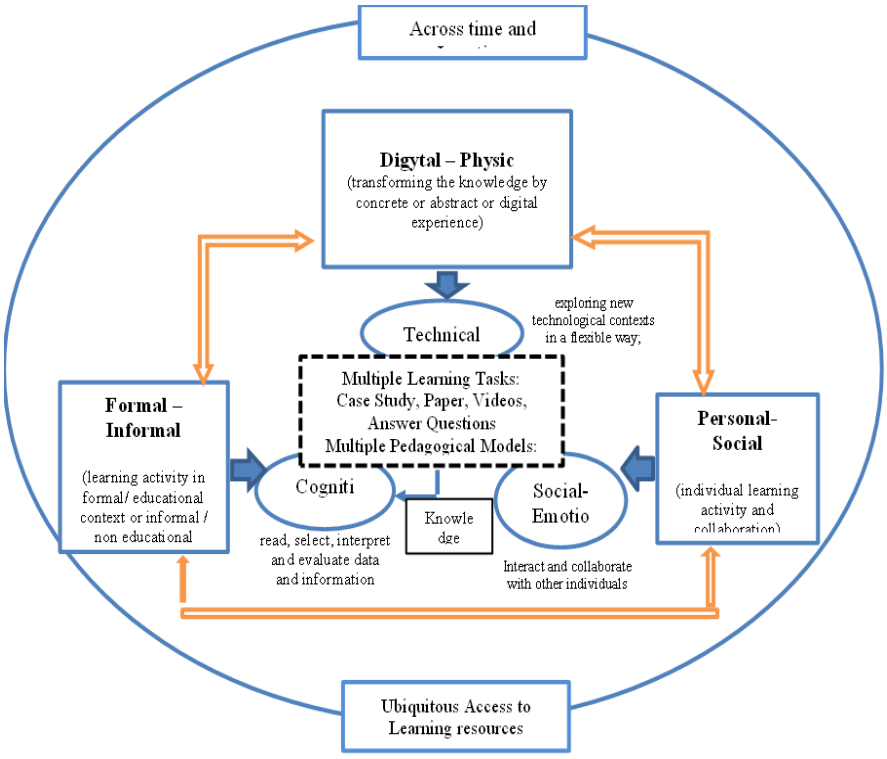

Figure 1. Design of seamless learning model design in improving digital literacy skills

This research is applied to entrepreneurship courses at Islamic tertiary institutions in Indonesia so that the learning outcomes and methods that can be used in seamless learning are as follows

Table 6. Seamless learning activity on entrepreneurship course

Sub CPMK (Course Learning Outcome)	Study Materials (Learning Materials)	Form & Method of Learning	Dimensions of MSL	Learning Method	Digital Literacy Skill Assesment	Indicators
Explain the concept of entrepreneurship Analyzing contemporary issues of entrepreneurial ethic	The entrepreneurial mind set The entrepreneurial process The opportunity	Open and learn the learning sources/ study material through LMS by personal and in a group Search and upload the other learning sources in LMS by personal or a group (arctichles, videos, news, e-	Fornal (Inclass) Digital Personnal-Social Across time & Location Multiple Pedagigical Multiple Devices Multiple learning tasks Knowledge	Problem based (case study)	Technical Cognitive Social-emotional	Can use the fitur of LMS to upload and read the learning sources and learning task well Can search, select and evaluate the learning sources which added in

Sub CPMK (Course Learning Outcome)	Study Materials (Learning Materials)	Form & Method of Learning	Dimensions of MSL	Learning Method	Digital Literacy Skill Assesment	Indicators
		book) Learning task: Case study: problem of small entreprise in indonesia	synthesis Ubiquitous learning			LMS Can synthesis the knowledge Can discuss the learning sources and tasks in a groups Can share the information in a groups
		Observe and interview the entrepreneurial mind set, process and opportunity by personal or in a group on local business Watching video about entrepreneurial mind set, process and opportunity Summarize the work Learning task: Make video of profil entrepreneus succeed	Informal (out class) Personnal-Social Physical Across time & Location Multiple Pedagigical Multiple Devices Multiple learning tasks Knowledge synthesis Ubiquitous learning	Project based Experiential based		
2.1 Explain the concept and urgency of Business Model in entrepreneurship 2.2 Analyzing the Business Model 2.3 Creating the Business Model	1.Business Model Canvass	Open and learn the learning sources/ study material through LMS by personal and in a group Search and upload the other learning sources in LMS by personal or a groups (arctichles, videos, news, e-	Fornal (Inclass) Digital Personnal-Social Across time & Location Multiple Pedagigical Multiple Devices Multiple learning tasks Knowledge	Problem based (case study) Experiential based	Technical Cognitive Social-emotional	Can use the fitur of LMS to upload and read the learning sources and learning task well Can search, select and evaluate the learning sources which added in

Sub CPMK (Course Learning Outcome)	Study Materials (Learning Materials)	Form & Method of Learning	Dimensions of MSL	Learning Method	Digital Literacy Skill Assesment	Indicators
		book) Learning task: Case study: analyzing and build a business model from business unit	synthesis Ubiquitous learning			LMS Can synthesis the knowledge Can discuss the learning sources and tasks in a groups Can share the information in a group
		1. Observe and interview business unit by personal or in a group and build a business model for that business 2. Discuss and presentation on a class about the business model 3. Learning task: 4. Build a new business/ product in a group 5. Arrange a business model	Informal (out class) Personnal-Social Physical	Project based Experiential based		

Seamless learning provides continuous learning experiences through various contexts [15]. Learning contexts can occur formally and informally, individually and socially, physically and virtually, both inside and outside the classroom [16 ,17]. Digital literacy is the ability to search, select and evaluate sources of information that can be obtained digitally [18]. This ability is closely related to natural and virtual learning contexts and formal and informal learning in forming knowledge in the seamless learning model. Digital literacy also relates to a person's ability to optimize the ability to solve problems related to the use of hardware technology; this is related to the seamless learning component that uses various devices (multi devices). Digital literacy is the ability to explore and interact socially and convey information responsibly, ensuring that information is valid. It relates to the seamless learning component in personal and social learning. Multiple learning tasks are used to translate students' digital literacy skills. Digital literacy required in implementation appropriate online learning needs participant educate in access the internet for support success learning.

Information and communication technology is one of the supports in managing the teaching and learning process. Learning without boundaries is an approach to continuous learning, which combines experience gained from various places, times, and technologies as intermediary media. Technological developments make it easier for users to access information

anywhere and anytime [19]. Mobile seamless learning is a learning model that provides opportunities for continuous learning without space and time limitations [7, 20]. Students use mobile smartphones as a medium for learning in various contexts, so they use digital technology media and the skills to operate the technology. Expertise in using digital media and skills to understand and use information are classified as digital literacy skills [18]. Digital literacy skills are skills in using various technological, information, and communication devices, socializing, interacting, collaborating, and having the ability to learn and think critically and creatively as digital competencies [7].

The main concept of this design is framed in a circle line, indicating that the components in the design are comprehensive and can be repeated according to the learning process's needs. The Seamless Learning learning design uses three main components of MSL, namely MSL 1 (Formal-Informal), MSL 2 (Personal-Social), and MSL 6 (Digital - Physical) [21]. All three are connected by two-way arrows indicating that the component can be started from any component direction. It indicates continuity for the three components. Digital – Physical Components are all learning activities that form new knowledge either through concrete learning experiences or abstract or virtual learning experiences, using different type of devices, then presented in the form of prototypes or learning tasks[22] [23]. This component will effectively improve digital literacy skills on the technical dimension, namely, one's ability to operate the new technology [4]. However, it does not rule out the possibility of improving other dimensions. The personal-Social component is an activity that aims to form new knowledge through communication, collaboration and interaction within study groups or interactions with the environment outside the study group, no matter who is inspired (learner or teacher) [22]. This component will effectively improve digital literacy skills in the social-emotional dimension. The Formal-Informal component is differentiated based on learning space, no matter who is inspired (earner or teacher). Formal learning is learning in a classroom environment or an explicit educational context [21, 24]. Informal learning is regarded as learning in real-world circumstances and, therefore, primarily in non-educational contexts[25]. This component will effectively increase the cognitive dimension because the learning context combines in-out class. Once again, this does not rule out the possibility that these three components can be used conjointly to increase the dimensions of students' digital literacy skills.

Conclusion

Technological developments make the learning process now expand beyond space and time. The seamless learning mobile learning design not only provides flexibility when and where the learning process occurs but also contains a continuous learning process where students will focus on a preferred learning activity to understand new knowledge. This experience provides students with interest and awareness that they have explored knowledge more broadly through various learning tasks, learning sources, formal-informal, digital-physical, personal-social, and using multiple devices. The seamless learning in mobile learning design that is applied to entrepreneurship courses can improve students' digital literacy skills, namely operating new technology, using technology to interact socially, and forming new knowledge.

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