International Journal of Instruction *July 2022 ● Vol.15, No.3*
e-ISSN: 1308-1470 ● www.e-iji.net *p-ISSN: 1694-609X*
pp. 329-344

Article submission code: 20210705083406
Received: 05/07/2021 Revision: 01/02/2022
Accepted: 22/02/2022 OnlineFirst: 24/04/2022

The Effect of Self-Directed Learning on Students' Digital Literacy Levels in Online Learning

Riswanti Rini
Universitas Lampung, Indonesia, *riswanti.rini@fkip.unila.ac.id*

Mujiyati
Universitas Lampung, Indonesia, *mujiyati@fkip.unila.ac.id*

Ismu Sukamto
Universitas Lampung, Indonesia, *ismu.sukamto1101@fkip.unila.ac.id*

Hasan Hariri
Universitas Lampung, Indonesia, *hasan.hariri@staff.unila.ac.id*

Digital literacy is a media-based learning that combines education and technology with the hope that students can make the most of it. This requires learning skills, one of which is the ability to take the initiative to be responsible for learning materials, often called self-directed learning. The purpose of this study was to describe the effect of self-directed learning on students' level of digital literacy in online learning. This study used a quantitative approach with ex-post facto research type. The populations in this study were students of the University of Lampung with a sample of 947 taken using simple random sampling. The data collection instrument used was adapted from the Self Rating Scale of Self-Directed Learning (SRSSDL) and Digital Literacy Measurement (DLM). The data collected were analyzed using linear regression. The results showed the positive and significant effect of self-directed learning on the digital literacy level of students, with the contribution of 54.80%, and the rest was influenced by other factors that were not measured in this study. The effect also had a positive direction, which means that the higher the student's self-directed learning score, the better the digital literacy skills will be.

Keywords: digital literacy, students, online learning, self-directed learning, learning

INTRODUCTION

Digital literacy is very important for students as a basis for being able to compete in the world of work. The digitally literate students will be able to use digital tools and contents when they learn. Such students can make their own digital content and can socially contribute to solving innovative problems (World Literacy Foundation, 2020).

Citation: Rini, R., Mujiyati., Sukamto, I., & Hariri, H. (2022). The effect of self-directed learning on students' digital literacy levels in online learning. *International Journal of Instruction*, *15*(3), 329-344. https://doi.org/10.29333/iji.2022.15318a

The concept of digital literacy was first put forward by Gilster (1997), which is described as the ability to use information obtained through digital systems that are obtained effectively and efficiently in the context of academic, career, and everyday life. Digital literacy is related to the interests, attitudes and abilities of individuals in using digital technology and communication tools to access, manage, integrate, analyze and evaluate information, build new knowledge, create and communicate with others (Potter, 2005). Efforts to literate society do not only introduce media, but also synergize thinking skills with daily activities that lead to increased productivity. Digital skills development is currently expected to be a major focus of education policy worldwide (Eynon, 2021).

Online skills, including searching for information on the Internet, can differ among students (Santos et al., 2013). In Turkey, research by Bayrak & Yurdugül (2013) found that digital literacy in male students is higher than that in female students. In contrast, in Cameroon, Bediang et al. (2013) found no significant differences among students in the use of information and communication technology. Digital technology is expected to produce change and innovation in education (Hassan & Mirza, 2021). For this to take place, teachers are required to enhance their digital competence in order to be able to effectively respond to rapid change and innovation towards student professional learning.

This is reinforced by research by Kingsley & Kingsley (2009) showing that, although some students are unable to demonstrate competency in website-based examinations, demographic factors (gender, age, and race) do not affect students' digital literacy competencies. Other factors that affect the level of digital literacy are computer ownership at home and language factors (Norishah et al., 2012), socio-economic status, and the duration of computer use that affects one's digital skills (Jara et al., 2015). However, the duration of using computers cannot be used as a predictor of digital literacy rates when the majority of students use computers only to surf the internet (Ivanković et al., 2013).

In essence, digital literacy is a digital media-based learning effort, in which there are two fields of knowledge, namely education and technology. However, in fact, digital literacy is very difficult to implement. This is due to the lack of students' interest in using digital platforms in the learning process; and particularly in developing countries, a number of teachers still need to be given training to improve their knowledge and skills of how to work with online ICT, including online learning platforms. The recent challenging situation demands technology-based learning by utilizing technology to find sources of information (Hassan et al., 2020). In other words, such digitally incompetent teachers will hamper the improvement of online student learning which then can result in low quality of education (Hassan & Mirza, 2021). Teachers are also required to be trained on how to use online learning media (Chusni et al., 2021).

Through digital literacy, students are required to have the ability to make maximum use of digital technology so that students need to have soft skills that are important to develop such as self-directed learning. Individuals who have high self-directed learning,

consciously and independently, will try to find information to increase their knowledge and insight (Toh & Kirschner, 2020).

Self-directed learning is the ability of students to act and take responsibility for learning content with or without other people, with aspects: awareness, learning strategies, learning activities, evaluation, and interpersonal skills (Setyawati, 2016). Lack of self-directed learning ability will hamper students' ability to acquire useful knowledge to support learning.

To get the maximum potential of students, it is important to have good self-study skills. According to Galinsky (2010), one of the basic skills that individuals must have is self-directed learning skills, so the keyword in education is independence. Handayani et al. (2013) stated that, through the results from their research, students with the self-directed learning model make higher learning achievement than conventional learning models.

Research results from Mariasa et al. (2014) also revealed that the learning model designed to foster learning independence in students has a positive effect on learning achievement. Thus, it can be said that independence in learning positively and significantly affects learning achievement. Self-directed learning is recognized as an important predictor of academic motivation and student achievement. Schunk (2005) argues that self-directed learning is a condition in which students consistently strive for their own learning activities without depending on others. Self-directed learning is driven largely by the choice initiative and the responsibility to the students themselves.

The effect of self-directed learning on students focuses on the processes that occur in individuals personally. Additional results obtained regarding the distribution of subjects in the self-directed learning, and digital literacy variables were also seen based on the theory and observations of researchers in the field. In accordance with the results of the survey that was conducted at the pre-research stage, the researchers found a phenomenon in which students of Universitas Lampung were very active in using internet devices but they experienced many obstacles when operating them for learning purposes.

A'yuni's (2015) research results show that the high intensity of a person looking for something with the help of the Internet does not guarantee have high digital literacy. This is because literacy is not only assessed using devices, but also by other competencies such as the ability to evaluate content obtained from the internet. Zimmerman (2008) sees self-directed learning as a proactive process rather than a reactive event that occurs in students due to impersonal forces such as teaching. Self-directed learning is formed from the attitudes and abilities of students to complete learning activities independently and be responsible for achieving learning goals.

Several aspects of digital literacy share the same characteristics as individual characteristics with self-directed learning. Bracey (2010) revealed that the characteristics of someone who has high self-directed learning are critical, creative, able to observe, a good listener and quite responsive to various things. Compared with aspects of digital literacy, competencies such as ability to think critically and creatively, ability to seek and find information, and sensitivity to the developing socio-cultural

context. However, other aspects such as collaboration and effective communication do not intersect with these characteristics.

The use of digital technology has not become a key factor in the learning process (Higgins & Begoray, 2012). These authors also emphasized that the most important thing in digital literacy is to know the purpose and way of using the device, not how often to use the digital device. Literature of self-directed learning in relation to digital literacy levels in online learning has relatively been well described worldwide. However, there is a dearth of this topic in an Indonesian higher education context, particularly in Lampung. Thus, the purpose of this study was to examine the influence self-directed learning on students' digital literacy levels in online learning at Universitas Lampung.

Literature Review

Digital Literacy

The term digital literacy itself became popular around 2005 (Davis & Shaw, 2011). Digital literacy is defined as the ability to relate to hyper-textual information in the sense of disorganized computer-aided reading. The term digital literacy was used in the 1980s (Davis & Shaw, 2011), when computing technology began to be used to support everyday life. Gilster (1997) then developed the concept of digital literacy as the ability to understand and use information from various digital sources that are used for personal and organizational purposes. In other words, the ability to read, write, and relate to information will determine how people develop.

Furthermore, Hague (2010) explains that digital literacy is the ability to be creative, collaborate and communicate more effectively, and understand how and when digital technology is good to use to support the process. Students who have this ability tend to be open and able to adapt quickly to change. The topic of digital literacy among students is not a new topic, there have been several studies examining this. Research conducted by Azmi (2006) at Qatar University shows that the skill of searching for information in databases is considered as one of the important skills that students must possess.

Special research that discusses this states that each country has a different definition of digital literacy because it involves policy systems and technological progress. Discussion on this matter has the same basic concept, namely the ability to use and understand the use of communication and information technology (Belshaw, 2012), so that this definition will continue to develop in the future.

Research conducted by Radovan (2014) also shows that academic performance is positively influenced by digital literacy. It can lead to more efficient task completion through the help of software and computer programs such as word processors and worksheets (Argentin et al., 2014). With regard to self-directed learning, research shows that this variable is tested more frequently in the context of online-based education (Bracey, 2010).

Self-Directed Learning

Self-directed learning is a mental process aimed personally accompanied and supported by behavioral activities that are involved in identifying and seeking information, including information from digital media (Sugianto & Lisiswanti, 2016). Self-directed learning will make students plan, implement, and evaluate learning with full responsibility for themselves and are expected to work independently to achieve learning goals. Thus, self-directed learning is the awareness of students taking the initiative to be responsible for material, strategies, activities, and evaluation of their learning with or without other people.

The application of self-directed learning can develop creativity in students (Lemmetty & Collin, 2021). This correlates with self-competencies such as creativity, communication, and collaboration in the workplace (Toh & Kirschner, 2020). The result is expected that individuals can be involved to take greater responsibility for themselves (Bansal, 2021).

The results of Leary's (2012) study also show a positive effect of self-directed learning in supporting problem-based learning. Self-directed learning, which is often defined as independent learning, is learning that is flexible but still oriented towards planning, monitoring, and evaluating depending on the student's ability to manage learning according to their autonomy. Independent learning requires students to be able to organize existing learning resources according to their needs and learning context.

According to Biggs (2003) the development of science and technology contributes to the improvement of self-directed learning skills. Through the use of technology and digital tools, individuals are given space to develop skills through various activities and resources, such as study groups and reflective writing activities (Hiemstra, 1994).

METHOD

Research Design

This study uses a quantitative approach to the type of research design is ex-post facto. Researchers examined retrospectively to establish the cause, relationship, association, or meaning of the effect of the dependent variable (Cohen et al., 2007). In this study, the researcher did not manipulate the variables. Researchers seek information about the causal relationship of an event and describe what happened to the independent variables.

Sample and Data Collection

The populations in this study were students from eight faculties of the Universitas Lampung. This study used simple random sampling with the results of 947 student sample from the university with the distribution from various faculties, departments, and study programs.

The data collection instrument used was an adaptation of the Self Rating Scale of Self-Directed Learning (SRSSDL) which has components of awareness, learning strategies, learning activities, evaluation, and interpersonal skills. The SRSSDL was developed by Williamson (2007). To determine the level of self-directed learning, it is seen from the

total score obtained by the subjects. When the lower the score is obtained, the lower the level of self-directed learning will be.

The level of digital literacy was measured using a digital literacy measurement (DLM) instrument with seven elements of digital literacy (JISC, 2017), including: (1) information; (2) scholarship; (3) learning skills; (4) ICT literacy; 5) career and deny management; (6) communication and collaboration, and (7) media literacy.

The instrument was analyzed using the Rasch Model approach through the Winsteps program application. According to Sumintono & Widhiarso (2014), the superiority of the Rasch Model compared to other methods is the ability to predict missing data, based on individual response patterns. In addition, Rasch can calculate standard error values of measurements for the developed instrument, which can increase the accuracy of calculations.

Data Analysis

The results of the research data were tested for normality and homogeneity of the data. Furthermore, after the data were collected, data analysis was performed using linear regression analysis. This analysis was used to determine causal relationship between variables, or influence of independent variable on dependent variable (Shavelson, 1988) by using SPSS version 18.

FINDINGS

Description of Data Characteristics

The sample taken in this study is in accordance with the simple random sampling approach. The sample distribution in this study can be seen in Table 1.

Table 1
Distribution of research samples

Faculty	Number of Samples
Faculty of Engineering	112
Faculty of Agriculture	191
Faculty of Mathematics and Natural Sciences	95
Faculty of Teacher Training and Education	234
Faculty of Medicine	58
Faculty of Social Science and Political Science	96
Faculty of Law	63
Faculty of Economics and Business	98
Total	947

Table 1 shows the sample distribution from the eight faculties at the Universitas Lampung with respondents from various departments and study programs. The distribution of respondents is not evenly distributed considering the number of departments and study programs that vary in the university.

Figure 1
Gender of research samples

The variety of the number of study programs in each faculty causes the number of representative research samples to vary. When viewed by gender, the entire study sample can be seen in Figure 1. Respondents' distribution by gender consisted of 390 (37%) male and 557 (63%) female.

Test of Reliability and Estimation Validity Using Principal Component Analysis

Reliability evaluation was carried out through three steps, namely by considering item reliability, personnel reliability, and interaction reliability between person and item on the Self Rating Scale of Self-Directed Learning (SRSSDL) and Digital Literacy Measurement (DLM).

Table 2
Estimation of test reliability SRSSDL (N = 200)

Estimation	Measure
Items reliability	0,90
Person reliability	0,92
Cronbach alpha (KR-20) person raw score test reliability	0,92
Item separation index	3,04
Person separation index	3,40

Data analysis was performed using the Rasch Model approach through the Winsteps program for Self-Rating Scale of SRSSDL. Data input consisted of 200 people with 25 items. Alpha Cronbach's value of 0.90 which measured reliability was the interaction between person and items as a whole being in the very good category. A person's reliability value of 0.92 shows that the consistency of respondents' answers was in the very good category and item reliability of 0.92 indicates that the quality of the items in the category was very good.

Unidimensionality is an important measure to evaluate whether SRSSDL is developed to be able to measure what is supposed to be measured. Rasch modeling in the estimation of validity is based on the Principal Component Analysis (PCA).

Table 3
Standardized residual variance of SRSSDL (N = 200)

	Empirical		Modeled	
Total raw variance in observations	44.6	100.0%		100.0%
Raw variance explained by measures	19.6	44.0%		43.9%
Raw variance explained by persons	14.2	31.9%		31.8%
Raw Variance explained by items	5.4	12.1%		12.1%
Raw unexplained variance (total)	25.0	56.0%	100.0%	56.1%
Unexplned variance in 1st contrast	2.9	6.6%	11.8%	
Unexplned variance in 2nd contrast	2.3	5.2%	9.3%	
Unexplned variance in 3rd contrast	2.1	4.7%	8.4%	
Unexplned variance in 4th contrast	1.8	4.1%	7.3%	
Unexplned variance in 5th contrast	1.7	3.9%	6.9%	

The unidimensionality of instruments is an important measure to evaluate whether the instrument is capable of measuring what it should be. Raw variance data is 43,9%. This shows that a minimum requirement of 20% can be fulfilled.

Table 4
Estimation of test reliability DLM (N = 200)

Estimation	Measure
Items reliability	0,82
Person reliability	0,86
Cronbach alpha (KR-20) person raw score "test" reliability	0,81
Item separation index	3,96
Person separation index	1,57

Data analysis to test the feasibility was carried out using the Rasch Model approach through the Winsteps for Digital Literacy Measurement (DLM) program. Data input consisted of 200 people with 28 items. Alpha Cronbach's value of 0.82 which measured reliability was the interaction between person and items as a whole being in the good category. A person's reliability value of 0.86 shows that the consistency of respondents' answers was in the good category and item reliability of 0.81 indicates that the quality of the items in the category was good.

Table 5
Standardized residual variance DLM (N = 200)

	Empirical		Modeled	
Total raw variance in observations	42.8	100.0%		100.0%
Raw variance explained by measures	14.8	34.6%		35.8%
Raw variance explained by persons	3.6	8.5%		8.7%
Raw Variance explained by items	11.2	26.1%		27.0%
Raw unexplained variance (total)	28.0	65.4%	100.0%	64.2%
Unexplned variance in 1st contrast	2.8	6.6%	10.1%	
Unexplned variance in 2nd contrast	2.5	5.8%	8.9%	
Unexplned variance in 3rd contrast	2.1	5.0%	7.6%	
Unexplned variance in 4th contrast	1.9	4.5%	6.9%	
Unexplned variance in 5th contrast	1.6	3.8%	5.7%	

The unidimensionality of instruments is a measure to evaluate whether this instrument is worthy of measuring what it is supposed to measure. The raw variance data is 35.8%. This shows that the minimum requirement of 20% can be met.

Test for Normality and Homogeneity of Data

Before performing the regression test, it is necessary to test the assumptions, namely the linearity and normality assumption tests. The following is the linearity test that the researchers did by looking at Table 6 below.

Table 6
Data linearity test

Term	SE Coef	95% CI	T-Value	P-Value	VIF
Constant	1.95	(37.12, 44.77)	21.02	0.000	
X	0.0198	(0.630, 0.708)	33.85	0.000	1.00

To detect multicollinearity symptoms, the VIF value can be seen in Table 6. It is said that there are no symptoms of multicollinearity if VIF <5. In Table 6, the VIF value is 1.00 where it is less than 5, then there are no symptoms of multicollinearity. This means that the data above meets the linearity requirements.

Furthermore, normality of the data was checked using histogram and normal quantile plot (see Figure 2).

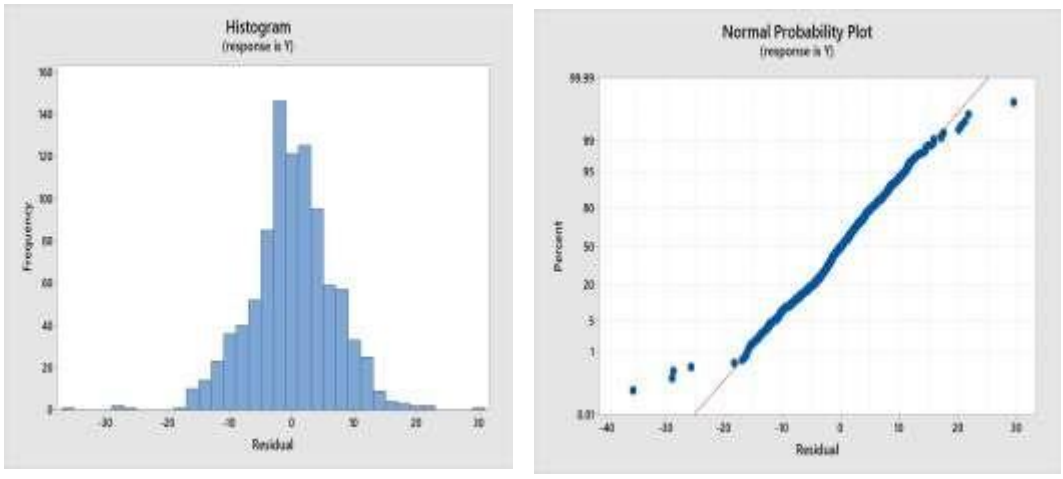

Figure 2
Data normality test

Figure 2 shows that residuals are stated to be normally distributed when the histogram resembles a bell facing upwards or if the plot follows a straight line (not evenly distributed above and below the 0 axis without forming a specific pattern). So from Figure 2 it can be concluded that the data is normally distributed. Thus, the requirements for conducting a regression test have been met.

Results of data analysis

The results of the data analysis regarding the effect of self-directed learning on students' digital literacy are presented in the following table.

Table 7
Analysis of variance

Source	DF	Seq SS	Contribution	Adj SS	Adj MS	F-Value	P-Value
Regression	1	52477	54.80%	52477	52476.6	1145.50	0.000
X	1	52477	54.80%	52477	52476.6	1145.50	0.000
Error	945	43291	45.20%	43291	45.8		
Lack-of-Fit	59	4618	4.82%	4618	78.3	1.79	0.000
Pure Error	886	38674	40.38%	38674	43.6		
Total	946	95768	100.00%				

The F test on regression functions as a simultaneous test, namely to determine whether the independent variable (self-directed learning) has a significant effect on the dependent variable (digital literacy). It can be said that there is an influence if the P value is less than the critical research limit or alpha (P-Value <0.05). If seen from Table 4.6, the P Regression on Analysis of Variance is 0,0001<0.05, indicating that simultaneously self-directed learning has a significant effect on students' digital literacy skills in online learning. In other words, the regression model can be used to predict the level of digital literacy skills of students.

Furthermore, to see how much influence self-directed learning has on students' digital literacy skills can be seen in Table 8.

Table 8
Model summary

S	R-sq	R-sq (adj)	PRESS	R-sq (pred)	AICc	BIC
6.76838	54.80%		43594.3	54.48%	6313.32	6327.85

Based on Table 8, it can be seen that the effect of self-directed learning on students' digital literacy abilities is 54.80%, meaning that the increase in students' digital literacy skills is influenced by most of the self-directed learning factors and some (45.20%) are influenced by other factors.

Table 9
Coefficients of the effect of self-directed learning on digital literacy

Term		SE Coef	95% CI	T-Value	P-Value	VIF
Constant	40.95	1.95	(37.12, 44.77)	21.02	0.000	
X	0.6693	0.0198	(0.630, 0.708)	33.85	0.000	1.00

From the results shown in Table 9, it is known that the constant value in the Coef column is 40.95, so that the regression equation can be obtained as follows: Y = 40.95 + 0.6693 X, meaning that every one-unit increase of self-directed learning will affect the level of students' digital literacy skills of 0.6693.

DISCUSSION

Based on the results of research conducted on 947 students of the University of Lampung, it shows that there is a significant influence of students' digital literacy skills on self-directed learning, which is 54.80%, and the rest is influenced by other factors. The influence of the two variables has a positive direction, which means that the higher

the student's self-directed learning is, the better his digital literacy skills will be. It also explains that the level of student self-directed learning can be viewed from their digital literacy competencies.

This is in line with research conducted by Knowles et al. (2014) who state that computer-based learning technology will enhance one's self-directed learning experience, especially adults. Information obtained through the Internet can be applied to situations experienced by individuals in real life. When individuals are able to solve problems based on information from the Internet, there will be associations within the individual towards technology as a problem-solving medium. This ability in technology has led to self-directed learning initiatives in individuals to go back to finding out and learning something else.

To achieve maximum results in the learning process, a person is required not only to be able to use digital devices well, but also to understand everything related to digital technology. In education, digital literacy has a significant role in developing individual knowledge of learning materials by encouraging creativity and curiosity (Hague & Payton, 2010). In addition, parental support is very helpful for the success of children's studies. (Adiputra, Mujiyati, & Hendrowati (2019).

Other studies have shown that the use of technology such as e-text and e-library has good benefits on students allowing them to make good, creative and up-to-date presentations (Kranzow & Hyland, 2011). Research conducted by Hague and Payton (2010) shows that students who use technology extensively and intensively will easily adopt learning strategies from various media to support the online learning process. In addition, self-regulation also affects academic achievement (Saputra, Alhadi, Supriyanto, & Adiputra, 2021).

The results also show that there is a positive correlation between self-directed learning and learning performance in students who learn in an online-based environment (Kranzow & Hyland, 2011). Grant et.al. (2010) presents the results of research on the application of digital literacy to several students in the UK which outlines several important points, such as providing space for students to be involved in choosing subject matter, improving communication skills between students through the use of digital technology and triggering student independence in learning. . This shows that self-directed learning cannot be separated from digital literacy. This means that self-directed learning skills in the learning process can be improved through good digital literacy skills.

The results of this study highlight the importance of teacher support when self-directed learning is implemented in schools. As a result, teacher support affects positive emotions and student learning behavior (Schweder & Raufelder, 2019). This strategy can support the development of independent learning (Toh & Kirschner, 2020). Especially during the COVID-19 situation, the development of self-directed learning is very important (Karatas & Arpaci, 2021). Self-directed learning training needs to be strengthened to develop learning autonomy, and promote lifelong learning (Rascón-Hernán et al., 2019).

When completing college assignments, students in this era need various kinds of digital information, both as a reference for independent learning, completion of coursework and as a reference in research when compiling a thesis into a good and correct scientific paper format. This is in line with the research of Timothy et al. (2010) showing that digital technology has a positive effect on self-directed learning through the facilities and features available to access various sources of information online.

With digital technology, individuals can encourage themselves to learn, solve problems and find things (Kranzow & Hyland, 2011). The process of online learning and self-directed learning will also be different when viewed based on the era and generation of humans. In generations Y and Z (born in 1990 - 2000) who have been exposed to digital technology from an early age, doing college assignments and independent learning is greatly facilitated by the Internet which provides access to scientific journals in an online version that can be downloaded anytime and anywhere (Patak & Akib, 2012). However, students need to improve their digital literacy in online learning or digital learning facilitated by educators (Tzur et al., 2021).

With good digital literacy skills, students will easily read and access features contained in digital technology that make them feel like they receive a reward, for example, when playing games, getting information as expected or communicating via online with other people (Feinstein, 2011). The results showed that age and grade level variables created significant differences in academic digitization (Ayyildiz et al., 2021). It is necessary to identify digital readiness in teachers so that learning can be maximized (Peled, 2021).

CONCLUSION

Based on the results of the study, it can be concluded that students of Universitas Lampung have a high initiative to learn independently even though their digital literacy skills are in the medium category. This happens because during the online learning process, there are several aspects of digital literacy that are not in direct contact with self-directed learning. In addition, the research conducted shows that there is a positive and significant effect of 54.80% on self-directed learning on students' digital literacy skills in online learning, and the rest is influenced by other supporting factors.

ACKNOWLEDGEMENT

The authors would like to thank Universitas Lampung for funding this research.

REFERENCES

Adiputra, S., Mujiyati, & Hendrowati, T. Y. (2019). Perceptions of Inclusion Education by Parents of Elementary School-Aged Children in Lampung, Indonesia. *International Journal of Instruction, 12*(1), 199-212. https://doi.org/10.29333/iji.2019.12113a

Argentin, G., Pennisi, A., Vidoni, D., Abbiati, G., & Caputo, A. (2014). Trying to raise (low) math achievement and to promote (rigorous) policy evaluation in Italy: Evidence from a large-scale randomized trial. *Evaluation Review, 38*(2), 99-132. https://doi.org/10.1177/0193841X14529125

A'yuni, Q. Q. (2015). *Literasi digital remaja di Kota Surabaya: Studi deskriptif tentang tingkat kompetensi literasi digital pada remaja SMP, SMA dan mahasiswa di Kota*

Surabaya [*Adolescent digital literacy in Surabaya City: Descriptive study of digital literacy competency levels in junior high school, high school and college students in Surabaya*]. (Doctoral dissertation, Universitas Airlangga).

Ayyildiz, P., Yilmaz, A., & Baltaci, H. S. (2021). Exploring digital literacy levels and technology integration competence of Turkish academics. *International Journal of Educational Methodology*, *7*(1), 15-31. https://eric.ed.gov/?id=EJ1285476

Azmi, H. (2006). Teaching Information Literacy Skills: A case study of the QU-core program in Qatar University. Innovation in Teaching and *Learning* in Information and Computer Sciences, 5(4), 1–20. JOUR. http://doi.org/10.11120/ital.2006.05040145

Bansal, K. (2021). A relative study of emotional intelligence on self-directed learning. *Materials Today: Proceedings*, *37*, 2934-2937. https://doi.org/10.1016/j.matpr.2020.08.701

Bayrak, F., & Yurdugül, H. (2013). University students' computer literacy readiness level in Turkey. Procedia - Social and Behavioral Sciences, 106, 3210–3215. http://doi.org/10.1016/j.sbspro.2013.12.370

Bediang, G., Stoll, B., Geissbuhler, A., Klohn, A. M., Stuckelberger, A., Nko'o, S., & Chastonay, P. (2013). Computer literacy and E-*learning* perception in Cameroon: the case of Yaounde Faculty of Medicine and Biomedical Sciences. BMC Medical Education, 13(1), 57–64. http://doi.org/10.1186/1472-6920-13-57

Belshaw, D. A. J. (2012). *What is' digital literacy'?: A pragmatic investigation* (Publication No. uk.bl.ethos.548838) [Doctoral dissertation, Durham University-Durham City]. EThOS e-theses online service. https://ethos.bl.uk/OrderDetails.do?uin=uk.bl.ethos.548838

Biggs, J. (2003). Aligning teaching for constructing *learning*. *Higher Education Academy*, *1*(4).

Bracey, P. (2010, October). *Self-directed Learning* vs self-regulated *learning*: Twins or just friends? In *E-Learn: world conference on e-learning in corporate, government, healthcare, and higher education* (pp. 1600-1607). Association for the Advancement of Computing in Education (AACE).

Chusni, M. M., Saputro, S., Rahardjo, S. B., & Suranto. (2021). Student's critical thinking skills through discovery learning model using e-learning on environmental change subject matter. European Journal of Educational Research, 10(3), 1123- 1135. https://doi.org/10.12973/eu-jer.10.3.1123

Cohen, L., Manion, L., & Morrison, K. (2007). *Research methods in education*. Routledge.

Davis, C. H. & Shaw, D. (2011). *Introduction to information science and technology.* Medford Information Today.

Eynon, R. (2021). Becoming digitally literate: Reinstating an educational lens to digital skills policies for adults. *British Educational Research Journal*, *47*(1), 146-162. https://doi.org/10.1002/berj.3686

Falloon, G. (2020). From digital literacy to digital competence: the teacher digital competency (TDC) framework. *Educational Technology Research and Development*, *68*(5), 2449-2472. https://doi.org/10.1007/s11423-020-09767-4

Feinstein, N. (2011). Salvaging science literacy. *Science Education*, *95*(1), 168-185. https://doi.org/10.1002/sce.20414

Galinsky, Ellen. (2010). *Mind in the making: The seven essential life skills every child needs.* Harper Collins Publisher.

Gilster, P. (1997). Digital literacy. John Wiley & Sons, Inc.

Grant, A., Townend, M., Mulhern, R., & Short, N. (2010). *Cognitive behavioural therapy in mental health care*. Sage.

Hague, C., & Payton, S. (2011). Digital literacy across the curriculum. *Curriculum Leadership*, *9*(10).

Handayani, L., Nyoman, N., Dantes, N., & Suastra, I. W. (2013). *Pengaruh model pembelajaran mandiri terhadap kemandirian belajar dan prestasi belajar IPA siswa Kelas VIII SMPN 3 Singaraja* [the influence of independent learning model on learning independence and science learning achievement of Grade 8 students of Public Junior High School 3 Singaraja]. [Unpublished doctoral dissertation]. Ganesha University of Education.

Hassan, M. M., & Mirza, T. (2021). The digital literacy in teachers of the Schools of Rajouri (J&K)-India: Teachers perspective. *International Journal of Education and Management Engineering*, *11*(1), 28-40. http://doi.org/10.5815/ijeme.2021.01.04.

Hassan, M. M., Mirza, T., & Hussain, M. W. (2020). A Critical Review by Teachers on the Online Teaching-Learning during the COVID-19 [J]. *International Journal of Education and Management Engineering*, *10*(8), 17-27. http://doi.org/10.5815/ijeme.2020.05.03

Hiemstra, R. (1994). *Self-directed learning. The sourcebook for self-directed learning, 9-20*.

Higgins, J. W., & Begoray, D. (2012). Exploring the Borderlands between Media and Health: Conceptualizing" Critical Media Health Literacy". *Journal of Media Literacy Education*, *4*(2), 136-148.

Ivanković, A., Špiranec, S., & Miljko, D. (2013). ICT literacy among the students of the Faculty of Philosophy, University of Mostar. *Procedia - Social and Behavioral Sciences*, 93, 684–688. http://doi.org/10.1016/j.sbspro.2013.09.261

Jara, I., Claro, M., Hinostroza, J. E., San Martín, E., Rodríguez, P., Cabello, T., … Labbé, C. (2015). Understanding factors related to Chilean students' digital skills: A mixed methods analysis. *Computers & Education*, 88, 387–398. http://doi.org/10.1016/j.compedu.2015.07.016

JISC. (2017). Developing digital literacies. JISC. Available at: https://www.jisc.ac.uk/rd/projects/building-digitalcapability

Karatas, K., & Arpaci, I. (2021). The role of self-directed learning, metacognition, and 21st century skills predicting the readiness for online learning. *Contemporary Educational Technology*, *13*(3), ep300. https://doi.org/10.30935/cedtech/10786

Kingsley, K., & Kingsley, K. (2009). A case study for teaching information literacy skills. BMC Medical Education, 9(1), 1–6. http://doi.org/10.1186/1472-6920-9-7

Knowles, M. S., Holton III, E. F., & Swanson, R. A. (2014). *The adult learner: The definitive classic in adult education and human resource development*. Routledge.

Kranzow, J., & Hyland, N. (2011). Marketing Climate: New Considerations for Target Marketing in Graduate Student Enrollment Management. *Journal of College Admission*, *211*, 22-25.

Leary, H. M. (2012). *Self-directed learning* in problem-based *learning* versus traditional lecture-based *learning*: A meta-analysis. All Graduate These and Dissertations.

Lemmetty, S., & Collin, K. (2021). Self-directed learning in creative activity: An ethnographic study in technology-based work. *The Journal of Creative Behavior*, *55*(1), 105-119. http://dx.doi.org/10.1002/jocb.438

Mariasa, I. K., Suarjana, I. M., & Rasana, I. D. P. R. (2014). Pengaruh model selfdirected *learning* terhadap prestasi belajar IPA siswa kelas V SDN 2 Seraya Timur [The influence of self-directed learning model on science learning achievement of fifth grade students of Public Primary School 2 Seraya Timur]. Mimbar PGSD Undiksha, *2*(1). http://dx.doi.org/10.23887/jjpgsd.v2i1.2066

Norishah, T. P., Shariman, T., Razak, N. A., & Mohd. Nor, N. F. (2012). Digital Literacy Competence for Academic Needs: An Analysis of Malaysian Students in Three Universities. Procedia - Social and Behavioral Sciences, 69(Iceepsy), 1489–1496. http://doi.org/10.1016/j.sbspro.2012.12.090

Patak, A. A., & Akib, E. (2012). *Mendeley: Citation & PDF Reference Manager plus Jejaring Sosial*. Arus Timur.

Peled, Y. (2021). Pre-service teacher's self-perception of digital literacy: The case of Israel. *Education and Information Technologies*, *26*(3), 2879-2896. https://doi.org/10.1007/s10639-020-10387-x

Potter, James W. (2005). Media literacy. Sage Publication.

Radovan, V. (2014). Digital literacy as a prerequisite for achieving good academic performance. *Croatia: Ecil*.

Rascón-Hernán, C., Fullana-Noell, J., Fuentes-Pumarola, C., Romero-Collado, A., Vila-Vidal, D., & Ballester-Ferrando, D. (2019). Measuring self-directed learning readiness in health science undergraduates: A cross-sectional study. *Nurse education today*, *83*, 104201. https://doi.org/10.1016/j.nedt.2019.08.019

Santos, R., Azevedo, J., & Pedro, L. (2013). Digital divide in higher education students' digital literacy. In S. Kurbanoğlu, E. Grassian, D. Mizrachi, R. Catts, & S. Špiranec (Eds.), *Worldwide commonalities and challenges in information literacy research and*

practice (pp. 178–183). Springer International Publishing. http://doi.org/10.1007/978-3-319-03919-0_22

Saputra, W. N. E., Alhadi, S., Supriyanto, A., & Adiputra, S. (2021). The Development of Creative Cognitive-Behavior Counseling Model as a Strategy to Improve Self-Regulated Learning of Student. *International Journal of Instruction, 14*(2), 627-646. https://doi.org/10.29333/iji.2021.14235a

Schunk, D. H. (2005). Self-regulated *learning*: The educational legacy of Paul R. Pintrich. *Educational Psychologist, 40(*2), 85–94. https://doi.org/10.1207/s15326985ep40023

Schweder, S., & Raufelder, D. (2019). Positive emotions, learning behavior and teacher support in self-directed learning during adolescence: Do age and gender matter?. *Journal of adolescence*, *73*, 73-84. https://doi.org/10.1016/j.adolescence.2019.04.004

Setyawati, S. P. (2016). Keefektifan model pembelajaran inquiry-based *learning* untuk meningkatkan *self-directed learning* mahasiswa [The effectiveness of inquiry-based learning model to improve student's self-directed learning]. *Nusantara of Research*, *3*(1).

Shavelson, R. J. (1988). *Statistical reasoning for the behavioral sciences*. Allyn and Bacon.

Sugianto, I. M., & Lisiswanti, R. (2016). Tingkat self-directed learning readiness (SDLR) pada mahasiswa kedokteran [Level of self-directed learning readiness (SDLR) in medical students]. *Jurnal Majority*, *5*(5), 27-31.

Sumintono, B., & Widhiarso, W. (2014). *Aplikasi model Rasch untuk penelitian ilmu-ilmu sosial (edisi revisi) [Applications of the Rasch model for social science research (revised edition)]*. Trim Komunikata Publishing House.

Timothy, T., Chee, T. S., Beng, L. C., Sing, C. C., Ling, K. J. H., Li, C. W., & Mun, C. H. (2010). The *self-directed learning* with technology scale (SDLTS) for young students: An initial development and validation. *Computers & Education*, *55*(4), 1764-1771. https://doi.org/10.1016/j.compedu.2010.08.001

Toh, W. & Kirschner, D. (2020). Self-directed learning in video games, affordances and pedagogical implications for teaching and learning. *Computers & Education*, *154*, 103912. https://doi.org/10.1016/j.compedu.2020.103912

Tzur, S., Katz, A., & Davidovich, N. (2021). Learning supported by technology: Effectiveness with educational software. European Journal of Educational Research, 10(3), 1137-1156. https://doi.org/10.12973/eu-jer.10.3.1139

Williamson, S. N. (2007). Development of a self-rating scale of *self-directed learning*. *Nurse researcher*, *14*(2). http://doi.org/10.7748/nr2007.01.14.2.66.c6022

World Literacy Foundation. (2020). *What is digital literacy and why does it matter?* World Literacy Foundation. https://worldliteracyfoundation.org/digital-literacy-why-does-it-matter/

Zimmerman, B. J. (2008). Investigating self-regulation and motivation: Historical background, methodological developments, and future prospects. *American Educational Research Journal*, *45*(1), 166-183. http://doi.org/10.3102/0002831207312909