THE EFFECTS OF DIGITAL LITERACY ON ENTREPRENEURIAL LEARNING AMONG THAI SECONDARY STUDENTS

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ABSTRACT

The aim of this research was to examine the relationship between digital literacy affecting entrepreneurial learning among Thai secondary students. The population in this study included 322 people. The instrument used for data collection were 1) the instrument measuring digital literacy of the population consisting of nine factors: digital right, digital access, digital communication, digital safety, media and information literacy, digital etiquette, digital health, digital commerce, and digital law; and 2) the instrument for measuring entrepreneurial learning consisting of six aspects: the entrepreneur, business management, starting a business, business operations, marketing and sales, and financial management. According to the study, it was revealed that the three factors of digital literacy - media and information literacy, digital safety, and digital law - statistically significantly affected and positively influenced entrepreneurial learning (The significant level < 0.05). Moreover, the variations that affected entrepreneurial learning of the study population can be explained for 72%. Thus the study confirmed that digital literacy effected to entrepreneurial learning among Thai secondary students.

Keywords: Digital Literacy, Digital Learning, Digital Curriculum, Entrepreneurial Learning, Entrepreneurial Competency

INTRODUCTION

Digital skills or digital literacy is an important indicator used for evaluating and verifying the development standards of an organization at the international and national level. Currently, both for-profit and non-profit organizations have initiated the development and implementation of digital literacy framework to support being citizens in the 21st century or digital citizenship.

The UNESCO's Annual World Report 2009, *Information Society Policies* (UNESCO, 2009), highlighted the major challenge policy makers are experiencing: the widening of the digital divide or the lack of improvement in the area of digital literacy in developing countries. In a large number of developing countries, digital literacy has become a national priority.

In addition, in 2015, United Nations Educational, Scientific and Cultural Organization (UNESCO-UN) established the Sustainable Development Goals (SDGs) for the total of 17 goals. Digital literacy is also considered as a sub-goal, which is stated in the goal 4.4.2 declaring that digital literacy is one of the important skills leading a country to be sustainable, create prospective jobs, and brings about business competency (UNESCO, 2015).

The researchers have gathered the importance of digital literacy from various national and international organizations where a competency framework or digital literacy curriculum is developed for their organization's development, which were described as follows.

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UNESCO (2013) set the standard of global media and information literacy assessment framework comprising three aspects: access, evaluation, and creation, to develop digital skills and digital literacy in the future.

The study also found that European Commission (2016) presented Digital Competence Framework for Citizens (DigComp 2.0) consisting of five competencies: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving.

Furthermore, a primary global corporation, Microsoft Corporation, has developed Microsoft Digital Literacy Standard Curriculum comprising five skills: computer basics, the internet - cloud services and the World Wide Web, productivity programs, computer security and privacy, and digital lifestyles (Microsoft Corporation, 2014).

Digital Intelligence Framework by DQ Institute is defined and designed in eight digital competencies including digital citizen identity, screen time management, cyber bullying management, cyber security management, digital empathy, digital footprints, critical thinking, and privacy management (DQ Institute, 2017).

Certiport (2020) designed the Digital Literacy Certification (IC3) consisting of three aspects: computer fundamentals, living online and key applications.

The various researches indicated that Thailand strongly emphasizes teaching and learning digital competency. There is also a competency framework or digital literacy curriculum established as well described below.

At the cabinet meeting of Thailand on September 26th, 2017, a resolution was adopted on the principles of digital skill development among civil servants and government personnel in order to transform into digital government as proposed by the Office of the Civil Service Commission (OCSC). It aims to provide government sectors with manpower with digital skills that will employ an important role of driving the government into the digital government as expected. Additionally, the objective is to help civil servants and government personnel adapt themselves with changing technology, be ready to perform the roles and actions in the context of digital government, and be able to optimize digital technology (OECD, 2020).

The Ministry of Digital Economy and Society (2018) together with Mahidol University designed the digital literacy curriculum for Thai citizens consisting of nine skills: digital right, digital access, digital communication, digital safety, media and information literacy, digital etiquette, digital health, digital commerce, and digital law, as a curriculum model in the future for undergraduate students.

Moreover, Thailand Professional Qualification Institute (TPQI - Public Organization) (2004) set the standard of computer and information competency as well as digital literacy which consist of nine competencies including basics of computer, basics of internet, basics of security, basics of word processing, basics of spreadsheet, online cooperation, basics of presentation program, digital media creation program, and digital security. It aims to develop and upgrade future career for Thai society.

The researchers also discovered that the Institute for the Promotion of Teaching Science and Technology of Thailand (IPST) (2017) designed and improved computational science curriculum comprising three aspects including computer science, information - communication technology and digital literacy. It has been applied in the basic curriculum of Thailand from the elementary level to the high school level since 2017.

From the rationale of digital literacy development mentioned above, the researchers have set two main objectives: to study the factors of digital literacy affecting entrepreneurial learning and to examine the relationship between digital literacy and entrepreneurial learning among secondary students. Besides, this study aims to answer the question regarding how digital literacy has an impact on entrepreneurial learning and what factors of digital literacy affect entrepreneurial learning.

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LITERATURE REVIEW

The Relationship between Digital Literacy and Entrepreneurial Learning

According to Rahmi and Cerya (2019), the relationship between digital literacy skills and entrepreneurial curriculum in Indonesia was studied and analyzed among 421 students. The five independent variables in the study related to digital skills included information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. It was found that the development and learning response of students on digital skills positively affected their entrepreneurship.

The researchers also found that Department of Economic Education, University of Jember (2019) conducted a study on the effects of digital literacy on an entrepreneurial behavior among students in Indonesia. The three main factors used for the experiment included basics of computer - internet, word processing, and basics of spreadsheet. The results revealed that 70% of the theoretical teaching and 30% of practical training on digital literacy led to higher development of entrepreneurship among those students.

In addition, from the study on the effects of digital competences influencing entrepreneurship in Mexico employing the European Digital Competence Framework, it consisted of five factors: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. From the experiment in the population of 209 business people, it was found that those with higher digital competency development were likely to have higher entrepreneurship (Gasca, 2018).

Apart from the above, the researchers also found that in 2019, the study was conducted on the relationship among digital literacy, AI literacy, and digital entrepreneurship by Hamburg et al. (2019) using DigComp Framework 2.0 which was developed by the European Commission comprising information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. The experiment was operated with 142 SMEs in Ireland, Germany, Lithuania, Portugal, and Romania. The results revealed that encouraging employees to have digital skills by about 80% allowed more creativity as well as new business innovation, generating an increase in market values and higher business profits of an organization.

Aziz and Razak (2010) examined the effects of digital literacy influencing 50 female entrepreneurs in Malaysia employing three factors: online usage, digital photography, and search engines. It was found that digital skill training hours positively affected entrepreneurship of the female entrepreneurs in Malaysia.

Saengchai and Jermsittiparsert (2019) found the positive relationship between IT standardized and trade digitalization among 300 Thai people who are in business sectors.

According to the conceptual framework and previous studies, most of them are based on DigComp Framework 2.0 developed by the European Commission consisting of only five factors: information and data literacy, communication and collaboration, digital content creation, safety, and problem solving. However, in this recent study, the researchers have developed and adapted the research framework based on various important frameworks worldwide such as UNESCO (2013), European Commission (2016), Microsoft Corporation (2014), DQ Institute (2017), and Certiport (2020) so that an in-depth research on digital literacy in nine aspects affecting entrepreneurial learning including digital right, digital access, digital communication, digital safety, media and information literacy, digital etiquette, digital health, digital commerce, and digital law can be conducted.

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Conceptual Framework and Hypotheses

The conceptual framework in this research covers analyzing and comparing factors as follows: digital literacy for nine parts including digital right (x_1), digital access (x_2), digital communication (x_3), digital safety (x_4), media and information literacy (x_5), digital etiquette (x_6), digital health (x_7), digital commerce (x_8), and digital law (x_9), as well as entrepreneurial learning competency (y) for six aspects: the entrepreneur, business management, starting a business, business operations, marketing and sales, and financial management. Based on the research conceptual framework, two hypotheses are raised in this study:

Ho1: There is no significant impact of digital literacy on the entrepreneurial learning of Thai secondary students.
Ha1: There is a significant impact of digital literacy on the entrepreneurial learning of Thai secondary students.

The conceptual framework is shown in the Figure 1.

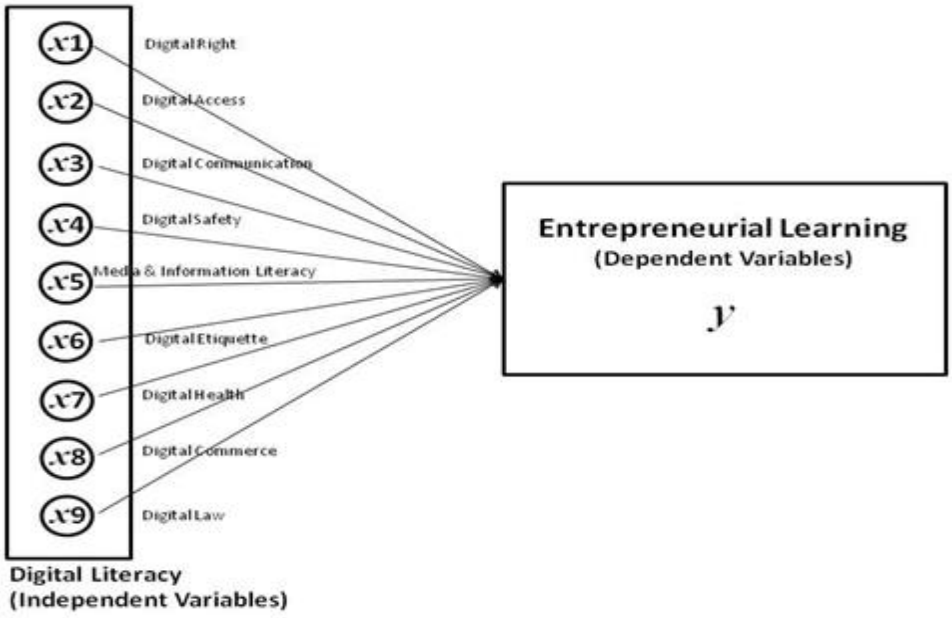

FIGURE 1
RESEARCH CONCEPTUAL FRAMEWORK

RESEARCH METHODOLOGY

Population and Sample

The population in this study are Thai secondary students in Montfort College, Secondary Section, , Muang Chiang Mai, Thailand in Academic Year 2021, divided into 164 male students (50.93%) and 158 female students (49.07%), for a total of 322 students.

Instruments and Data Collection

This research is a descriptive research aiming to identify the relationship between digital literacy and entrepreneurial learning competency and what factors of digital literacy affect entrepreneurial learning. The instruments used for testing hypotheses and measuring the results from

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the study population are as follows. 1) Digital literacy test which was adapted and applied from Mahidol University's digital literacy curriculum in 2016 based on the context of Thai general people (under the creative and socially responsible digital literacy project by the Ministry of Digital Economy and Society, Thailand) was employed. The test used in this study consists of nine aspects: digital right (x_1), digital access (x_2), digital communication (x_3), digital safety (x_4), media and information literacy (x_5), digital etiquette (x_6), digital health (x_7), digital commerce (x_8), and digital law (x_9) five items each, for a total of 45 items. Index of Item-Objective Congruence (IOC) was determined from experts in the development and promotion of digital skills with at least ten years of experience from agencies at the secondary education level for three people and higher education level for two people, for the total of five people. Fifteen aspects in the digital literacy test were considered such as consistency of the test content with research objectives, suitability of the test with the population, and suitability of the content regarding digital literacy in the test. The mean of congruence of the digital literacy test was 0.75 (*** IOC > 0.5 = acceptable, indicating that the tool was consistent with content within the criteria that could be used for data collection (Rovinelli & Hambleton, 1977)). Moreover, the researchers also tested the reliability of the test in a volunteer group of 50 secondary students (Cohen and Manion, 1994), and then it was analyzed using Cronbach's alpha coefficient. The value was 0.907 ($\alpha > 0.80$ = good, indicating that the tool has reliability that could be used for data collection (Nunnally, 1978)). 2) Entrepreneurial learning competency test used in this experiment was adapted from Entrepreneur and Small Business (ESB) Test from the MBA Research and Curriculum Center, USA. It is a 30-item international standard test based on the European Commission's ENTRECOMP Framework (2018), comprising entrepreneurship competency (y) for six aspects: the entrepreneur, business management, starting a business, business operation, marketing and sales, and financial management, five items each.

Data Analysis

From the analysis of the instruments used for collecting independent variables (digital literacy: x_1 - x_9) by Pearson's Product Moment Correlation Coefficient (Pearson, 1895), it can be explained that, for example, digital right (x_1) had a very small positive correlation with digital communication (x_3), digital safety (x_4), media and information literacy (x_5), and digital etiquette (x_6) with correlation coefficients of 0.049, 0.049, 0.058, 0.079, and 0.095, respectively (Best, 1977). This relationship had statistical significance at 0.05, as shown in Table 1.

Table 1
CORRELATIONS COEFFICIENT OF INDEPENDENT VARIABLES (DIGITAL LITERACY: $X_1 – X_9$)

Digital Literacy	x_1	x_2	x_3	x_4	x_5	x_6	x_7	x_8	x_9
Digital Right (x_1)	1								
Digital Access (x_2)	-0.02	1							
Digital Communication (x_3)	0.049	-0.1	1						
Digital Safety (x_4)	0.058	-0.035	-.117*	1					
Media and Information Literacy (x_5)	0.079	-0.037	0.086	0.134*	1				
Digital Etiquette (x_6)	0.095	0.54	0.37	0.005	0.008	1			
Digital Health (x_7)	-0.052	-0.04	0.07	-0.051	0.009	-0.018	1		
Digital Commerce (x_8)	-0.014	0.082	0.012	-0.073	0.04	-.118*	-0.021	1	
Digital Law (x_9)	-0.046	-0.056	-0.012	0.062	0.001	-0.022	0.021	-0.039	1

** Correlations is significant at the 0.05 level (P-Value)*

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The Design and Duration of the Experiment

This study was conducted in the first semester of Academic Year 2021 starting from April - July 2021, divided into three phases: phase 1, digital literacy test during April and phase 2, entrepreneurial learning during May, and phase 3, data analysis for determining the factors affecting the relationship between digital literacy and entrepreneurial learning in June - July 2021.

RESULTS AND DISCUSSION

Descriptive Statistics Analysis

In data collection process, the population of 322 Thai secondary students took two sets of the test: set 1: independent variable for nine digital literacy factors (*x1* - *x9*) and set 2: dependent variable for six aspects of entrepreneurial learning (*y*), as illustrated in Table 2 below.

Table 2
THE MEAN SCORES OF INDEPENDENT AND DEPENDENT VARIABLES FROM THE TEST

No.	Variables	Literacy / Skill		Mean Scores from the Test		
		Digital Literacy: *N = 322*		**Mean**	**S.D.**	**Sig.(P-Value)**
1	Independent (*x*)	Digital Right	x_1	2.93	0.468	.364
2		Digital Access	x_2	4.12	0.658	.985
3		Digital Communication	x_3	3.68	0.586	.340
4		Digital Safety *	x_4	3.43	0.739	.002
5		Media and Information Literacy *	x_5	4.10	0.617	.000
6		Digital Etiquette	x_6	2.97	0.643	.271
7		Digital Health	x_7	3.41	0.646	.098
8		Digital Commerce	x_8	4.06	0.795	.904
9		Digital Law *	x_9	2.19	0.645	.000
			Total	**3.43**	**0.644**	
		Entrepreneurial Learning: *N = 322*		Mean	S.D.	
10	Dependent (*y*)	The Entrepreneur		3.46	0.631	
11		Business Management		3.01	0.843	
12		Starting a Business		3.34	0.697	
13		Business Operation		2.93	0.726	
14		Marketing and Sale		4.07	0.684	
15		Financial Management		2.48	0.632	
			Total	**3.21**	**0.702**	
* Significant at the 0.05 level (P-Value)						

According to the Table 2, it was revealed that overall, the mean scores from the test for independent variables (digital literacy: x_1 - x_9) were at good level: mean = 3.43 and *S.D.* = 0.644. The secondary students earned the best score from digital access (x_2) with the mean score of 4.12 and *S.D.* of 0.658, and the least score from digital right (x_1) with the mean of 2.93 and *S.D.* of 0.468. For dependent variable (entrepreneurial learning: y), the overall mean scores were also at good level: mean = 3.21 and *S.D.* = 0.702. The secondary students earned the best score from marketing and sales with the mean of 4.07 and *S.D.* of 0.684, and the least score from financial management with the mean of 2.48 and *S.D.* of 0.632.

Moreover, the relationship between independent variables (digital literacy: x_1 - x_9) and dependent variable (entrepreneurial learning: *y*) was found by statistical analysis of Multiple Linear Regression Analysis. The researchers employed stepwise method as criteria for selecting

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independent variables into the equations with F-test at the level of 0.10 or above (stepwise criteria: Probability-of-F-to-enter <= 0.050, stepwise criteria: Probability-of-F-to-remove >= 0.100). The results of the analysis revealed that only three independent variables out of nine variables (*p-value < 0.05) met the test criteria which were digital safety* (x_4) with p-value = 0.000, media and information literacy* (x_5) with p-value = 0.002 and digital law* (x_9) with p-value = 0.000. Then, the three independent variables were used to calculate equation relationship, and three equations were found as shown in Table 3.

Table 3
THE RESULTS OF ANALYSIS OF CORRELATION OF INDEPENDENT AND DEPENDENT VARIABLES

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	0.177[a]	0.031	0.028	0.275
2	0.227[b]	0.051	0.045	0.272
3	0.269[c]	0.072	0.064	0.270

a) Predictors: (Constant), x5 : b) Predictors: (Constant), x5, x4 : c) Predictors: (Constant), x5, x4, x9
d) Dependent Variable: y

From the Table 3, it can be explained as follows. In Model 1, media and information literacy (x_5) was correlated to entrepreneurial learning (y) at 0.177. In other words, it can be said that x_5 can account for 31% of the variation affecting y. In Model 2, media and information literacy (x_5) together with digital safety (x_4) was correlated to entrepreneurial learning (y) at 0.227. In other words, x_5 and x_4 can account for 51% of variation affecting y. In Model 3, media and information literacy (x_5), digital safety (x_4), and digital law (x_9) were correlated to entrepreneurial learning at 0.269. Likewise, it can be said that x_5, x_4, and x_9 can account for 72% of variation affecting y. The values obtained from Multiple Linear Regression Analysis in the Table 3 can demonstrate the straight-line relationship between independent variables (x_5, x_4, and x_9) and dependent variable (y) with positive correlation and direct variation as shown in Figure 2.

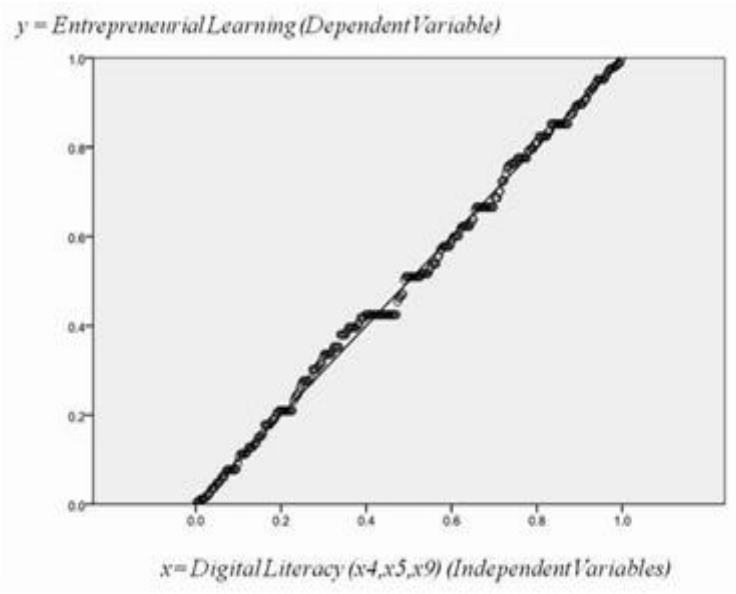

FIGURE 2
THE GRAPH OF POSITIVE CORRELATION BETWEEN INDEPENDENT AND DEPENDENT VARIABLES

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Besides, from the variance analysis of the three independent variables based on the ANOVA for testing the experiment hypothesis to determine statistical significance, it can be shown in Table 4.

Table 4
THE ANALYSIS RESULTS OF HYPOTHESIS TESTING BASED ON THE ANOVA

Model		Sum of Square	df	Mean Square	t-Test	Sig. (P-Value)
1	**Regression**	0.773	1	0.773	28.005	.002[a]
	Residual	24.023	318	0.076		
	Total	24.797	319			
2	**Regression**	1.273	2	0.637	25.852	.000[b]
	Residual	23.524	317	0.074		
	Total	24.797	319			
3	**Regression**	1.795	3	0.598	23.155	.000[c]
	Residual	23.002	316	0.073		
	Total	24.797	319			

a) Predictors: (Constant), x5 **:** b) Predictors: (Constant), x5, x4 **:** c) Predictors: (Constant), x5, x4, x9
d) Dependent Variable: y

According to the Table 4, the results of hypothesis testing can be concluded that t-test value and significance (P-value) of the three independent variables from Model 3 including media and information literacy (*x5*), digital safety (*x4*), and digital law (*x9*) were at 23.155 and 0.000 (Sig < 0.05), respectively. Thus, it can be interpreted that digital literacy had a statistically significant difference in entrepreneurial learning. Therefore, it can be summarized that digital literacy in this study affected entrepreneurial learning in Thai secondary students in Montfort College in a more effective way.

Table 5
THE RESULTS OF STEPWISE MULTIPLE LINEAR REGRESSION ANALYSIS FOR PREDICTING ENTREPRENEURIAL LEARNING

Independent Variables (Predictors)	b	Beta	t-Test	Sig. (P-Value)
Digital Safety (x_4)	-.058	-.153	-2.787	0.002*
Media and Information Literacy (x_5)	.089	.197	3.606	0.000*
Digital Law (x_9)	.063	.145	2.678	0.006*
Constant	2.911		23.155	0.008

a. Dependent Variable: y : R = 0.269, R^2 = 0.72 , F= 8.220, *P-Value < 0.05

Table 5 illustrated the influence and direction of the factors in the experiment predicting entrepreneurial learning using digital literacy of secondary students. It was found that three independent variables used in a statistical equation for statistically significantly determining the relationship between independent and dependent variables included media and information literacy (*x5*), digital safety (*x4*), and digital law (*x9*) (P-value < 0.05). The prediction equation in raw scores can be demonstrated in equation 1. as follows.

$$\text{Entrepreneurial Learning } (y) = 2.991 - 0.058(x_4) + 0.089(x_5) + 0.063(x_9) \quad (1)$$

And the prediction equation in standard score is presented in equation 2. as follow:

$$Z\,(\textit{Entrepreneurial Learning}) = 0.197(Z\,\textit{Media and Information Literacy}) - 0.153(Z\,\textit{Digital Safety}) + 0.145\,(Z\,\textit{Digital Law}) \quad (2)$$

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CONCLUSION

From the study and comparison of the relevant research, for example, the research conducted by Cavalheiro, et al., (2019) examined digital literacy in four aspects: grow up with technology, comfortable with multitasking, reliant on graphics for communication, and thrive on instant gratification rewards among 50 entrepreneurs in European countries. The results showed that digital literacy had a statistically significant effect on entrepreneurship. Furthermore, there was a relevant research exploring the relationship between digital environment implementation and entrepreneurial learning improvement among students in Ukraine using Virtual Reality (VR). Three factors were identified: playing with machine, playing with reality, and playing with others (Andriushchenko et al., 2021). It was revealed that digital environment in class positively affected students in virtual reality classroom. Also, the researchers discovered that this recent research was consistent with the study by Islami (2019) on the effects of digital literacy on entrepreneurial behavior among 140 students in Indonesia by examining two aspects: internet skill and computer skill. The results indicated that digital literacy can increase the efficiency of entrepreneurial behavior with statistical significance. From the result of this study, it can be concluded those three variables of digital literacy (out of nine variables): media and information literacy, digital safety, and digital law statistically significantly positively affected and influenced entrepreneurial learning in the secondary students. This was consistent with the previous research mentioned above. As well, all of the three variables can account for 72% of variation affecting entrepreneurial learning.

RECOMMENDATIONS AND FURTHER STUDY

According to the results of this study, the equation from statistical analysis can be applied to predict, develop learning unit design, and promote digital literacy enhancing activity affecting entrepreneurship among secondary students. Moreover, there should be more comparative studies conducted on both national and international population in order to identify similar and different factors influencing entrepreneurial learning. The experiment can be conducted in the form of action research between the experimental and control groups. In addition, performance evaluation before and after implementing digital literacy in classroom of secondary students is suggested to examine in-depth factors or others relevant, which will better the quality of the research in the future.

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