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The Contribution of Communication Skills and Digital Literacy to Students' Critical Thinking Skills

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Abstract

Past studies rarely reported the contribution of communication skills and digital literacy to students' critical thinking skills in biology. The present study identified the correlation between communication and digital literacy skills and its contribution to students' critical thinking skills by implementing three learning models. This study employed a correlational research design and involved all biology education students in Ternate, North Maluku, Indonesia. The research sample included 60 students from IAIN Ternate and STIKIP Kie Raha, Ternate. The study was conducted in the even semester of the 2021/2022 academic year. Data were gathered using a questionnaire, observation sheets, and an essay test. Multiple linear regression analysis showed the simultaneous contribution of communication and digital literacy to critical thinking in the WE-ARe classroom (73.3%); STAD (63.6%); and conventional (50.4%). These results suggest that the contribution of the predictors to critical thinking was higher in the WE-ARe class than in STAD or conventional classes.

Keywords: Communication Skills, Critical Thinking Skills, Digital Literacy, Learning Model

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INTRODUCTION

In the twenty-first century, digitalization in different spheres of life has altered the paradigm and order of the learning process. As a result, digital literacy must be developed in students and integrated into their knowledge-acquisition process (Faraniza, 2021). An education system needs to focus on honing students' skills in facing current challenges to gain professional and personal success (Abualrob, 2019). Information flexibility enables students to find, analyze, and evaluate information to develop their learning skills in the classroom or for their future (Hasanah & Malik, 2020). Flexible learning strategies can help students enhance their communication skills, bridge the communication gap between students and instructors, and help students communicate more effectively with their classmates (Sriarunrasmee et al., 2015). Learning media integrated with technology (e-learning media) creates a more effective and efficient learning environment. E-learning media can also facilitate access to information and knowledge. Using e-learning media, students can learn from anywhere and at any time, collaboratively (through online discussion) and independently (Jou et al., 2016). In the digital age, ease of access to information must be complemented by appropriate skills, attitudes, beliefs, and knowledge (Napal et al., 2020).

Digital literacy is knowing and using various digital information to solve problems (Beck et al., 2021; Sukarno & Widdah, 2020). Digital literacy includes knowledge and skills in using digital media, communication tools, or networks to find, evaluate, create,

and utilize information wisely, intelligently, carefully, precisely, and law-abidingly (Silamut & Petsangsri, 2020). Students with adequate digital literacy skills will understand when and why they need information, where to find it, evaluate it, and use and communicate it ethically and legally. Students with sufficient digital literacy can find, access, evaluate, and use information ethically and legally (Anunobi & Udem, 2015). Individuals use digital literacy to utilize technology to make learning more effective (Falloon, 2020; Huseyin & Pourfeiz, 2015). With good digital literacy skills, students will quickly read and access the features contained in digital technology (Feinstein, 2011).

Indonesian students' digital literacy is still quite low (Perdana et al., 2020), although literacy proficiency is a vital indicator of boosting the performance of the younger generation to attain success (Asrizal et al., 2022). Digital literacy is required in all learning activities (Amin, 2022). The findings of Giovanni demonstrate a significant association between digital literacy and learning achievement (Giovanni & Komariah, 2019). Students are expected to have survival abilities in the face of an excess of knowledge if they are prepared with digital literacy skills (Cahyati et al., 2019). The more a person accesses the internet, the more s/he learns which digital portals provide high-quality information (Hafiza et al., 2022). Previous studies have found a link between digital literacy and cognitive learning outcomes (Hafiza et al., 2022).

Critical thinking in tertiary institutions includes students' cognitive skills, knowledge of theoretical concepts, and attitudes toward learning that include creativity, collaboration, and communication (Gube & Lajoie, 2020). Educators must assess students' higher-order thinking skills (HOTS) to determine the methods to run the learning process. Individuals with strong HOTS can connect, modify, and transform their knowledge and experience to face 21st-century challenges and competition. Students with strong HOTS can develop the ability to apply the material learned in class in real-world situations (Haritani et al., 2021).

Literacy awareness will significantly aid a person's success in dealing with various issues (Oktariani & Ekadiansyah, 2020). Problem-solving abilities are closely linked to critical thinking abilities. According to (Eyisi, 2016; Van Laar et al., 2017), there is a favorable relationship between problem-solving skills and critical thinking. Students with strong problem-solving skills are more likely to think critically. The low involvement of higher-order thinking in learning undermines the relationship between critical thinking dispositions and academic accomplishment (Wan & Cheng, 2018). Digital literacy can empower students to think, communicate, and work independently of time and place in ways that impact learning outcomes (Pangrazio, 2016).

Argumentation skills are a crucial component of one's thinking ability for success in life (Indrawatiningsih et al., 2020). As a result, recognizing valid scientific arguments is critical since these arguments can be used to prove or defend a scientific conclusion (Osborne et al., 2011). Students who lack appropriate information sometimes struggle to argue, either to support or to oppose the viewpoints of others (Gurkan & Kahraman, 2019; Lin, 2014). Communication skills can be evaluated in numerous ways, including 1) oral communication, 2) written communication, 3) listening comprehension, and 4) communication content (Kyaw et al., 2019; Sagala et al., 2019). Information literacy (an intellectual framework for understanding, locating, evaluating, and using information) corresponds with scientific literacy (Fausan et al., 2021). Critical thinking is associated with in-depth analysis and non-subjective assessment efforts to make the right decisions (Amin, Ahmad, et al., 2022; D'Alessio et al., 2019).

Poor critical thinking skills can also impede students' comprehension of science topics, the development of abilities to create a pleasant learning environment (Sheybani & Miri, 2019), and the future growth of students' critical thinking skills (Furness et al., 2017; Saefi et al., 2017). The results of Tican and Deniz research indicate that 21st-century

student skills, particularly critical thinking skills, are favorably connected with 21st-century teacher competencies (Amin, 2023; Tican & Deniz, 2019). Critical thinking is associated with cognitive thinking skills (such as logical reasoning and problem-solving abilities, intellectual autonomy (such as having an opinion and having excellent grounds to defend the opinion), and emotional intelligence (Saputri et al., 2020). Students with solid digital literacy skills continue to grow and create new works (Behforouz et al., 2021).

Research on the impact of communication skills and digital literacy on critical thinking, particularly in biology learning, is still scarce. This research is significant as it examines three variables that are crucial for developing the skills of preservice biology teachers in the 21st century, enabling them to be globally competitive. Ongoing training and enhancement of 21st century skills should be integrated into every classroom learning process to ensure students develop proficiency. Improving 21st century skills can bolster students' ability to learn independently. This study aims to offer new insights into types of learning models that can be used by teachers and lecturers to enhance students' critical thinking skills. Therefore, the current study attempted to identify (1) the contribution of communication skills and digital literacy on students' critical thinking skills in the WE-ARe classroom; (2) the contribution of communication skills and digital literacy on students' critical thinking skills in the STAD classroom; (3) the contribution of communication skills and digital literacy on students' critical thinking skills in the conventional classroom. WE-ARe is an active learning model developed to meet the demands of 21st-century learning. The WE-ARe learning model was developed based on the constructivism learning theory. Teachers implemented the learning model to improve students' motivation, critical thinking, metacognitive, argumentative, communicative, digital literacy, and knowledge of biology concepts (Amin, 2022). The results of the present study are expected to contribute to the development of learning quality in the 21st century.

METHODS

The current study employed a correlational research design. The research population contained all biology education students in Ternate, North Maluku, Indonesia. The study sample comprised 60 students from the department of biology education at IAIN Ternate and STIKIP Kie Raha, Ternate. This correlational study was executed in the even semester of the 2021/2022 academic year. A quasi-experimental study preceded the correlational study. Table 1 shows the design of the quasi-experimental study.

Table 1. The Pretest-Posttst Control Group Design

Group	Prestest	Treatment	Posttest
Experimental	O_1	WE-ARe	O_2
Positive Control	O_3	STAD	O_4
Negative Control	O_5	Conventional	O_6

Notes:
O_1 = The pretest score of the experimental (WE-ARe) group
O_2 = The post-test score of the experimental (WE-ARe) group
O_3 = The pretest score of the positive control (STAD) group
O_4 = The post-test score of the positive control (STAD) group
O_5 = The pretest score of the negative control (conventional) group
O_6 = The post-test score of the negative control (conventional) group
X = Research treatment (the implementation of the WE-ARe learning model)

The research sample was determined based on the results of an equivalence test, which was distributed to the participants. The equivalence test was administered as a placement test. Before use, the test questions had undergone expert and empirical validation, demonstrating valid and reliable items. The digital literacy data were obtained using observation sheets containing the following indicators: internet searching, hypertextual navigation, content evaluation, and knowledge assembly. Table 2 presents the digital literacy indicators.

Table 2. Digital Literacy Indicators

No	Dimension	Indicator(s)
1	Internet searching	1. Able to utilize the internet. 2. Able to utilize the search engine.
2	Hypertextual navigation	1. Able to identify how web browser, bandwidth, http, html, and URL work. 2. Able to identify the differences between textbooks and the internet. 3. Able to navigate hypertext in a web browser. 4. Able to recognize hypertext dan hyperlink.
3	Content evaluation	1. Able to analyze the background (source and maker) of information on the internet. 2. Able to evaluate information content from various websites. 3. Able to distinguish between display and content. 4. Able to understand domain types (.com, ac.id, sch, edu,. go, .org).
4	Knowledge assembly	1. Able to use various kinds of media to obtain the truth of information. 2. Able to create a personal newsfeed. 3. Able to *crosscheck* or-re-examine information obtained from a source. 4. Able to compile knowledge from the information obtained. 5. Able to read and understand a piece of information.

Data on communication skills were also collected through observation. The observation was conducted during classroom discussions and student presentations. During the observation, researchers referred to a rubric adapted from (NEA, 2012; P21 (Partnership for 21st Century Skills), 2011). The rubric measures four indicators of communication ability, covering the ability to speak, listen, write, and use non-verbal modes of communication. Observations were done to collect data on participants' communication skills and the implementation of the learning model syntax.

Participants' critical thinking skills were assessed using an essay test. Participants' responses to the essay test questions were analyzed using a rubric developed by (Zubaidah et al., 2015). The five-scale (0-5) rubric is an adapted form of the Illinois Critical Thinking Essay Test dan Guidelines for Scoring Illinois Critical Thinking Essay Test. Data analysis was performed in SPSS, where a multiple linear regression test and an ANOVA test were run.

Table 3. Communication Skills Indicators

No	Dimension	Indicator(s)
1	Speaking	1. Content 2. Organization 3. Information Presentation and Delivery
2	Writing	1. Content 2. Organization 3. Syntax 4. Presentation and Information
3	Listening	1. Response 2. Paraphrase and Syntax
4	Non-Verbal	1. Attitude 2. Gesture

RESULTS & DISCUSSION

Results

The WE-ARe Classroom

A multiple linear regression analysis was performed to investigate the contribution of the independent variables X1 and X2 on Y. Table 4 shows the regression analysis results.

Table 4. Summary of the ANOVA test on the Contribution of Communication Skills and Digital Literacy on Critical Thinking (y)

Model	Sum of Squares	df	Mean Square	F	Sig.
Regression	172.238	2	86.119	23.289	.000[b]
Residual	62.864	17	3.698		
Total	235.102	19			

a. Dependent Variable: Critical Thinking (y)

b. Predictors: (Constant), Digital Literacy (x2), Communication (x1)

Table 4 indicates that X1 and X2 simultaneously affect Y, with an F-calculated value of 23.289 and a significance level of 0.000 (less than 0.05). These statistical values suggest accepting the hypothesis "Communication Skills and Digital Literacy simultaneously affect critical thinking skills (y)".

Table 5 shows that $Y = -114.869 + 1.255\ X_1 + 0.984\ X_2$. The regression equation suggests that: (a) if X1 and X2 equal 0 (zero), then Y -114.869; (b) X1 has a positive (unidirectional) effect on Y, meaning that if X1 increases by 1 unit, Y increases by 1.255 and vice versa; (c) X2 has a positive (unidirectional) effect on Y, meaning that if X2 increases by 1 unit, Y increases by 0.984 and vice versa.

Table 6 shows a determination coefficient (R-square) of 0.733. The statistical value indicates that 73.3% of Y variables are influenced by X1 and X2, while other factors influence the rest (26.7%). In other words, communication skills (X1) and digital literacy (X2) contribute 73.3% to critical thinking skills (Y). Based on the information presented in Table 7, we calculated the effective contribution of the independent variables using the EC formula, where EC = Beta x Zero Order. The results are presented below.

Communication (x1) = 0.51 x 0.68 x100%= 34.41

Digital Literacy (x2) = 0.55x0.71 x100% = 38.85

Table 5. Regression Coefficient of Communication Skills, Digital Literacy, and Critical Thinking Skills (y)

Model	Unstandardized Coefficients		Standardized Coefficients			Correlations		
	B	Std. Error	Beta	t	ig.	Zero-order	Partial	art
(Constant)	-114.869	30.117		-3.814	.001			
Communication (x1)	1.255	.328	.506	3.824	.001	.680	.680	.480
Digital Literacy (x2)	.984	.237	.548	4.146	.001	.709	.709	.520

a. Dependent Variable: Critical Thinking (y)

Table 6. The result of the Multiple Regression Analysis on the Contribution of Communication Skills and Digital Literacy on Critical Thinking (y)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.856[a]	.733	.701	1.92298

a. Predictors: (Constant), Digital Literacy (x2), Communication (x1)
b. Dependent Variable: Critical Thinking (y)

Table 7. The Contribution of Communication Skills and Digital Literacy to Critical Thinking Skills (Y)

Variable	RC (%)	EC (%)
Communication (x1)	46.97	34.41
Digital Literacy (x2)	53.03	38.85
Total	100.00	73.26

Table 7 shows that communication skills and digital literacy contribute 34.41% and 38.85% to students' critical thinking skills, respectively.

The STAD Classroom

A multiple linear regression analysis was performed to investigate the contribution of the independent variables X1 and X2 on Y in the STAD classroom. Table 8 shows the results of the multiple linear regression analysis.

Table 8. Summary of the ANOVA test on the Contribution of Communication Skills and Digital Literacy on Critical Thinking (y)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	233.406	2	116.703	14.866	.000[b]
	Residual	133.452	17	7.850		
	Total	366.858	19			

a. Dependent Variable: Critical Thinking (y)
b. Predictors: (Constant), Digital Literacy (x2), Communication (x1)

Table 9 indicates that X1 and X2 simultaneously affect Y, with an F-calculated value of 14.866 and a significance level of 0.000 (less than 0.05). These statistical values suggest accepting the hypothesis "Communication Skills and Digital Literacy simultaneously affect critical thinking skills (y)".

Table 9. Regression Coefficient of Communication Skills, Digital Literacy, and Critical Thinking Skills (y)

Model	Unstandardized Coefficients		Standardized Coefficients			Correlations		
	B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part
(Constant)	-73.683	25.822		-2.853	.011			
Communication (x1)	1.011	.360	.482	2.804	.012	.709	.562	.410
Digital Literacy (x2)	.938	.375	.430	2.500	.023	.684	.518	366

a. Dependent Variable: Critical Thinking (y)

Table 9 shows that Y = -73.683 + 1.011 X_1 + 0.938 X_2. The regression equation suggests that: (a) if X1 and X2 equal 0 (zero), then Y -73.683; (b) X1 has a positive (unidirectional) effect on Y, meaning that if X1 increases by 1 unit, Y increases by 1.011 and vice versa; (c) X2 has a positive (unidirectional) effect on Y, meaning that if X2 increases by 1 unit, Y increases by 0.938 and vice versa.

Table 10. The result of the Multiple Regression Analysis on the Contribution of Communication Skills and Digital Literacy on Critical Thinking (y)

Model	R	R Square	Adjust d R Square	Std. Error of the Estimate
1	.798[a]	.636	.593	2.80181

a. Predictors: (Constant), Digital Literacy (x2), Communication (x1)

b. Dependent Variable: Critical Thinking (y)

Table 10 shows a determination coefficient (R-square) of 0.636. The statistical value indicates that 63.6% of Y variables are influenced by X1 and X2, while the rest (36.4%) are influenced by other factors. In other words, communication skills (X1) and digital literacy (X2) contribute 63.6% to critical thinking skills (Y). Based on the information presented in Table 11, we calculated the effective contribution of the independent variables using the EC formula, where EC = Beta x Zero Order. The results are presented below.

Communication (x1)=0.48 x 0.71 x100%=34.17

Digital Literacy (x2)=0.43x0.68 x100% = 29.41

Table 11. The Contribution of Communication Skills and Digital Literacy to Critical Thinking Skills (Y)

Variable	RC (%)	EC (%)
Communication (x1)	53.74	34.17
Digital Literacy (x2)	46.26	29.41
Total	100.00	63.59

Table 11 indicates that communication skills and digital literacy contribute 34.17% and 29.41% to students' critical thinking skills, respectively.

The Conventional Classroom

A multiple linear regression analysis was performed to investigate the contribution of the independent variables X1 and X2 on Y. Table 12 shows the results of the regression analysis.

Table 12. Summary of the ANOVA test on the Contribution of Communication Skills and Digital Literacy on Critical Thinking (y)

Model		Sum of Squares	df	Mean Square	F	Sig.
1	Regression	199.733	2	99.866	8.631	.003[b]
	Residual	196.707	17	11.571		
	Total	396.439	19			

a. Dependent Variable: Critical Thinking (y)

b. Predictors: (Constant), Digital Literacy (x2), Communication (x1)

Table 12 indicates that X1 and X2 simultaneously affect Y, with an F-calculated value of 8.631 and a significance level of 0.000 (less than 0.05). These statistical values suggest accepting the hypothesis "Communication Skills and Digital Literacy simultaneously affect critical thinking skills (y)".

Table 13. Regression Coefficient of Communication Skills, Digital Literacy, and Critical Thinking Skills (y)

	Unstandardized Coefficients		Standardized Coefficients			Correlations		
Model	B	Std. Error	Beta	t	Sig.	Zero-order	Partial	Part
(Constant)	-43.573	19.048		-2.288	.035			
Communication (x1)	.765	.285	.462	2.683	.016	.522	.545	.458
Digital Literacy (x2)	.983	.349	.485	2.817	.012	.542	.564	.481

a. Dependent Variable: Critical Thinking (y)

Table 13 shows that $Y = -43.573 + 0.765\ X_1 + 0.983\ X_2$. The regression equation suggests that: (a) if X1 and X2 equal 0 (zero), then Y -43.573; (b) X1 has a positive (unidirectional) effect on Y, meaning that if X1 increases by 1 unit, Y increases by 0.765 and vice versa; (c) X2 has a positive (unidirectional) effect on Y, meaning that if X2 increases by 1 unit, Y increases by 0.938 and vice versa.

Table 14. The Result of the Multiple Regression Analysis on the Contribution of Communication Skills and Digital Literacy on Critical Thinking (y)

Model	R	R Square	Adjusted R Square	Std. Error of the Estimate
1	.710[a]	.504	.445	3.40161

a. Predictors: (Constant), Digital Literacy (x2), Communication (x1)

b. Dependent Variable: Critical Thinking (y)

Table 14 shows a determination coefficient (R-square) of 0.504. The statistical value indicates that 50.4% of Y variables are influenced by X1 and X2, while the rest (49.6%) are influenced by other factors. In other words, communication skills (X1) and digital literacy (X2) contribute 50.4% to critical thinking skills (Y). Based on the

information in Table 15, we calculated the effective contribution of the independent variables using the EC formula, where EC = Beta x Zero Order. The results are presented below.
Communication (x1)=0.46 x 0.52 x100%=24.12
Digital Literacy (x2)=0.49x0.54 x100% = 26.29

Table 15. The Contribution of Communication Skills and Digital Literacy to Critical Thinking Skills (Y)

Variable	RC (%)	EC (%)
Communication (x1)	47.85	24.12
Digital Literacy (x2)	52.15	26.29
Total	100.00	50.40

Table 15 indicates that communication skills and digital literacy contribute 24.12% and 26.29% to students' critical thinking skills, respectively.

Discussion

The multiple linear regression analyses show Y = -114.869 + 1.255 X_1 + 0.984 X_2 for the WE-ARe class, Y = -73.683 + 1.011 X1 + 0.938 X2 for the STAD class, and Y = -43.573 + 0.765 X1 + 0.983 X2 for the conventional class. In the WE-ARe class, communication skills and digital literacy contribute 73.3% to critical thinking. In the STAD class, communication skills and digital literacy contribute 63.6% to critical thinking. Meanwhile, in the conventional class, communication skills and digital literacy contribute 50.4% to critical thinking. These results indicate that the contribution of communication skills and digital literacy to critical thinking is higher in the WE-ARe class than in the STAD or conventional classes. Constructivism theory posits that students construct knowledge through a series of stages, including the development of schemas based on initial information and the subsequent assimilation of that information into knowledge (M. Y. Zhou & Brown, 2013). Educators' dominance in the classroom negatively affects students' motivation to actively participate in cognitive and educational activities (Harianja et al., 2023). Hence, selecting an appropriate learning model based on students' learning requirements is crucial.

Educators in the WE-ARe class provide more space and opportunities for students to become more independent. The *warm-up* phase in WE-ARe allows students to think about the learning material and sleep on it (incubate). Incubation refers to giving students time to re-read learning-related literature, whether in a book, a research article, or other learning resources. Following that, students participate in learning activities that transform student experiences. Then, the *exploring* phase fosters student collaboration. This phase is related to the zone of proximal development, which is the distance between pupils' current conditions and their potential while solving issues with the assistance of more capable individuals. Meanwhile, in the *argumentation* phase, the educator's role is to facilitate students in producing argumentative discourse and monitor students' progress. In this phase, students can discuss, and practice arguments based on prior knowledge and learning experiences. Students can increase interaction with peers in developing their argumentative discourse. Thus, students can enhance mutual respect, cooperation, and closer social communication through group and class discussions. The *resume* phase attempts to teach students how to analyze material independently so that they can increase the quality of their argumentative discourse on their own. At this point, educators should incorporate a range of learning strategies to boost student learning motivation. The phases in WE-ARe have been shown effective to support communication skills and digital literacy, which contribute

to students' critical thinking. The enhancement of student learning outcomes is contingent upon both their intrinsic motivation to excel academically and the instructional approaches employed by educators within the classroom setting (Sariam & Harahap, 2022).

Active participation in problem analysis within group collaborations can enhance students' critical thinking and problem-solving skills (Tseng et al., 2012). According to Slavin, learning is facilitated by sensory registration, which requires individuals to pay attention to specific information (Slavin, 2000). One method for fostering student curiosity is by presenting problems that require solutions (Rotgans & Schmidt, 2011). Student participation in class discussions allows for brainstorming, critique, response, and question answering, thereby indirectly enhancing critical thinking. Critical thinking skills encompass several key components, including clarification, assessment, justification, connecting ideas, and novelty (Indrawati, 2021). Critical thinking enhances students' ability to effectively analyze problems, evaluate relevant information, and draw informed conclusions, thereby fostering the development of stronger comprehension and analytical skills (Palinussa et al., 2023).

Communication skills are the ability to express and receive messages in different contexts. Communication helps students articulate ideas and thoughts orally, in writing, and non-verbally in various contexts so that listeners can receive the messages effectively and adequately (Rahman et al., 2019). Inadequate communication skills can impair one's capacity to receive information, integrate thought and speech, and adjust to one's surroundings (Wood & Hasrtshorne, 2017). The use of digital media can help students improve their communication abilities as well as their learning independence (Amin, Karmila, et al., 2022; Retnawati, 2017). Vygotsky proposed that an individual's cognitive development is influenced by the social environment (Schunk, 2012). According to Claro, conveying information is the primary element of communication skills (Claro et al., 2012). Effective communication skills enhance students' argumentative proficiency (D. Zhou et al., 2021). Effective communication involves both verbal and non-verbal aspects of how individuals express themselves and actively listen to others (Velentzas & Broni, 2014).

Digital media supports the development of students' communication skills. Students can use digital media during presentations, studies, or to acquire information to solve educational challenges (Greter & Yadav, 2016). Students must be able to use digital media responsibly (Rasmusson et al., 2013). Students can use digital media to practice talking in small group discussion forums and to discuss current topics in an appealing manner and conformity with the character of today's society (Hujjatusnaini et al., 2022). The flexibility of the information collected by students allows them to identify, analyze and evaluate the information they need, and use it for the development of their skills in the classroom or their future (Sriarunrasmee et al., 2015).

Digital literacy allows students to recognize the right way to use technology to communicate. Students, for example, must distinguish between communicating with teachers via technology and face-to-face. Students must also estimate the precision of employing technology for communication. To reduce the risk of technological misuse among college students, digital literacy is required(Pew Research Internet Project, 2013). Digital literacy encompasses various components, including critical thinking, creativity, information construction and evaluation, as well as proficient utilization and development of digital media, such as digital writing (Al-Qallaf & Al-Mutairi, 2016). Dimmit and Weber discovered a link between critical thinking skills and information literacy (Dimmitt, 2017; Weber et al., 2018). Multidisciplinary learning can assist students in connecting and synthesizing information from diverse viewpoints, enhancing critical thinking. With critical thinking, students can examine and analyze all forms of knowledge. Students with strong information literacy skills have expertise using many sources of information and thoroughly assessing and evaluating information (Subekti et al., 2018).

CONCLUSION

The present study revealed the contribution of communication and digital literacy skills to critical thinking when implementing the WE-ARe learning model. The relationship between the three variables is depicted in the regression equation Y = -114.869 + 1.255 X_1 + 0.984 X2. The equation suggested that, in the WE-ARe classroom, communication skills and digital literacy contributed 73.3% to critical thinking. This study also proved the contribution of communication and digital literacy skills to critical thinking when implementing STAD, where Y = -73.683 + 1.011 X1 + 0.938 X2. The equation indicated that, in the STAD classroom, communication skills and digital literacy contributed 63.6% to critical thinking. We also found that communication and digital literacy skills contributed 50.4% to critical thinking. The relationship between the three variables can by explained by the equation Y = -43.573 + 0.765 X1 + 0.983 X2. These results indicate that the contribution of communication skills and digital literacy to critical thinking is higher in the WE-ARe class than in the STAD or conventional classes. This study highlights the significance of implementing active and innovative learning models in classrooms to support the development of communication skills and digital literacy. Both skills must be cultivated and honed as they significantly influence the enhancement of students' critical thinking skills. The WE-ARe model is anticipated to be selected as an alternative model by educators to meet the learning needs of students in the 21st century. Future researchers can expand the scope of the current study by increasing the sample size and conducting research on a broader scale.

CONFLICT OF INTEREST

The authors have no conflicts of interest to disclose.

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