JISE 11 (3) 2022 : 347-361

Journal of Innovative Science Education

http://journal.unnes.ac.id/sju/index.php/jise

Critical Thinking Skills and Digital Literacy of High School Students in Science Learning Using E-Learning with STEM Vision

Sarini Rahayu ✉, **Wiwi Isnaeni, Masturi Masturi**

Pascasarjana, Universitas Negeri Semarang, Indonesia

Article Info

Article History :
July 2022
Accepted
September 2022
Published
December 2022

Keywords:
critical thinking, digital literacy, e-learning with a STEM vision

Abstract

Critical thinking skills and digital literacy are competencies that students must have in facing the challenges of 21st century learning, including in contextual biology learning and STEM vision. The learning process is in line with technological developments, so it needs to be utilized optimally through E-Learning. This study aims to analyze the effect of STEM-vision E-Learning on digital literacy, critical thinking, and determine the responses of teachers and students to the application of STEM-vision E-Learning learning. This study used a quasi-experimental design with a pretest-posttest control group design. The subjects of this study included 60 students in class XI MIPA 4 and 5 as the Experiment class E-Learning with STEM Vision and 60 students in XI MIPA 6 and 7 as the control class Conventional E-Learning. This research was conducted at SMA N 1 Ungaran. The data measured in this study were critical thinking skills, digital literacy, teacher and student responses to STEM-Vision E-Learning learning, and data on the implementation of the learning process. The instruments used include written tests, observation sheets, questionnaires, and interviews. Data on critical thinking skills and digital literacy were analyzed using the n-gain test, T test, regression test, and MANOVA test. The response data of teachers and students, as well as the process of implementing STEM-Vision E-Learning learning was analyzed descriptively. Research results:1Shows that in general there is a significant difference in digital literacy between the experimental class and the control class. 2There is a significant difference in critical thinking ability between the experimental class and the control class. 3There are significant differences in critical thinking skills and digital literacy between the experimental class and the control class. 4Learning STEM Vision E-Learning can be implemented well, students and teachers give a positive response to learning STEM Vision E-Learning on the material circulation system. Suggestions for this research: For teachers who want to improve students' critical thinking skills and digital literacy, teachers can use STEM vision E-Learning.

✉ correspondence :
Jalan Kelud Utara III No.37, Kota Semarang,
Jawa Tengah, Indonesia 50237
E-mail: sarinirahayu@gmail.com

p-ISSN 2252-6412
e-ISSN 2502-4523

INTRODUCTION

US-based Partnership for 21st Century Skills(P21), identified the competencies needed in the 21st century, namely "The 4Cs" - communication, collaboration, critical thinking, and creativity (Zubaidah, 2016). These competencies are important to be taught to students in the context of learning biology in the 21st century. 21st century skills are divided into 4 categories, namely 1) way of thinking consisting of creativity, innovation, critical thinking, problem solving, and decision making. 2) the way of working consists of communication, collaboration and teamwork skills. 3) tools for working consist of communication and information technology literacy skills. 4) skills for living in the world consist of skills based on information literacy, including mastery of information technology, new communications, the ability to learn and work through digital social networks.

There are many ways that can be done to improve students' critical thinking skills, one of which is by doing Biology learning which was developed with the STEM approach(Wahyuaji & Suparman, 2018). The STEM approach is learning that integrates various disciplines, namely Science, Technology, Engineering and Mathematics (Wahyuaji & Suparman, 2018). Learning with a STEM approach can develop skills in scientific inquiry and problem solving skills (Integrated et al., 2019).

STEM will be integrated in the Biology learning process if it is carried out by providing an experience for students to solve complex and real problems in everyday life, for example through simple practicum activities (Tseng et al., 2013). Learning that uses the STEM approach is proven to be effective in improving students' critical and creative thinking skills. STEM is a learning approach to develop quality digital literacy skills and critical thinking skills in accordance with the demands of 21st century skills(Wahyuaji & Suparman, 2018).

According toAceh & Scientific (2020)The STEM approach can provide benefits to students, because the teacher invites students to do meaningful learning. Some of the things that make learning meaningful include being able to understand a concept and explore through project activities. If learning is teacher-centered, students will not be interested in learning. Students are more interested in something new, namely in the discovery process obtained from students as a provision for social life in solving problems faced in everyday life related to the field of STEM science, so students will be actively involved in the learning process (Wibowo, 2018).

The current learning conditions force students and teachers to carry out online learning processes due to Covid 19. The government has issued a policy of limiting distance and restrictions on community movement. Distance learning makes more use of internet media to meet face-to-face and interact in learning (Wibowo, 2018). The Ministry of National Education launched an information and communication technology service program to optimize learning media in the form of Google .com facilities. The Minister of National Education hopes that these learning facilities can improve the quality of education and expand student learning opportunities (Sudibjo, 2019). This also makes teachers and students carry out online learning by utilizing internet media(Sutame, 2019). Online learning has also begun to be developed, such as research conducted by Putra & Sudarti (2015) who developed E-Learning to improve critical thinking skills. E-Learning is a learning process from sharing information about science that allows the delivery of teaching materials to students using internet media.(Ramadhani & Gustin, 2020).

In the current learning process, teachers and students are required to be internet literate. In E-Learning learning, teachers are required to understand digital literacy, by being able to distinguish valid and invalid sources of information from teaching materials via the internet (Ramadhani & Gustin, 2020). Teaching materials are tools to help teachers and students in the learning process to be more effective. In addition, teaching materials will be integrated into Biology learning materials using digital literacy.

Digital literacy is an activity related to an individual's ability to use ICT and the Internet to achieve results in an activity (Yusuf et al., 2019). In addition, digital literacy involves various abilities, including understanding, analyzing, evaluating various information received, and evaluating the information (Ramadhani & Gustin, 2020). This is also the case in Biology learning, students can

understand information about the circulation system material correctly through digital literacy.

The circulation system material is included in the emergency curriculum which was formed in response to the outbreak of covid-19, so there is a need for simplification in learning and changes to the KD numbering so as not to burden students. Basic competencies (KD) that must be achieved by students in the circulation system material include KD 3.8 and 4.8. KD 3.8 describes the things that must be achieved by students, namely students are expected to be able to analyze the relationship between the structure of the tissues making up organs in the circulatory system related to bioprocesses and organ dysfunction. KD 4.8 describes the things that must be achieved by students, namely presenting the results of an analysis of the influence of lifestyle on abnormalities in the structure and function of organs that cause disturbances in the circulatory system and its relation to technology.

Based on the results of interviews with several Biology teachers who joined the MGMP Kab. Semarang, obtained information, among others; 1).In the learning process, students have not been able to apply critical thinking skills and digital literacy well, because of the low digital literacy of students and the results of students' critical thinking skills test 2).Students have not been able to innovate with technology through the learning process with a STEM approach.3) The learning of circulation system material with the STEM approach at SMA N 1 Ungaran in class XI MIPA has not been fully integrated, due to the lack of mathematical and engineering components, so students can only solve simple problems in the learning process. 4). Teachers find it difficult to carry out practical activities during the COVID-19 pandemic, so that students only memorize a learning concept on the circulation system material through printed books obtained from the school without carrying out project activities. This also resulted in the low ability of critical thinking skills and digital literacy in students.

Based on this description, it is necessary to innovate in learning to support the optimization of the learning process on the excretory system material at SMA N 1 Ungaran by using E-learning with STEM vision. Through E-Learning with STEM vision, students are expected to have better digital literacy and critical thinking skills.

METHODS

This research is a quasi-experimental research with pretest-posttest control group design (Sugiyono, 2015). Systematically this research design can be described in Table 1 as follows:

Table 1. Pretest- Posttest Control Group Design.

Group	Pre test	Treat	Post test
Experiments	PR 1	X1	Po1
Control	PR 2	X2	Po2

Information :

PR 1.2 : Pretest (Critical thinking skills and digital literacy)

X1 :*E-Learning*STEM vision

X2 :*E-Learning*conventionally (using lecture and discussion methods with Google classroom and whatsapp grub)

Po : Posttest (Critical thinking skills and digital literacy)

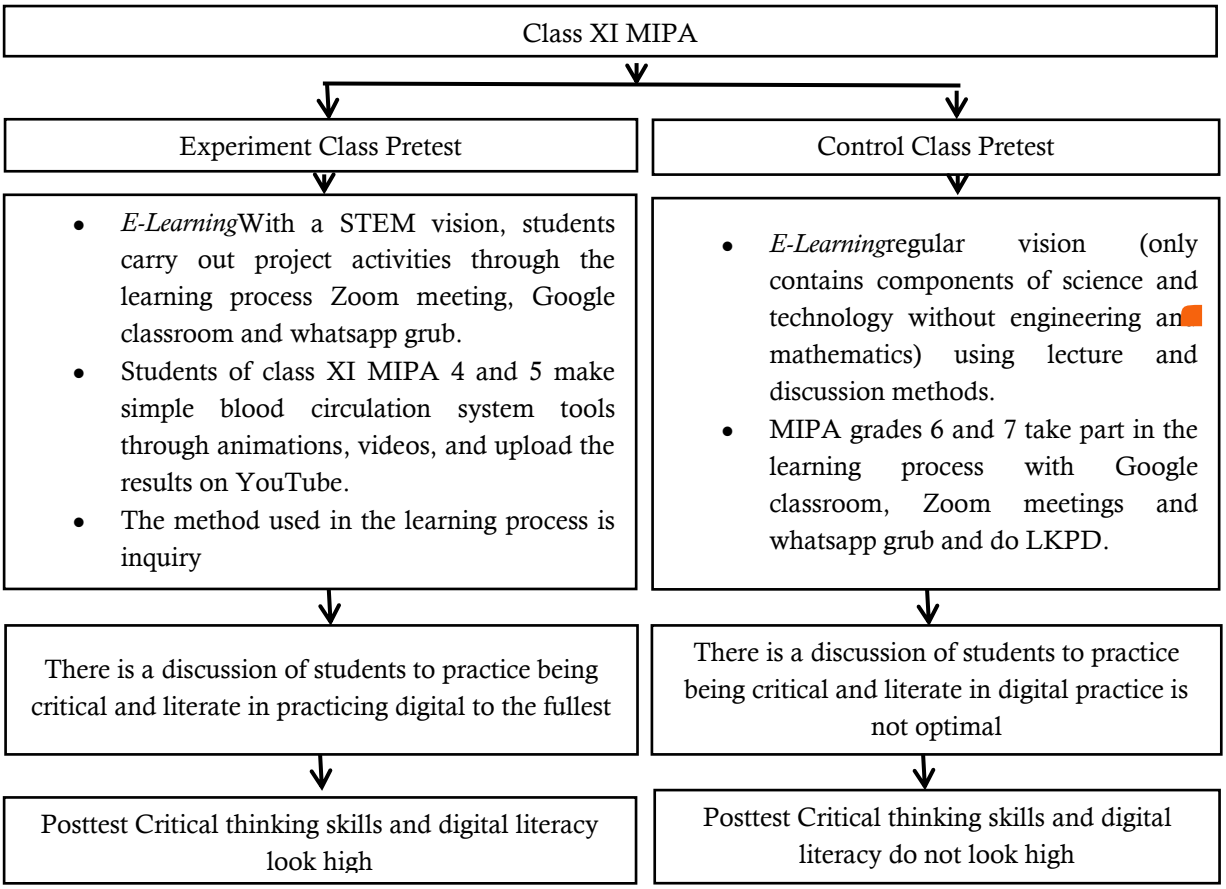

Figure 1. Flowchart of the process of implementing E-Learning learners with a STEM vision

Data collection was carried out using two techniques, namely test and non-test techniques. The test technique was used to collect data on critical thinking skills. Non-test techniques used to collect data include; digital literacy, teacher and student responses to E-Leraning learning with STEM vision, and the learning implementation process. The test and non-test data collection instruments will be validated before being used to collect data. The test instrument is validated by means of; discriminatory test, difficulty test, and reliability test. The non-test instrument was validated by means of a validation sheet. The test instrument was used to collect data on critical thinking skills. Non-test instruments were used to collect digital literacy data, teacher and student responses to STEM-vision E-Leraning learning, as well as the learning implementation process.

Critical thinking skills data were analyzed by means of validity, reliability, discriminatory power,difficulty level, and n-gain. Digital literacy data, teacher and student response data in STEM-vision E-Leraning learning, as well as learning implementation data were analyzed by means of observation sheets and questionnaire sheets. The data were analyzed using the Independent Sample T-Test, regression, and MANOVA analysis techniques, to perform the T-Test, regression and MANOVA tests, it was necessary that the data had to be homogeneous and normally distributed, therefore before performing the T-Test, regression, and MANOVA tests, conductedfirst test for normality and homogeneity.

RESULTS AND DISCUSSION

The results of this study include: critical thinking skills, digital literacy, student and teacher responses to STEM-vision E-Learning learning, as well as the process of implementing STEM-vision E-Learning learning with circulation system materials.

A. Students' critical thinking skills

Critical thinking skills of experimental and control group students, before and after the study are presented in Table 2.

Table 2. Critical Thinking Skills of Experimental and Control Group Students

Class	Pre-test	Lowest Value	The highest score	Post-ttest	Lowest Value	The highest score
Experiment	72.41	60	86	84.63	75	98
Control	69.60	57	83	81.26	71	93

From Table 2 it can be seen that the pretest and posttest scores of the control class students were lower than the experimental class students or the experimental class students got higher scores than the control class.

The data in Table 2 were then analyzed by the N-gain test.The N-Gain achievement of critical thinking skills in the experimental and control groups can be seen in Figure 2

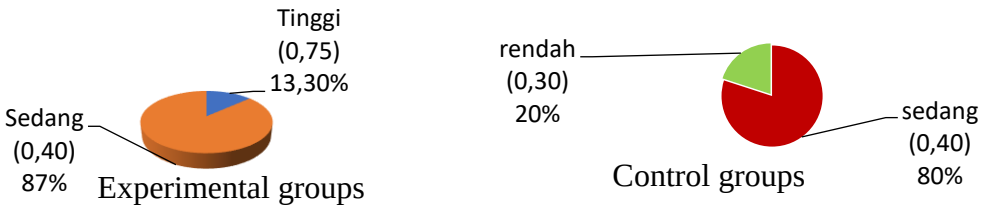

Figure 2. Achievement of critical thinking skills in the experimental and control groups

The results of the analysis of the average N-gain showed that the n-gain index of the experimental group students was higher than the control group, namely 0.75 and 0.40 in the high and medium categories. From the N-gain analysis, it is known that 8 students (13.30%) of the experimental group reached the high category and 52 students (86%) of the experimental group reached the medium category. In general, the results showed that the critical thinking skills of the experimental class students were better than the control class. This is in line with the research of Wibowo (2018) and the research of Wahyuaji and Suparman (2018) which states that learning with the STEM approach can cause students' critical thinking skills to be higher.

Based on Figure 2, it is known that the achievement of increasing critical thinking skills of high category students is only obtained by experimental class students. This is also supported by data obtained from observations of the learning process in the experimental class including project activities. The following is Table 3 Project activities carried out by experimental class students.

Table. 3. Project activities carried out by experimental class students

Rated aspect	Group animation video achievement score*				Achievement scores of animated videos about the process of making simple group tools*					
	1	2	5	10	3	4	6	7	8	9
Planning	3	3	4	4	3	3	3	3	3	4
Data collection	3	3	4	4	3	3	3	3	4	4
Organizing	3	3	4	4	3	3	4	4	4	4
Data processing	3	3	4	4	3	3	4	4	4	4
Data presentation	3	3	4	4	3	3	3	4	4	4
Average	3	3	4	4	3	3	3.4	3.6	4	4

Notes * Scores are assessed as 1-4, 1 = not good, 2 = not good, 3 = good, 4 = very good

In Table 3 it is known that the project activity data for each aspect assessed in groups 1-10 all reached the good and very good categories. The very good category was achieved by the category of students in groups 5, 10, and 9. From these data, it can be concluded that all experimental class students were very enthusiastic in making simple tools for the human circulation system. Unlike the case with the control class, students did not experience an increase in the category of high-level critical thinking, because in the learning process they did not carry out project activities. However, the learning process is carried out using the lecture or discussion method and working on the LKPD given by the teacher. This is in line with researchArdiansyah et al (2020)and Subdijo (2019) the use of multimedia in the learning process is able to visualize abstract material concepts to be more concrete, so that students are challenged to analyze, criticize, and make conclusions about the concepts studied. This can also be observed from student activities during learning and the work produced by students. Each group tries to present their best work. In addition to data from observations of the learning process by carrying out project activities, it can also be supported fromcritical thinking ability indicator data. In Table 4 the N-Gain Results of Critical Thinking Ability Per indicator.

Table 4. N-Gain Results of Critical Thinking Ability Per Indicator in Experimental and Control Group Students

Indicator	N-gain klp Experiment	Criteria	N-gain klp Control	Criteria
1. Give a simple explanation	0.433	Currently	0.327	Currently
2. Make further explanation	0.535	Currently	0.451	Currently
3. Make an estimate	0.350	Currently	0.265	Low
4. Making basic skills Observation	0.307	Currently	0.268	Low
5. Conduct deductions and assess deduction result	0.860	Currently	0.642	Currently
Average N-Gain	0.497	Currently	0.390	Currently

Based on Table 4, it is known that the n-gain achievement data for each indicator in the experimental group all reached the medium category, but in the control group there were 2 indicators that reached the low category, namely no. 3 and 4. This is in line with the research.Barisan (2022)STEM learning is able to stimulate students' critical thinking skills through the evaluation stage.

Data on critical thinking skills in the experimental group and control group students will then be tested for normality. Normality test on critical thinking ability data is used to determine whether the data is normally distributed or not. The test was carried out through the Kolmogorov-Smirnov test with the provisions according to Aripin (2013) as follows: If the value of sig < 00.5 then the data is not normally distributed. If the value of sig > 0.05 then the data is normally distributed. These data can be presented in Table 5

Table 5. Normality Test of Critical Thinking Ability Test on Experimental Group Students and Control Group

	Kolmogorov- smirnova			Shapiro-wilk		
	Statistics	Df	Sig	Statistics	Df	sig
Experiment	0.093	60	0.200*	0.964	60	0.073
Control	0.104	60	0.167	0.964	60	0.075

Based on Table 5 Tests of Normality in the Kolmogorov-Smirnov column, it can be seen that the significance value for the normality of the initial critical thinking ability test data for the control class = 0.167 > 0.05, while the significance value for the normality of the initial critical thinking ability data for the experimental class = 0.200 > 0, 05 then it is declared accepted. This shows that the initial critical thinking ability test data for the control class and the experimental class are normally distributed. After doing the normality test, then the homogeneity test was carried out.H_0

Homogeneity testing is carried out to determine whether one sample with another sample has similarities or not. Homogeneity testing in research can use the SPSS 23 application with the provisions of the test results as follows:

If the value of sig < 0.05 then the data is not homogeneously distributed. If the value of sig > 0.05 then the data is homogeneously distributed. These data can be presented in Table 6

Table 6. Homogeneity Test Critical Thinking Ability Test Initial Values for Students in the Experimental Group and Control Group

Levene Statistics	df 1	df 2	Sig
0.00	1	118	0.990

Based on Table 6, the homogeneity of the initial critical thinking ability test data = 0.990 > 0.05, then it is accepted. This shows that the variance of the control class and the experimental class is said to be homogeneous. Data on critical thinking abilities of students in the experimental group and control group which are normally distributed and homogeneous will then be analyzed through the Independent Sample T-Test. The following is Table 7. The results of the analysis of the Independent Sample T-TestH_0

Table 7. T-test of Critical Thinking Ability in Experiment and Control group students

	Levene's test forequality of variances		t-test for equality of means						
	F	Sig	T	df	Sig(2-tailed)	mean difference	Std error difference	95% Confidence internal of the different Lower	upper
N-Gain Equal variances assumed	1.550	0.216	2819	118	0.006	.06815	.02417	.02028	.11601
Equal variances not assumed			2819	114631	0.006	.06815	.02417	.02027	.11603

Based on Table 7 Independent Sample T-Test, it is known that the significance value is , then it is declared rejected. This means that there is a significant difference in students' critical thinking skills between learning through E-Learning with STEM vision and without STEM vision E-Learning on circulation system material.$(\propto) = 0{,}006 < 0{,}05 H_0$

The data in Table 7 will then be analyzed by using a regression test to determine whether or not there is an effect of STEM-vision E-Learning on the critical thinking skills of experimental class students. The following is Table 8 Simple linear regression test results:

Table 8. Simple Linear Regression Test Results E-Leraning with STEM Vision on Critical Thinking Ability of the experimental group

Model	R	Rsquare	Adjusted R Square	Std Error of the estimate
1	0.953a	0.907	0.906	1.902

Based on Table 8, it is known that the R Square value is 0.907. This value means that the influence of pLearning through E-Learning with STEM vision on students' critical thinking skills on the circulation system material is 90.7% while 9.3% of students' critical thinking skills on the circulation system material are influenced by other variables not examined. So the regression model can be used to predict or in other words, there is an effect of STEM-vision E-Learning on students' critical thinking skills on the material of the circulation system.The following is Table 9 which is the basis for determining the regression equation between E-Learning with STEM vision and critical thinking skills.

Table 9. Value of Regression Equation Between E-Learning with STEM Vision and Critical Thinking Ability. Coefficientsa

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	Std Error	Beta		
(Costanta)_STEM Learning	45.362	1 1.666		45.327.234	0.00
	1.642	0.069	0.953	23.837	0.00

Based on Table 9 Coefficients of significance value, it is declared rejected. This means that there is a significant influence between learning through E-Learning with STEM vision on students' critical thinking skills on the material of the circulation system.$= 0{,}000 < 0{,}05 H_0$

Regression equation:

$$\hat{Y} = 45{,}362 + 1{,}642x$$

It means: Learning through E-Learning with STEM vision has a positive effect on students' critical thinking skills on the material of the circulation system. According to Putra & Sudarti (2015). E-Learning with a STEM vision can improve critical thinking skills. This is in line with the research of Wibowo (2018) and the research of Wahyuaji and Suparman (2018) which state that learning with the STEM approach can cause students' critical thinking skills to be higher. Meanwhile, according to Aceh & Scientific (2020). The STEM approach can provide benefits to students, because the teacher invites students to do meaningful learning. This is also supported by the data obtained from the observations in Tables 3 and 4. Meaningful learning in the results of this study students carried out the learning process with various kinds of project activities, including; students make simple tools for the mechanism of the human circulation system, animations, and videos. These project activities can improve students' critical thinking skills. One indicator of students' critical thinking skills is to make estimates by identifying the mechanism of blood circulation. In addition to students doing project activities, students are also more interested in something new (Wibowo, 2018). This is also in line with the opinion Hadiyanto & Thaib (2016)To solve a problem in the learning process, students must have abilities such as problem solving, thinking, group work, communication, and the ability to obtain information, process information and exchange information, so that the learning process carried out in this study for the experimental class used the inquiry method.

B. Student Digital Literacy

The digital literacy of experimental group students and control group students is presented in Table 10.

Table 10. Percentage of Digital Literacy Per-Indicator of Experimental Student Groups and Groups Control Student

Indicator	The percentage of digital literacy in the control group	The percentage of digital literacy in the experimental group
1.Using the internet	18.00%	19.00%
2.Using the internet for get information	17.60%	17.60%
3.Using electronic media	17.60%	17.60%
4.Using the internet for obtain information directly effective	17.60%	17.88%
5.Producing media for various information	17.60%	18.00%

Based on Table 10, it is known that the percentage for each digital literacy indicator of students in the experimental group obtained a higher percentage than the control group students, as shown in indicators 1, 4 and 5. From these data it can be concluded that the internet is needed for students to carry out learning activities. in the midst of the COVID-19 pandemic. This is also in line with the opinionNahdi & Jatisunda (2020)Digital literacy has four abilities, namely basic internet skills, the ability to find and obtain information, frequently used information sources, and the ability to use information effectively.(Nahdi & Jatisunda, 2020). Besides, in lineaccording to Ramadhani & Gustin (2020)Digital literacy involves various abilities, including understanding, analyzing, evaluating various information received, and evaluating the information.

From the data in Table 10, it was then analyzed through the Independent Sample T-Test. The following is Table 11. The results of the Independent Sample T-Test test of digital literacy for experimental group students and control group students.

Table 11. T-test of digital literacy of experimental group students and control group students
Independent Sample T-Test

	Levene's test forequality of variances		t-test for equality of means						
	F	sig	T	Df	Sig(2-tailed)	mean difference	Std error difference	95% Confidence internal of the different lower	Upper
Digital literacy Equal variances assumed	139.00	0.00	30.067	118	0.00	45.933	1.528	42.908	48.959
Equal variances not assumed			30.067	82.511	0.00	45.933	1.528	42.895	48.972

Based on Table 11 Independent Sample T-Test, it is known that the significance value is , then it is declared rejected. This means that there is a significant difference in students' digital literacy skills between the experimental and control classes on the circulation system material.$(\propto) = 0{,}000 < 0{,}05 H_0$

From the data in Table 11, it will then be analyzed by using a regression test to determine whether or not there is an effect of STEM-vision E-Learning on digital literacy. The following table 12 The effect of E-Learning with STEM vision on digital literacy in the experimental class is carried out based on a regression test

Table 12. The results of the STEM-vision E-learning regression test on Digital Literacy in students experimental group

Model	R	Rsquare	Adjusted R Square	Std Error of the estimate
1	0.951a	0.905	0.903	1.922

Based on Table 12, it is known from the R Square value of 0.905. This value means that the effect of learning through E-Learning with STEM vision on students' digital literacy skills on the circulation system material is 90.5% while 9.5% of students' digital literacy skills on circulation system materials is influenced by other variables not examined. . From the data in Table 12, it is then analyzed using the following regression equation, Table 13 as a reference in making the regression equation.

Table 13. Value of Regression Equation Between E-Learning with STEM Vision and Digital Literacy.
Coefficientsa

Model	Unstandardized Coefficients		Standardized Coefficients	T	Sig
	B	Std Error	Beta		
1. (Costana)	44.596	11.683		45.326.499	0.00
_STEM ran ran learner					
	1.633	0.070	0.951	23.463	0.00

Based on Table 13. Coefficients is known to have a significance value, so it is declared rejected. This means that there is a significant influence between learning through E-Learning with STEM vision on students' digital literacy skills on the material of the circulation system.$= 0{,}000 < 0{,}05 H_0$

Regression equation:

$$\hat{Y} = 44{,}596 + 1{,}633x$$

It means: Learning through E-Learning with STEM vision has a positive effect on students' digital literacy skills on the material of the circulation system.

From the results of this study, it can be interpreted that the digital literacy of students is focused on E-Learning learning with STEM vision. This is in line with the opinion of Wahyuaji & Suparman (2018) and Sutame (2019) which state that E-Learning with STEM vision can improve digital literacy.

Analysis of the MANOVA test to determine the effect of STEM-vision E-Leraning on critical thinking skills and digital literacy. The following is Table 14. The results of the MANOVA E-Learning test with STEM vision on critical thinking skills and digital literacy.

Table 14. MANOVA (Multivariate Analysis of Variance) E-Learning Test Results with STEM Vision on Critical Thinking and Digital Literacy

Multivariate Tests[a]

Effect		Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	1.000	72553.512[b]	2.000	45.000	.000
	Wilks' Lambda	.000	72553.512[b]	2.000	45.000	.000
	Hotelling's Trace	3224.601	72553.512[b]	2.000	45.000	.000
	Roy's Largest Root	3224.601	72553.512[b]	2.000	45.000	.000
PEMBELAJARAN_ELEARNING_STEM	Pillai's Trace	1.443	9.156	26.000	92.000	.000
	Wilks' Lambda	.023	19.511[b]	26.000	90.000	.000
	Hotelling's Trace	22.554	38.169	26.000	88.000	.000
	Roy's Largest Root	21.606	76.452[c]	13.000	46.000	.000

a. Design: Intercept + PEMBELAJARAN_ELEARNING_STEM

b. Exact statistic

c. The statistic is an upper bound on F that yields a lower bound on the significance level.

Based on Table 14, it is known that the Multivariate Tests in the E-Learning column with STEM vision on Sig are known values so that H0 is accepted, meaning that STEM-vision E-Learning learning has a significant effect on students' critical thinking skills and digital literacy on circulation system materials. This is in line with$sig.\,0{,}000 < 0{,}05$Hidayati et al (2019)the improvement of students' critical thinking skills is influenced by the ease of students in accessing information in the learning process through STEM-vision E-Learning. According to Ramadhani & Gustin (2020) Information received by students can be obtained through digital literacy through the learning process through E-Learning with the STEM EM vision. Following is Table 14. Based on the Test of Between-Subjects Effects table in the Learning_Elearning_STEM column with the value of critical thinking and literacy skills digital

The following is Table 15. Based on the Test of Between-Subjects Effects table

Tests of Between-Subjects Effects

Source	Dependent Variable	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	NILAI_KBK	1818.067[a]	13	139.851	15.661	.000
	LITERASI_DIGITAL	2148.208[b]	13	165.247	76.440	.000
Intercept	NILAI_KBK	327250.309	1	327250.309	36645.874	.000
	LITERASI_DIGITAL	318371.114	1	318371.114	147272.987	.000
PEMBELAJARAN_ELEARNING_STEM	NILAI_KBK	1818.067	13	139.851	15.661	.000
	LITERASI_DIGITAL	2148.208	13	165.247	76.440	.000
Error	NILAI_KBK	410.783	46	8.930		
	LITERASI_DIGITAL	99.442	46	2.162		
Total	NILAI_KBK	436239.000	60			
	LITERASI_DIGITAL	422087.000	60			
Corrected Total	NILAI_KBK	2228.850	59			
	LITERASI_DIGITAL	2247.650	59			

a. R Squared = ,816 (Adjusted R Squared = ,764)

b. R Squared = ,956 (Adjusted R Squared = ,943)

Based on Table 15, it is known that the Test of Between-Subjects Effects in the column Learning E-learning STEM with a known value of critical thinking ability means that there is a significant effect of STEM E-Learning learning on students' critical thinking skills. Meanwhile, in the STEM E-Learning column with digital literacy, it is known that the value means that there is a significant influence on STEM E-Learning learning on students' digital literacy.$sig.\,0{,}000 < 0{,}05 sig.\,0{,}000 < 0{,}05$

C. Teacher and Student Response

Student response to the ongoing learning is very important to find out what students actually feel during the learning process.

This response can be input for teachers to improve further learning.

The results of the analysis of the teacher's response to E-Learning with STEM visionon the material of the circulation system can be seen in Table 16.

Table 16. Teacher's Responses to STEM-Vision E-Learning

Indicator number & description		Questionnaire score* Teacher 1	Teacher 2	Average	Note:
1	The project model used for E-Learning with an interesting STEM vision is taught to students	4	4	4	Strongly agree
2	Learning through E-Learning with STEM vision makes it easier for students to solve problems in everyday life	3	4	3.5	Agree
3	Learning through E-Learning with the STEM vision encourages students to find new ideas in making project activities.	4	4	4	Strongly agree
4	The contents of the LKPD through E-Leraning have a STEM vision according to the material being invited so that students understand the material presented by the teacher more quickly	4	3	3.5	Agree
5	By creating various types of project models through E-Leraning learning with STEM vision, it can motivate students in learning and develop students' creativity.	3	4	3.5	Agree
6	By making various types of project models through E-Learning learning with STEM vision, students can develop critical thinking skills and digital literacy.	3	4	3.5	Agree
7	By creating various types of project models through E-Leraning with the STEM vision, you can do it alone and together	3	4	3.5	Agree

Notes * Scores were scored as 1-4, 1=disagree, 2=disagree, 3=agree, 4=strongly agree.

Based on Table 16, it is known that the teacher's responses regarding the implementation of learning with digital literacy through E-Learning with the STEM vision are more dominant in agreeing which means that the implementation of learning with digital literacy skills through E-Learning with the STEM vision is good.

The results of the analysis of student responses to E-Learning with STEM vision on the circulation system material can be seen in Table 17.

Table 17. Student Responses to E-Learning with STEM Vision

Indicator number & description		Frequency of Respondents			
		score1	score2	score3	score4
1	The project model as an illustration of the circulation system mechanism using E-Learning with STEM vision is interesting.	0	2	38	20
2	I feel interested in learning to use E-Learning with a STEM vision	0	2	40	18
3	By carrying out project activities the circulation system mechanism can increase my knowledge about the circulation system material	0	2	40	18
4	Contents of LKPD Through E-Learning with STEM vision according to the material being taught	1	2	40	17
5	Instructions and steps for the circulation system mechanism project activity using E-Learning with STEM vision on LKPD are easy to understand	1	5	39	15
6	By making various types of circulation system mechanism project models using E-Learning with STEM vision, it can help me remember the circulation system material	2	2	28	28
7	By making various types of circulation system mechanism project models using E-Learning with a STEM vision, it motivates me to study	1	4	30	25
8	By creating various types of circulation system mechanism project models using E-Learning with STEM vision, I can develop digital literacy skills by creating animations or other media.	2	4	36	18
9	By making various types of circulation system mechanism project models using E-Learning with a STEM vision, it can be done alone and together	2	2	18	38

Based on Table 17, it is known that the assessment of learning with digital literacy through E-Learning with STEM vision, the experimental class was dominated by students giving positive responses, namely scores of 3 and 4 rather than negative. Based on the results of observations of the learning process, students rarely use gadgets to search for information through web browsers, but students find it easier to conclude information via the internet compared to textbooks, so it can be concluded that learning assessments with digital literacy skills use additional tasks for students in the form of e-reading activities. book for the control group students did not enjoy learning, while the experimental group carried out project activities by making learning videos related to E-Learning with STEM vision, students were happy and enjoyed the learning process. These activities have a positive impact on the evaluated learning aspects. This is also in line with researchWidana et al (2020)argues that students not only absorb knowledge, but they learn by being actively involved in the learning process.

CONCLUSION

Based on the analysis of the results and discussion, it can be concluded as follows: a) The critical thinking ability of students in class XI SMA N1 Ungaran through E-Learning learning with STEM vision has a significant difference with learning without STEM vision E-Learning on the circulation system material. b) The digital literacy of class XI students of SMA N 1 Ungaran through E-Learning learning with STEM vision has a significant difference with learning without STEM vision E-Learning on circulation system material. c) E-Learning learning with STEM vision has an effect on increasing students' critical thinking skills on the circulation system material. e) E-Learning learning

with STEM vision has an effect on increasing critical thinking skills and digital literacy in circulation system materials. f) The responses of teachers and students to the STEM vision of E-Learning can be categorized as good or positive responses.

REFERENCES

Aceh, B., & Scientific, B. (2020). Implementation of STEM Learning on Plant and Animal Reproductive System Materials on the Scientific Thinking Ability of Junior High School Students. Indonesian Journal of Science Education, 8(2), 241–256.

Ardiansyah, R., Diella, D., & Suhendi, HY (2020). 21st Century Learning Device Development Training With STEM-Based Project Based Learning Model for Science Teachers. Education Publications, 10(1), 31.

Barisan, K.K. (2022). Mathematics Education Study Program, Singaperbangsa Karawang University

Hadiyanto, S., & Thaib, D. (2016). Respiration Concept. EduHumanities : Journal of Basic Education, 8(1), 55–65.

Hidayati, N., Irmawati, F., & Prayitno, TA (2019). Improving Critical Thinking Skills of Biology Students Through Multimedia STEM Education. JPBIO (Journal of Biology Education), 4(2), 84–92.

Nahdi, D.S, & Jatisunda, MG (2020). Digital Literacy Analysis of Elementary School Teacher Candidates in Virtual Classroom-Based Learning During the Covid-19 Pandemic. Journal of Pendas Cakrawala, 6(2), 116–123.

Ramadhani, S., & Gustin, E. (2020). Student Responses to the Utilization of Google Classroom as an Online Learning Media Students' Responses to Google Classroom Utilizing as an Online Learning Media. 08(3), 278–281.

Sugiyono.(2015). Research Methods Quantitative, Qualitative, and R&D Approaches. Bandung: Alphabet.

Sudibjo, A. (2019). Use of Google Classroom-Based Science Learning Media on Optical Instrument Materials to Improve Motivational Responses and Student Learning Outcomes at SMP Negeri 4 Surabaya. Journal of Education and Development, 7(3), 278–284.

Sutame, K. (2019). Building a Classroom-Based Digital Classroom at Smk Negeri 3 Banjarmasin. 92–106.

Integrated, JIPA, Mathematics, F., Science, AND, & Nature, P. (2019). Implementation of the I-Stem Strategy (Islamic, Science, Technology, Engineering, And Mathematics) in Science Learning on Creative Thinking Ability.

Wahyuaji, NR, & Suparman. (2018). Description of the Need for E-Learning Learning Media with a STEM Approach to Develop Critical and Creative Thinking Skills for Class XI High School Students. Ahmad Dahlan National Seminar on Mathematics Education, May, 194–199.

Wibowo, I.G.A.W. (2018). Improving Students' Scientific Skills in Learning Physics Through the Application of STEM Approaches and E-Learning. Journal of Education Action Research, 2(4), 315.

Widana, I.W., Sumandya, IW, Sukendra, K., & Sudiarsa, IW (2020). Analysis of Conceptual Understanding, Digital Literacy, Motivation, Divergent of Thinking, and Creativity on the Teachers Skills in Preparing Hots-based Assessments. Journal of Advanced Research in Dynamical and Control Systems, 12(8), 459–466.

Yusuf, R., Sanusi, Maimun, Hayati, E., & Fajri, I. (2019). Improving Digital Literacy of High School Students Through the Project Citizen Model. Proceedings of the National Seminar on the Realization of the Concept of Indonesian Citizenship, 185–199.

Zubaidah, S. (2016). SitiZubaidah-STKIPSintang-10Dec2016. National Seminar on Education, 2, 1–17. 6