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Effectiveness and Practicality of Wetland Ethnoscience E-Magazine Based on the Scientific Critical Thinking (SCT) Model for Improve Critical Thinking Skills

Rusmansyah[1]*, Abdul Hamid[1], Mohamad Nor Aufa[1], Isnawati[2], Arief Ertha Kusuma[3]

[1]Chemistry Education Study Program, Lambung Mangkurat University, Banjarmasin, Indonesia.

[2]Primary Teacher Education Study Program, Lambung Mangkurat University, Banjarmasin, Indonesia.

[3]Primary Teacher Education Study Program, Borneo Tarakan University, Tarakan, Indonesia.

ABSTRACT

This research is a research and development (R&D) study using the ADDIE model, which aims to determine the effectiveness and practicality of the SCT Model-Based Wetland Ethnoscience E-Magazine on students' critical thinking skills in stoichiometry learning. Data collection techniques use test instruments, response questionnaires, learning implementation sheets, and the teacher's ability to use e-magazines to test effectiveness and practicality. The effectiveness test is carried out using test instruments for critical thinking skills. Meanwhile, practicality tests were conducted on teachers' and students' responses to e-magazine products, observation sheets on learning implementation, and teachers' ability to use e-magazines. The results of research on critical thinking skills in students at SMAN 3 Banjarmasin, SMAN 7 Banjarmasin, and SMAN 12 Banjarmasin showed an average n-gain value of 0.80; 0.81 and 0.80 in the high category, so it is effective for improving students' critical thinking skills. The influence test results using the Wilcoxon test show an influence or improvement in students' thinking skills using the significance of the Wetland Ethnoscience E-Magazine Based on the Scientific Critical Thinking (SCT) Model. The results of the difference test (Kruskall Wallis) show that there is no difference (consistency) in the increase in students' critical thinking skills after using the Wetland Ethnoscience E-Magazine Based on the Scientific Critical Thinking (SCT) Model for each school. The results of the teacher response questionnaire regarding the use of E-magazine showed a mean value of 4.67. The response results from students at SMAN 3 Banjarmasin, SMAN Banjarmasin, and SMAN 12 Banjarmasin showed a mean of 4.31, 4.33, and 4.34 in the very good category. The results of teachers' ability to use E-magazines at SMAN 3 Banjarmasin, SMAN 7 Banjarmasin, and SMAN 12 Banjarmasin showed scores of 4.63, respectively, 4.65 and 4.64. Learning implementation results with a score of 4.57, 4.60, and 4.58. Based on these results, it can be said that the use of the SCT Model-Based Wetland Ethnoscience E-Magazine is effective and practical in the learning process for student's critical thinking skills.

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KEYWORDS:

e-magazine, wetland ethnoscience, scientific critical thinking model, critical thinking skills

I. INTRODUCTION

21st-century education requires students to have high-level thinking skills (Hidiyah et al., 2023; Panjaitan, 2022). The thinking ability that students must have is critical thinking skills (Anindhita et al., 2022; Ariyatun & Octavianelis, 2020). Critical thinking is a skill for thinking openly and reflectively (Anindhita et al., 2022) to form students who can focus (Kurnia et al., 2022) to make decisions regarding what they believe and what they will do (Rusmansyah, Huda, et al., 2022). Critical thinking skills shape a person into a person who is skilled in analyzing and evaluating (Melcin et al., 2021) a problem or information (Rusmansyah, Abdul, et al., 2023), which is then used to provide ideas or ideas for solutions or solutions to obtain

Corresponding Author: Rusmansyah

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conclusion. Critical thinking is a focused thinking process to find the central problem (Agustine et al., 2020), provide solutions to problems, and carry out analysis and evaluation of the good and evil before taking action (Hajar et al., 2022), so students must have the skills think critically so that it is hoped that students can become individuals who excel in thinking (Hasbie et al., et al., 2023; Nunn & Braud, 2013).

The results of the initial test of critical thinking skills in class 2020). This is in line with the results of research by Basri (2019), which states that interpretation or explanation skills for a problem are in the low category because more than 60% of students cannot interpret well. In addition, evaluation, analysis, and self-regulation skills are the lowest critical thinking sub-skills students can master compared to other critical thinking sub-skills.

One of the reasons why students' critical thinking skills are low is because students are still dependent on teachers as educators (Almubarak & Rusmansyah, 2020) and the use of learning resources in the form of textbooks and student worksheets (LKS) provided by schools which ultimately becomes a limitation for students. in learning in class (Nursidah et al., 2019). The research results of Putri et al (2021) state that learning requires the use of technology for the learning process.

Based on the explanation regarding the problem of low critical thinking skills and the demands of learning in the 21st century, learning innovation is very necessary. Renewal innovation by packaging something more attractively and efficiently with a new appearance (Jusniar & Hardin, 2023). Gunawan et al (2022) the innovation used must provide convenience and adapt to the use of technology and knowledge packaged into one unit. Learning will be considered successful if students are the center of learning (Rusmansyah et al., 2023); supporting facilities are needed to meet student's needs so that students remember more easily and learning becomes memorable (Hadi et al., 2019; Roza et al., 2021). Learning must make students active and foster a high level of curiosity, so interactive media is needed to facilitate this (Fitriah & Ita, 2022; Syahmani et al., 2022).

According to Febrianti (2021), using textbooks makes students bored in the learning process, so learning becomes inefficient in terms of time and energy if students have difficulty understanding the material. Teaching materials must contain material that is easy to understand and easy to learn so that students can be motivated to learn and interested in learning. One way is to develop teaching media and incorporate ethnoscience into teaching materials. Learning with an ethnoscience approach is a learning strategy with a learning experience that combines culture or life in the students' environment as part of the learning activity process (Nuralita, 2020).

According to Syazali & Umar (2022), Knowledge can be obtained from habits, culture, and traditions in people's lives. Using ethnoscience makes learning effective because it is close to real life, and students can imagine and understand their environment. (Andayani et al., 2021). Using an ethnoscience approach will influence students' critical thinking skills because the media is interested in honing students' mindsets to think when seeing the displays presented.

One model that has been widely used to improve critical thinking skills is the SCT (Scientific Critical Thinking) model. The SCT model is a learning model explicitly developed from the Problem-Based Learning (PBL) and Inquiry models (Mariam et al., 2019). Scientific Critical Thinking (SCT) is a constructivist learning model that can be applied to improve students' critical thinking skills (Rusmansyah et al., 2018). In this research, it is hoped that this SCT model can improve students' critical thinking skills. The Scientific Critical Thinking (SCT) model has scientific activities to solve problems (Hasbie et al., 2023; Nisa et al., 2021; Rusmansyah et al., 2022). This is in line with research showing that applying the inquiry model in conjunction with Problem-Based Learning (PBL) can improve students' critical thinking skills (Trisna et al., 2022).

Based on this, innovation in learning media and learning models is needed that can increase students' learning motivation to make it more meaningful and realize the importance of learning chemistry, especially those related to the environment, to make it more interesting and enjoyable for students (Aminah & Afrianis, 2021). One media that can attract interest and is certainly easier for students to understand is e-magazine. E-magazine is an electronic form of media that not only takes the form of writing, but also contains animation (Fuad et al., 2020). E-magazines are not in paper form because they are digital files that can be used online using devices such as laptops and smartphones which have features to load video animations, images, audio and various games in the form of quizzes (Astuti et al., 2022; Saraswati, 2022; Syafii & Gusnia Putri, 2021).

Using e-magazines for learning chemistry has been researched a lot before, one of which was by Arief et al (2021), who developed an e-magazine on the chemistry of reduction and oxidation reactions. The results of this research are that e-magazine media can help students in the learning process and is suitable for use. Other research (Muhaimin, 2019) also shows very good construct and content validity results with a score of 4.4 in the interval > 4.2-5.0 results from teacher assessment questionnaires with a score of 4.7 in the interval class > 4.2-5.0 which is categorized as very good and the student response questionnaire also produces a good score with a percentage of 91.1%, theoretically the e-magazine is declared very feasible and practical to use. Based on the results of this description, researchers want to develop learning media in the form of ethnoscience e-magazine media based on the scientific critical thinking (SCT) model to improve students' critical thinking skills in learning stoichiometric chemistry.

II. METHOD

The type of research used in this research is Research and Development (R&D), namely the development of a Wetland Ethnoscience E-Magazine based on the Scientific Critical Thinking (SCT) Model for students' critical thinking skills in stoichiometric chemistry learning as a learning medium. The development model used is the ADDIE model, which consists of 5 stages, namely: 1) analysis, 2) design, 3) development, 4) implementation, and 5) evaluation. The population of this research was class XI students at SMAN 3 Banjarmasin, SMAN 6 Banjarmasin, and SMAN 12 Banjarmasin, and three classes were taken as samples.

Developing a wetland ethnoscience e-magazine based on the scientific critical thinking (SCT) model for critical thinking skills was validated by paying attention to aspects of content, presentation, grammar, and media. Effectiveness testing is carried out through pretest and posttest test instruments with several questions adjusted to the indicators to be achieved. Calculations to determine the increase in critical thinking skills are calculated using N-gain. N-gain is calculated using a formula developed by Hake.

$$\text{N gain} = \frac{S_{post} - S_{pre}}{S_{maks} - S_{pre}}$$

The effectiveness criteria interpreted from the normality gain values can be seen in Table 1 below:

Table 1. N-gain value

Value	Criteria
g ≥ 70	High
0,30 ≤ g < 0,70	Medium
g < 0,30	Low

(Hake, 1999)

Apart from N-gain, the pretest and posttest results were tested for influence and differences. Before determining the effects and differences, prerequisite tests, namely normality and homogeneity, must be carried out. If the data is typically distributed, parameter tests can be carried out, namely the paired sample t-test and the unpaired t-test (independent t-test). However, if the data is not normally distributed, the tests carried out are non-parametric, namely the Wilcoxon and Kruskall-Wallis tests.

Analysis of the practicality of the wetland ethnoscience e-magazine based on the SCT model, namely through data from teacher response questionnaires and student response questionnaires as well as observation sheets on teachers' ability to use learning media and implementation of learning. The practicality percentage calculation uses the following formula:

$$\text{Practicality value} = \frac{Number\ of\ scores\ obtained}{Maximum\ number\ of\ scores} \times 5$$

The percentage obtained from the wetland ethnoscience e-magazine practicality sheet based on the SCT model is then grouped based on assessment criteria referring to the Likert scale shown in Table 2 below:

Table 2. Ethnoscience E-Magazine Practicality Categories

Value	Criteria
4.25 < V ≤ 5.00	Very Good
3.50 < V ≤ 4.25	Good
2.75 < V ≤ 3.50	Enough Good
1.75 < V ≤ 2.50	Not so Good
1.00 < V ≤ 1.75	Not Good

(Widoyoko, 2018)

III. RESULTS & DISCUSSION

This research explains the results of the feasibility of wetland ethnoscience e-magazine media based on the scientific critical thinking (SCT) model and the results of testing the media on students' critical thinking skills using test instruments to determine its effectiveness, while the responses of teachers and students after using learning media and its implementation learning process to find out its practicality. The following is a presentation of the media feasibility results by validators and an evaluation of the use of e-media.

1) Aspects of e-magazine effectiveness

Aspects of the effectiveness of the Wetland Ethnoscience E-Magazine based on the Scientific Critical Thinking (SCT) Model developed can be seen based on the analysis of student's critical thinking skills test instruments as shown in Tables 3(a), 3(b), and 3(c) below.

Table 3(a). Results of critical thinking skills of students at SMAN 3 Banjarmasin

Indicator	Pretest Value	Posttest Value	*N-gain* <g>	Criteria
Provides a simple explanation	1.63	3.63	0.84	High
Building basic skills	1.84	3.63	0.83	High
Concluding	1.13	3.47	0.82	High
Make further explanation	1.00	3.34	0.78	High
Strategy and tactics	1.66	3.44	0.76	High

Table 3(b). Results of critical thinking skills of students at SMAN 7 Banjarmasin

Indicator	Pretest Value	Posttest Value	*N-gain* <g>	Criteria
Provides a simple explanation	1.49	3.63	0.85	High
Building basic skills	1.83	3.60	0.82	High
Concluding	1.03	3.43	0.81	High
Make further explanation	1.00	3.37	0.79	High
Strategy and tactics	1.80	3.49	0.77	High

Table 3(c). Results of critical thinking skills of students at SMAN 12 Banjarmasin

Indicator	Pretest Value	Posttest Value	*N-gain* <g>	Criteria
Provides a simple explanation	1.67	3.64	0.84	High
Building basic skills	1.12	3.48	0.82	High
Concluding	1.18	3.45	0.81	High
Make further explanation	1.00	3.33	0.78	High
Strategy and tactics	1.79	3.45	0.75	High

Based on Table 3, which contains the n-gain value categories, it can be seen that if the n-gain value obtained from the initial test and final test scores is > 0.7, then the increase in critical thinking skills is in the high category. This can be seen based on the results in Table 3(a), Table 3(b), and Table 3(c) above. The average n-gain value of SMAN 3 Banjarmasin Students is 0.80 in the high category. Next, students at SMAN 7 Banjarmasin had an average n-gain of 0.81 in the high category, and students at SMAN 12 Banjarmasin had an average n-gain of 0.80.

Calculating the significance of the impact of the effectiveness of Wetland Ethnoscience E-Magazine Based on the Scientific Critical Thinking (SCT) Model for improving critical thinking skills can be carried out by using SPSS 26 assisted influence and similarity tests, which begin with prerequisite tests for normality of initial test data and final tests of critical thinking skills through tests. normality, namely Kolmogorov Smirnov, and homogeneity test, namely Levene, are presented in Table 4.

Table 4. Results of the normality test and homogeneity test of critical thinking skills

School	Test *Kolmogorov Smirnov*		Test Levene	
	p	Explanation	*p*	Explanation
XI SMAN 3 Banjarmasin	0,031	Not normally distributed	0,446	homogenously distributed
XI SMAN 7 Banjarmasin	0,031	Not normally distributed	0,083	homogenously distributed
XI SMAN 12 Banjarmasin	0,044	Not normally distributed	0,077	homogenously distributed

Table 4 shows that the initial and final critical thinking tests do not meet the prerequisites for conducting a parametric test. Therefore, the Wilcoxon test was chosen to test the significant effect of Wetland Ethnoscience E-Magazine Based on the Scientific Critical Thinking (SCT) Model for improving critical thinking skills. The Wilcoxon test results can be presented in Table 5 below.

Table 5. Wilcoxon test results of critical thinking skills

School	N	Uji *Wilcoxon* *p*
SMAN 3 Banjarmasin	32	<0,000
SMAN 7 Banjarmasin	35	<0,000
SMAN 12 Banjarmasin	33	<0,000

Table 5 shows data from the Wilcoxon test results. Based on these results, the sig value was obtained. (2-tailed) is 0.000 < 0.05, so Ho is rejected, and Ha is accepted. The results of the Wilcoxon test can be concluded that there is a significant influence or increase in the critical thinking skills of students who use the E-Magazine Ethnoscience Wetlands significance based on the Scientific Critical Thinking (SCT) Model or there is an average difference between the pretest and posttest results of the learning process using the E-Magazine significance Wetland Ethnoscience Magazine Based on the Scientific Critical Thinking (SCT) Model to improve critical thinking skills.

After that, a Wilcoxon (non-parametric) test was carried out to determine the impact and consistency of implementing the Wetland Ethnoscience E-Magazine based on the Scientific Critical Thinking (SCT) Model by testing the significant difference in the average N-gain score of critical thinking skills of students at SMAN 3 Banjarmasin, SMAN 7 Banjarmasin and SMAN 12 Banjarmasin are the Kruskall Walls test (non-parametric) because they do not meet the prerequisite tests for normality and homogeneity.

Table 6. Kruskall Walls test results for critical thinking skills

School	N	Uji *Krusskall Walls* *p*
SMAN 3 Banjarmasin	32	<0,000
SMAN 7 Banjarmasin	35	<0,000
SMAN 12 Banjarmasin	33	<0,000

Table 6 shows Asymp. Sig. > 0.05, which proves that there is no difference in N-gain in critical thinking skills after using the E-Magazine Wetland Ethnoscience Based on the Scientific Critical Thinking (SCT) Model between SMAN 3 Banjarmasin, SMAN 7 Banjarmasin and SMAN 12 Banjarmasin. These results show no difference (consistency) in the increase in students' critical thinking skills after using the Wetland Ethnoscience E-Magazine based on the Scientific Critical Thinking (SCT) Model in each school.

This shows that the wetland ethnoscience e-magazine based on the scientific critical thinking (SCT) model is adequate for critical thinking skills. This aligns with the research results of Nurhayati et al. (2021), showing that STEM-based chemistry e-modules with an ethnoscience approach are in the feasible category at 87%.

2) Practical aspect

The practical aspect of the wetland ethnoscience e-magazine based on the scientific critical thinking (SCT) model which was developed is seen based on questionnaire analysis, namely student response questionnaires and teacher response questionnaires, while the observation sheet is used to observe teachers' abilities using the wetland ethnoscience e-magazine based on the SCT model and observation of learning implementation.

a) Teacher's ability to use e-magazines

Two chemistry teacher observers observed the teacher's ability to use E-magazine during 4 RPP (stoichiometry learning) meetings. Teachers can use E-magazines in Classes XI-1 SMAN 3 Banjarmasin, XI-3 SMAN 7 Banjarmasin, and XI-5 SMAN 12 Banjarmasin. The average values obtained are presented in Table 7 below.

Table 7. Teachers' ability to use e-magazines

Indicator	Statement	3	7	12
Media Instructions	Teachers can understand the instructions for using media well	5,00	5,00	5,00
	The teacher can explain the instructions for using the media well	4,25	4,25	4,13
	Teachers can model instructions for using media well	5,00	5,00	5,00
	Teacher corrects inappropriate use based on media use instructions	4,88	4,88	5,00
Media Content	Teachers can understand the material in the media well	4,50	4,75	4,50
	Teachers can explain material in the media well	4,75	4,88	4,75
	Teachers can model material in the media well	4,25	4,25	5,00
	Teachers can guide material and activities in the media well	4,25	4,25	4,25
	Teachers can display media well and clearly	4,38	4,50	4,13
Ease of Using Media	Teachers quickly access the media used	4,75	4,63	4,63
	Teachers cannot use the Internet when using media	4,75	4,63	4,50
	Teachers can share media easily with students	4,75	4,75	4,75
Rerata		**4,63**	**4,65**	**4,64**

b) Implementation of learning with e-magazine

The implementation of the learning process using the wetland ethnoscience e-magazine based on the scientific critical thinking (SCT) model can be seen in Table 8 below.

Table 8. Implementation of learning with e-Magazine

Indicator	Statement	3	7	12
Implementation of Preliminary Activities	The teacher opens the lesson	5,00	5,00	5,00
	The teacher prepares the physical condition of the class and the psychological condition of the students	4,13	4,25	4,13
	The teacher conveys the learning objectives and provides apperception regarding previous material that supports today's learning	5,00	5,00	5,00
	Teachers motivate students about the benefits of the material to be studied	4,88	4,88	5,00
Implementation of Core Activities	Implementation of Core Activities Teachers carry out core activities using e-magazine media	4,63	4,75	4,50
	Teachers carry out learning with the syntax of the scientific critical thinking model	4,75	4,75	4,75
	Teachers and students, or students and teachers interact in learning	4,25	4,25	4,63
	Teachers and students can complete and conclude learning well	4,25	4,25	4,25

Implementation of Closing Activities	Implementation of Closing Activities The Teacher reflects on the learning that has been implemented	4,50	4,50	4,13
	The teacher informs the lesson plan for the next meeting	4,63	4,63	4,63
Time Allocation	Time Allocation Time allocation by Teaching Module	4,25	4,38	4,38
Mean		**4,57**	**4,60**	**4,58**

Based on Table 8 above, it can be seen that the average score obtained after observation by observers was 4.57 for teachers at SMAN 3 Banjarmasin, 4.60 for teachers at SMAN 7 Banjarmasin, and 4.58 for teachers at SMAN 12 Banjarmasin. This shows that teachers learning using the wetland ethnoscience e-magazine based on the scientific critical thinking (SCT) model are very good. This is in line with research results, which state that the high average value of the results of observations of learning implementation shows that the media used is easy and practical to apply during the teaching and learning process. This can also be seen from the responses from teachers and students regarding using the wetland ethnoscience e-magazine based on the scientific critical thinking (SCT) model.

c) Results of teacher and student responses to the use of e-magazines

Teachers and students are given a questionnaire containing ten statements. The average values observed are presented in Table 9 below.

Table 9. Teacher and Student Responses to E-Magazine

No	Response	Value	Criteria
1	Teacher response	4.67	Very Good
2	Student responses from SMAN 3 Banjarmasin	4.31	Very Good
3	Student responses from SMAN 7 Banjarmasin	4.33	Very Good
4	Student responses from at SMAN 12 Banjarmasin	4.34	Very Good

Table 9 above is the result of a questionnaire response from teachers and students regarding using the wetland ethnoscience e-magazine based on the scientific critical thinking (SCT) model in the range of 4.31 to 4.67 in the very practical category. This is in line with the research results of Nurhayati et al. (2021), a practicality test with teacher and student respondents conducted using a questionnaire showed that STEM-based chemistry e-modules with an ethnoscience approach in the practical category were used in learning with a score of 86.2%. This is also similar to the research results of Puri et al. (2019), in that the teacher assessment questionnaire obtained a score of 4.7 very good, and the results of the student response questionnaire obtained 91.1% very good so the development of this e-magazine was declared practically feasible. Based on the research results above, it can be seen that the wetland ethnoscience e-magazine based on the scientific critical thinking (SCT) model is practical and easy to use.

IV. CONCLUSION

Based on the results of research on the development of a wetland ethnoscience e-magazine based on the scientific critical thinking (SCT) model on students' critical thinking skills, it can be concluded that the results of research on critical thinking skills in students at SMAN 3 Banjarmasin, SMAN 7 Banjarmasin, and SMAN 12 Banjarmasin show an average n-gain value of 0.80; 0.81; and 0.80 in the high category so it is effective for improving students' critical thinking skills. Apart from that, the results of the influence test using the Wilcoxon test show that there is an influence or increase in the critical thinking skills of students who use the significance of Wetland Ethnoscience E-Magazine Based on the Scientific Critical Thinking (SCT) Model and the differences (kruskall walls) show that there is no difference (consistency) in the increase in skills students' critical thinking after using the Wetland Ethnoscience E-Magazine based on the Scientific Critical Thinking (SCT) Model in each school. The results of the teacher response questionnaire regarding the use of E-magazines showed a mean value of 4.67. The responses of students from SMAN 3 Banjarmasin, SMAN 7 Banjarmasin, and SMN 12 Banjarmasin showed a mean of 4.31, 4.33, and 4.34 in the very practical category. The results of teachers' ability to use E-magazines at SMAN 3 Banjarmasin, SMAN 7 Banjarmasin, and SMAN 12 Banjarmasin showed a value of 4.63, respectively, 4.65 and 4.64. Learning implementation results with a score of 4.57, 4.60, and 4.58. Based on these results, the development of the Wetland Ethnoscience E-Magazine Based on the SCT Model is effective and practical for use in the learning process for students critical thinking skills, especially in learning stoichiometric chemistry.

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