

Development of Wetland Ethnoscience E-Magazine Based on Scientific Critical Thinking Model to Improve Students' Critical Thinking Skills and Scientific Literacy

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Abstract: This research is based on students' low critical thinking skills and scientific literacy in their ability to absorb the subject matter. So to overcome these problems, and based on an initial needs analysis, an innovative learning resource was created in the form of an e-magazine which aims to facilitate the student learning process and improve students' critical thinking and science literacy skills. This research is a Research and Development (R & D) type of research to describe the validity of the Wetland Ethnoscience E-Magazine Based on the Scientific Critical Thinking (SCT) Model to be able to improve students' skills in terms of critical thinking skills and scientific literacy. The development model used is ADDIE, which consists of five stages: analysis, design, development, implementation, and evaluation. The results of research into the feasibility test of the product quality of E-Magazine Ethnoscience Wetlands Based on the SCT Model, which experts have validated, obtained an average validation score of 4.57, which is in the very valid criteria range. Based on this, the e-magazine is suitable and can be used in teaching and learning activities, especially in improving students' critical thinking skills and scientific literacy in chemistry learning.

Keywords: Critical thinking skills; E-Magazines; Ethnoscience; Science literacy; Validity

Introduction

Science and technology are developing rapidly (Puri et al., 2019; Jariati & Yenti, 2020), and students can study anywhere and anytime according to their wishes and desired learning style. Under these conditions, the teacher has an essential role as a facilitator in bridging students' access to quality learning (Arief et al., 2021). Teachers, as facilitators, are required to be able to provide learning resources (Febrianti, 2021; Saraswati et al., 2019). So that it can improve the quality of education by selecting appropriate learning resources according to the needs of students during the teaching and learning process (Gunawan et al., 2022).

The learning resources teachers use in the learning process generally use books in printed form (Sari et al.,

2021; Syahmani et al., 2022). This follows Tarihoran et al. (2022), which state that print-based learning resources tend to be monotonous and need to experience renewal in line with information and communication technology developments. This is also supported by the statement of Widodo et al. (2017), which states that books need updating in the form of creations to make learning easier for students.

In the development of science and technology, of course, in the field of education, students must be equipped with qualified hard skills and soft skills to be able to compete so they are not left behind in knowledge and produce a quality generation (Ariana et al., 2020). To balance knowledge and technology, it is necessary to have learning media that can be used in learning to

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attract interest and increase students' curiosity, namely by using e-magazine learning media.

The E-magazine is a digital book that switches from a paper magazine to a digital form online (Neelamalar & Vivakaran, 2019; Palmeirao & Carneiro, 2020; Tarawi et al., 2020). E-magazine reading activities are more flexible and can be accessed anytime and anywhere via laptops or smartphones (Kurniawan et al., 2023; Putri et al., 2021; Syafii & Gusnia, 2021). Based on the needs analysis that has been carried out, it is known that only a few teachers in schools use e-magazines in the learning process. This also follows Gultom et al. (2022), which state that most teachers only use pdf files that still need to be in electronic form.

Based on interviews with teachers at schools, it was found that there is a great need for innovation in learning resources, namely by using e-magazines, especially in chemistry learning. Chemistry material is abstract, so they are less interested when it is taught using only printed books, and students need to absorb the process of transferring knowledge. When students are taught by showing videos/animations related to the subject matter, they are very enthusiastic, and when asked questions, they quickly remember them, and their absorption is high. This follows the research by Puri et al. (2019), which states that learning with e-magazines is feasible and practical for teaching material for chemical equilibrium material. Furthermore, Jariati et al. (2020) obtained the results of validating material experts on e-magazines in a very valid category. Then et al. (2020) also states that electronic magazines are suitable for use in the material learning process for the fundamental laws of chemistry. The results of Rochman et al. (2023) this research conclude that e-magazines can be used as alternative media to increase student literacy both in terms of media content and appearance. The resulting Panggabean et al. (2022) E-magazine research results have met valid criteria and proven effective in increasing student literacy in high order thinking skills.

The chemical material that is difficult for students to understand when they only use printed media based on information from the teachers interviewed is the reaction rate. In the matter of reaction rate, students need help being able to have critical thinking skills and low scientific literacy. This follows Ariyatun et al. (2020), which state that students have difficulty answering questions related to social issues in life. Students tend to memorize theoretical and legal concepts. So it is necessary to increase critical thinking skills and scientific literacy in the learning process.

Critical thinking skills are skills that students must possess to be able to solve various problems today (Hasbie et al., 2023; Aufa et al., 2021). Meanwhile, scientific literacy is the ability to identify terms and

questions and explain scientific phenomena using scientific evidence to gain new knowledge (Fuadi et al., 2020). So it is necessary to develop learning media in e-magazine, which can improve students' critical thinking skills and scientific literacy.

Phenomena in society in social life are closely related to myths or original scientific understanding of society (Sudarmin, 2014; Sulistri et al., 2020), so there is a need to reconstruct environmental understanding into scientific science in chemistry learning. So that everything that happens can be explained scientifically or as a phenomenon called ethnosience (Andayani et al., 2021; Nurhayati et al., 2021; Syazali & Umar, 2022). Ethnosience seeks to be able to maintain a balance between scientific knowledge by instilling scientific attitude values with local wisdom values that exist in science itself (Sumarni, 2018; Winarti et al., 2018).

So, based on the analysis of the needs and problems described above, the researchers developed a product in the form of a wetland ethnosience e-magazine based on the Scientific Critical Thinking (SCT) model to improve students' critical thinking skills and scientific literacy. This is supported by research by Widyawati et al. (2021), stating that ethnosience-based media can improve students' critical thinking skills. Then the results of research (Nurcahyani et al., 2021) ethnosience learning can significantly increase students' scientific literacy. The SCT model is a learning model that builds concepts with experiments (Rusmansyah et al., 2018).

The SCT model has been widely used in research to improve critical thinking skills. This is supported by the results of Medina et al. (2018), which state that the SCT model can improve students' science process skills and self-efficacy in the material of electrolyte and non-electrolyte solutions. Furthermore, the research results of Rusmansyah et al. (2020) state that the SCT model can improve students' critical thinking, communication, and self-efficacy.

Method

This research is a type of Research and Development (R&D) research using the ADDIE development model which has five steps, namely analysis, design, development, implementation and evaluation. At the analysis stage, carry out a needs analysis to obtain initial data. Next is design and development, designing and developing a wetland ethnosience e-magazine based on the SCT model. Then, the implementation stage is the implementation of the wetland ethnosience e-magazine based on the SCT model at SMAN 3 Banjarmasin, SMAN 7 Banjarmasin, and SMAN 12 Banjarmasin. Lastly, evaluation of Wetland Ethnosience Magazine Based on the SCT

Model at SMAN 3 Banjarmasin, SMAN 7 Banjarmasin, and SMAN 12 Banjarmasin. If the product is suitable for use, the product will be disseminated widely. However, the product will be redesigned and developed again if there are many improvements. A brief explanation regarding this research is presented in the form of a flowchart, which can be seen in Figure 1.

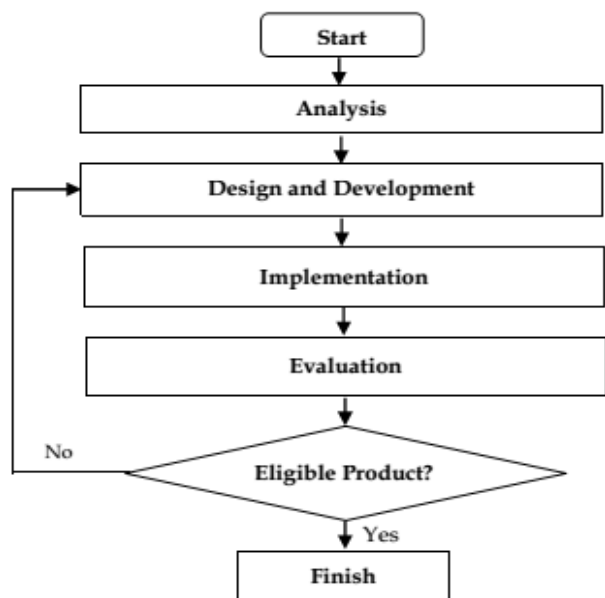


Figure 1. Research flowchart

The e-magazine was validated by five validators consisting of 2 lecturers from Lambung Mangkurat University and three teachers from SMAN 3 Banjarmasin, SMAN 7 Banjarmasin, and SMAN 12 Banjarmasin. Data collection techniques are carried out through documentation and walkthroughs. This documentation aims to collect various supporting documents to develop an e-magazine. The walkthrough is the validator evaluation stage to determine the validity of the e-magazine in terms of content, language, presentation, and media.

According to Widoyoko (2015), a scale of five for validity scores is better for uncovering differences in validator judgments. The following validity categories can be seen in Table 1.

Table 1. Categories for Validity

Average Score	Category
> 4.20 - 5.00	Very Valid
> 3.40 - 4.20	Valid
> 2.60 - 3.40	Valid Enough
> 1.80 - 2.60	Less valid
1.00 - 1.80	Invalid

Result and Discussion

The type of research used in this study is Research and Development (R & D), which aims to produce specific products and test the effectiveness of the products being developed (Sugiyono, 2016). The development model used is ADDIE, which has five stages: analysis, design, development, implementation, and evaluation.

The following is a detailed explanation of the stages developed with this ADDIE model, namely:

Analysis Stage

At this stage, interviews and observations were conducted with the teacher to obtain data on the needs analysis aspect (Nuraida et al., 2022). The main activity in this stage is conducting a need analysis related to developing new learning media based on the material's characteristics, the learning media's aspects, the students' characteristics, and so on. The initial needs analysis was carried out by observing several schools.

Design Stage

At this stage, preparation of a product e-magazine manufacturing plan with the initial steps of designing a plan using Canva in making an ethnosience e-magazine with the SCT model on the subject of reaction rate to improve critical thinking skills and scientific literacy. The focus in preparing this e-magazine is product specifications that have been made and designing products made with Canva. Then, the researcher collects the necessary materials, such as learning materials, videos, and supporting images regarding the subject matter, in addition to making quizzes that can improve students' understanding of the value of reaction rates in the context of wetland ethnosience with the SCT model.

Development Stage

The product design that has been prepared is then developed based on stages such as collecting materials to make e-magazine media, which are then integrated into the steps of a learning model with an ethnosience-based SCT approach. Next, change the e-magazine media in the form of Canva into electronic format using a flipbook. Then the researcher re-examined the resulting media that was developed before being validated. If it is appropriate, then the product is ready to be validated. After being validated and getting input from experts, revisions were made. Then, the development can proceed to the next stage.

Implementation Stage

At this stage, the products that have been developed are tested on students from three schools, namely SMAN 3 Banjarmasin, SMAN 7 Banjarmasin,

and SMAN 12 Banjarmasin, which consist of two classes per school with different levels of cognitive abilities.

Evaluation Stage

At this stage, it evaluates each step that has been carried out along with the product that has been developed. Conduct evaluation in terms of practicality and effectiveness aspects. The practicality aspect is measured using observation and interview techniques using the learning implementation sheet instrument. At the same time, the effectiveness of using critical thinking skills test instruments and scientific literacy. Products from the SCT model-based wetland ethnoscience e-magazine to improve high school students' critical thinking skills and scientific literacy can be seen in Figure 2.

material elements of knowledge, the module is also done with aesthetic elements so that students who use it do not feel bored. They are happy to be able to learn lessons.

The results of the validity of the SCT model-based wetland ethnoscience e-magazine to improve students' critical thinking skills and scientific literacy based on the assessment results from the validator regarding the quality of the e-magazine in terms of content, presentation, language used, and media can be seen in Table 2, which based on calculations from five validators obtained an average final score of 4.66 so that it can be said to be very valid. This is in line with the research results of Trisna et al. (2022) that PBL model-oriented e-magazine teaching materials are very valid for use in Biology learning. The e-magazine also improves students' critical thinking skills and caring attitude toward laboratory safety.



Figure 2. SCT model wetland ethnoscience e-magazine

Based on Figure 2. The SCT model-based wetland ethnoscience e-magazine is designed with due regard to writing procedures and formats and is also equipped with guidelines for using the e-magazine to make it easier for students to use it. In addition to fulfilling the

Table 2. E-magazine Validation Results

Validation	Validator					x̄	Category
	I	II	III	IV	V		
Content	3.86	4.79	4.79	4.93	4.86	4.64	Very valid
Presentation	4.27	4.64	4.45	4.73	4.82	4.58	Very valid
Language	4.25	4.58	4.58	4.67	4.75	4.57	Very valid
Media	4.00	4.57	4.71	4.57	4.71	4.51	Very valid
						Final Value	4.57 Very valid

Based on Table 2 above, after validation results were obtained with an average of 4.57 very valid categories with a few revisions related to input from the validator, the SCT model-based wetland ethnoscience e-magazine product to improve students' critical thinking skills and scientific literacy can further test. This is relevant to the statement according to Puri et al. (2019) that learning with e-magazine chemical equilibrium material with a validation value of 4.4 is feasible and practical to use as teaching material. This is also supported by research results by Arief et al. (2021), which state that the e-magazine media developed in research using the ADDIE model is valid, with the results of the validity analysis obtaining a score of 1.00 with valid criteria. Furthermore, the results of the research by Jariati et al. (2020) stated that the results of the validation of material experts obtained that the validity of e-magazine for chemistry learning in high school on electrolyte and non-electrolyte solutions was in the very valid category with a validity value of 100%.

Based on the validation results in Table 2, the SCT model-based wetland ethnoscience e-magazine meets the criteria for a product being developed to be valid because it displays innovation in the form of renewal. This is by the results of research by Hasbie et al. (2023), which stated that the final results obtained from the validator's assessment stated that the product contained novelty, met knowledge needs, had suitable format and

grammar, and an attractive presentation to support the learning process.

Conclusion

Based on the research results, it can be concluded that the wetland ethnoscience e-magazine based on the SCT model can improve critical thinking skills and scientific literacy in learning reaction rate chemistry with validation results with an average score of 4.66 in the very good/valid category.

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Author Contributions

Conceptualization, R, A.H, M.N.A, I, A.E.K.; methodology, A.E.K.; validation, R and A.H.; formal analysis, M.N.A.; investigation, I, and R.; resources, A.E.K. and I.; data curation, R.; writing-original draft preparation, M.N.A. and A.H.; writing-review and editing, A.E.K.: visualization, and A.H. and M.N.A. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interests

The authors agreed to publish this article and there will be no conflict of interest.

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