



Development of an E-Magazine Based on Ethnoscience of Semarang's Traditional Food in the Topic of Temperature and Heat to Train Students' Scientific Literacy Skills

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DOI:

<https://doi.org/10.47134/physics.v2i4.1959>

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Received: 22-07-2025

Accepted: 22-08-2025

Published: 22-09-2025



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Abstract: This study aims to analyze the characteristics, feasibility, and effectiveness of an e-magazine based on ethnoscience of Semarang's traditional food on the subject of temperature and heat to train students' scientific literacy skills. The Research and Development (R&D) method, utilizing the ADDIE model, was employed. The study involved VII D class students at SMP Negeri 5 Semarang, with data collected through feasibility validation, pretest, posttest, and student responses. The results showed that the characteristics of the e-magazine produced include an attractive and colorful visual design, compatibility with various devices, efficiency, practicality, and flexibility, interactive features, an ethnoscience approach, scientific literacy aspects, and encouragement of independent learning. The findings indicate the e-magazine is highly feasible for use, scoring 96.11% for media aspects, 96.21% for content aspects, and 91% for student readability. Its effectiveness in improving scientific literacy was statistically significant (Wilcoxon test $0.00 < 0.05$). An N-Gain score of 0.73 indicates a high improvement in scientific literacy, with an overall effectiveness level of 73% (moderately effective category). In conclusion, an e-magazine based on ethnoscience of Semarang's traditional food supports innovative learning, is highly suitable as a learning medium, and is sufficiently effective in developing students' scientific literacy skills.

Keywords: E-Magazine, Ethnoscience, Scientific Literacy

Introduction

The rapid development of technology in the 21st century has brought significant changes to various aspects of life, including education. These changes require educational systems to produce a generation that is knowledgeable and globally competitive (Jayanti & Nurfathurrahmah, 2023). Among the essential skills to be developed from an early age are those related to science and technology, particularly scientific literacy. Scientific literacy involves the ability to understand, utilize, and apply scientific concepts in making decisions related to everyday life (Afina *et al.*, 2021; Kalyani, 2024).

Scientific literacy is a key component of 21st century learning, especially within science education. Science education plays a crucial role in equipping students with scientific knowledge that can be applied in real-life contexts. By integrating scientific literacy into the learning process, students are encouraged not only to learn theoretical concepts but

also to relate them to contextual phenomena (Irsan, 2021). However, the level of scientific literacy among Indonesian students remains relatively low (Istighfarini *et al.*, 2022). According to the Programme for International Student Assessment (PISA), Indonesia's average science score declined from 403 in 2015 to 396 in 2018 and further to 383 in 2022, which is far below the international average of 485 (OECD, 2022).

Interviews with science teachers at SMP Negeri 5 Semarang revealed that students find it difficult to understand science concepts, particularly those related to temperature and heat. These topics are considered abstract and challenging to relate to daily experiences, resulting in low learning outcomes and the failure to meet the Learning Objective Achievement Criteria. Several factors contribute to the low level of scientific literacy, including uninnovative teaching methods, lack of contextual and visually engaging learning media, and inadequate educational facilities (Juniati *et al.*, 2020; Tusin *et al.*, 2024). Several educational institutions have not yet provided adequate learning facilities and infrastructure, thereby hindering an effective learning process.

To overcome these challenges, 21st century learning emphasizes the integration of technology as a tool to enhance students' scientific literacy skills in facing the demands of the modern era (Rahayu *et al.*, 2022). One such digital learning medium is the e-magazine, a digital version of a traditional magazine that can be accessed via electronic devices (Pribadi, 2017). E-magazines offer several advantages, such as ease of access, flexibility, and interactive features including hyperlinks, videos, and quizzes that enhance engagement and comprehension (Ardianto *et al.*, 2004). They also foster reading interest, support a literacy culture, and present content systematically and attractively (Assegaff, 1983; Suprayetno & Riynaldiy, 2020). However, e-magazines also face limitations, such as dependence on internet access and the time required for careful development.

In this study, the development of an e-magazine incorporates an ethnoscience approach to make science learning more meaningful and contextually relevant. Ethnoscience is an approach that integrates scientific knowledge with local cultural practices (Sudarmin *et al.*, 2017). It reflects the way local communities think and act based on inherited wisdom (Prodjosantoso *et al.*, 2023). When scientifically examined, local knowledge can be reconstructed as science learning content, enabling students to understand scientific concepts through experiences grounded in their cultural context (Ansya *et al.*, 2024).

Science education plays a pivotal role in developing scientifically literate individuals who can think critically, solve problems, and connect scientific knowledge with everyday life. Scientific literacy not only involves the mastery of facts but also comprises three core components: content knowledge, understanding scientific practices, and the ability to explain phenomena scientifically (Dibner & Snow, 2016). Thus, enhancing scientific literacy is one of the primary goals of science education in schools.

This study aims to analyze the characteristics, feasibility, and effectiveness of an e-magazine based on ethnoscience using the context of Semarang's traditional food, specifically on the topic of temperature and heat. It is expected that this e-magazine will provide a meaningful, engaging, and easily understandable learning experience for students.

Methodology

This research is a research and development (R&D) study that employs the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) proposed by Branch (2009). Each stage is carried out as follows:

1. Analysis Stage

At this stage, field observations and interviews with science teachers at SMP Negeri 5 Semarang were conducted to identify problems in science learning.

2. Design Stage

In this stage, the concept and structure of the draft e-magazine based on ethnoscience were designed. The researcher also developed research instruments, including expert validation forms for content and media, readability questionnaires, student response questionnaires, as well as pretest and posttest questions.

3. Development Stage

In this stage, the e-magazine focused on Semarang's traditional foods was developed based on the design created in the previous stage. The e-magazine was designed using Canva and uploaded to <https://www.heyzine.com>. Before implementation with students, a validation test was conducted to assess its feasibility. Validation was carried out by subject matter experts and media experts, consisting of two lecturers from the Faculty of Mathematics and Natural Sciences (FMIPA) at UNNES and one science teacher from SMP Negeri 5 Semarang.

4. Implementation Stage

This stage was conducted after the product was validated by the experts. Implementation began with a small scale trial involving 15 students from Class VIII C. After revisions based on the results of the readability test, the revised product was then tested in a large scale trial involving students from Class VII D at SMP Negeri 5 Semarang during science lessons.

5. Evaluation Stage

The evaluation stage was carried out continuously throughout each phase of development to improve the quality of the e-magazine based on ethnoscience. The evaluation aimed to assess the content validity, readability, and effectiveness of the e-magazine.

Data collection techniques are presented in Table 1.

Table 1. Data collection techniques

| Type of Data | Data Collection Method | Instrument | Analysis |
|---|------------------------|--|-----------------------------------|
| Student learning outcomes in the Final Semester Assessment (SAS) for the odd semester of grade VII in the 2024/2025 academic year | Documentation | - | Homogeneity test |
| Characteristics of an e-magazine based on ethnoscience of Semarang's traditional food | Questionnaire | 1. Media validation questionnaire by media experts | Descriptive, qualitative analysis |

| Type of Data | Data Collection Method | Instrument | Analysis |
|---|------------------------|--|--|
| | | 2. Content validation questionnaire by content experts | |
| Readability of e-magazine based on ethnoscience of Semarang's traditional food | Questionnaire | Media readability questionnaire by students | Descriptive, quantitative analysis |
| Feasibility of e-magazine based on ethnoscience of Semarang's traditional food | Questionnaire | 1. Media validation questionnaire by media experts 2. Material validation questionnaire by material experts | Descriptive, quantitative analysis |
| Test instrument validity | Test | Trial questions | 1. Item validity test 2. Reliability test 3. Difficulty level 4. Discrimination power |
| Effectiveness of e-magazine based on ethnoscience of Semarang's traditional food in training students' scientific literacy skills | Test Questionnaire | Pretest and posttest questions Student response questionnaire | 1. Normality test 2. Wilcoxon test 3. N-Gain test Descriptive, quantitative analysis |

The media and material validation analysis stage in this study was conducted by analyzing the product validation data filled in by the validators. Product feasibility validation in this study was analyzed using a descriptive percentage test with the following formula :

$$P = \frac{\sum f}{N} \times 100 \%$$

Information:

P : Assessment percentage

$\sum f$: Score obtained

N : Maximum score

To determine the validity of the developed product, the assessment qualification criteria presented in Table 2 were used.

Table 2. Expert Validation Calculation Scale

| Score | Criteria |
|-------|-----------|
| 4 | Very Good |
| 3 | Good |
| 2 | Poor |
| 1 | Very Poor |

After that, the percentage of data is converted based on the criteria presented in Table 3.

Table 3. Percentage of Media and Material Suitability

| Percentage | Criteria |
|-----------------|-----------------|
| 81,25% - 100% | Very Suitable |
| 62,50% - 81,24% | Suitable |
| 43,75% - 62,49% | Fairly Suitable |
| 25% - 43,74% | Less Suitable |

| Percentage | Criteria |
|----------------|--------------|
| $\leq 24,99\%$ | Not Suitable |

(Arikunto, 2021)

Normality tests are used to determine whether the data are normally distributed. If the data follow a normal distribution, parametric analysis is applied. Conversely, if the data do not follow a normal distribution, non-parametric analysis is used. In this study, the Shapiro-Wilk test was employed because the number of respondents was fewer than 50. According to Sugiyono (2019), the Shapiro-Wilk test is appropriate for testing the distribution of small sample data.

The hypotheses used for the normality test are as follows:

H_0 : The data are normally distributed if Sig (2-tailed) < 0,05

H_a : The data are not normally distributed if Sig (2-tailed) > 0,05

To test the hypothesis, the Shapiro-Wilk formula is used:

$$W = - \frac{(\sum_{i=1}^n a_i y_i)^2}{\sum_{i=1}^n (y_i - \bar{y})^2}$$

Where:

W : Shapiro-Wilk test statistic

a_i : Constant obtained from the Shapiro-Wilk table, based on sample size n

y_i : Ordered sample value (from smallest to largest)

\bar{y} : Sample mean

n : Sample size

(Shapiro & Wilk, 1965; Zulkifli *et al.*, 2025)

The Wilcoxon Signed Rank Test is used to test differences between two paired or correlated data sets that are not normally distributed. The basis for decision making in this test is as follows:

- 1) If the Asym.sig 2-tailed probability value is < 0.05, then there is a difference in the mean
- 2) If the probability value Asym.sig 2-tailed > 0.05, then there is no difference in the mean.

The formula for the Wilcoxon test is:

$$Z = \frac{T - \frac{N(N+1)}{4}}{\sqrt{\frac{N(N+1)(2N+1)}{24}}}$$

Information:

Z : Standard test statistic value of the Wilcoxon test

T : The smallest sum of positive and negative ranks

N : The number of data pairs that changed after treatment

The pretest and posttest data collected from the students were used as the basis for determining the effectiveness of the e-magazine based on ethnoscience. The analysis was conducted using the N-Gain (normalized gain) test with the following formula:

$$N - \text{Gain} = \frac{\text{posttest score} - \text{pretest score}}{\text{maximum score} - \text{pretest score}}$$

Information:

N – Gain (g) : magnitude of the gain factor

Posttest score : posttest score (after treatment)

Pretest score : pretest score (before treatment)

Maximum score : maximum test score

(Sugiyono, 2019)

The magnitude of the N-Gain factor is categorized based on the criteria in Table 4.

Table 4. N-Gain Criteria

| Magnitude of the factor (g) | Evaluation criteria |
|-----------------------------|---------------------|
| $g \geq 0,7$ | High |
| $0,3 \leq g < 0,7$ | Moderate |
| $g < 0,3$ | Low |

The level of effectiveness based on the N-Gain results is then determined using the criteria in Table 5.

Table 5. Criteria for Determining the Level of Effectiveness

| Percentage (%) | Interpretation |
|----------------|------------------------|
| < 40 | Not Effective |
| 40 – 55 | Less Effective |
| 56 – 75 | Sufficiently Effective |
| > 76 | Effective |

(Sukarelawan *et al.*, 2024)

The results of the pretest and posttest of scientific literacy skills were analyzed with reference to the categorization of scientific literacy skills adapted from Arikunto. The categories of scientific literacy skills are presented in Table 6.

Table 6. Categories of Scientific literacy Skills

| Percentage | Criteria |
|----------------------|-----------|
| $86 \leq X \leq 100$ | Very High |
| $72 \leq X \leq 85$ | High |
| $58 \leq X \leq 71$ | Moderate |
| $43 \leq X \leq 57$ | Low |
| 0 – 42 | Very Low |

(Amelia *et al.*, 2023)

The student response questionnaire was analyzed using a Likert scale, as presented in Table 7.

Table 7. Likert Scale for Student Responses

| Category | Score |
|-------------------|-------|
| Strongly Agree | 4 |
| Agree | 3 |
| Disagree | 2 |
| Strongly Disagree | 1 |

The student responses were analyzed by summing the scores obtained for each question. The total score obtained was then converted into a percentage using the formula:

$$\text{Percentage (x)} = \frac{\text{total score obtained}}{\text{maximum score}} \times 100\%$$

The criteria for assessing student responses are presented in Table 8.

Table 8. Student Response Categories

| Score (%) | Criteria |
|-----------------|-------------|
| 81,25% - 100% | Very Good |
| 62,50% - 81,24% | Good |
| 43,75% - 62,49% | Fairly Good |
| 25% - 43,74% | Poor |
| ≤ 24,99% | Very Poor |

(Arikunto, 2021)

Result and Discussion

Characteristics of E-magazine Based on Ethnoscience

An e-magazine based on ethnoscience was developed as an interactive digital learning medium that incorporates local context specifically, the process of *Tahu Bakso* and *Kulit Lumpia* as examples of heat transfer phenomena. The development of this e-magazine was aligned with the Learning Outcomes and Learning Objectives of the Merdeka Curriculum on the topic of temperature and heat, and it was published through the Heyzine platform.

The characteristics of the e-magazine based on ethnoscience were identified through a feasibility analysis validated by media experts and subject matter experts and a readability analysis conducted with students. Based on the analysis results, the developed e-magazine fulfills the characteristics of a magazine as defined by Ardianto *et al.* (2004), adapted into an electronic format in accordance with digital learning media principles outlined by Munir (2012), and further contextualized by Sudarmin (2014) through the integration of ethnoscience elements. The characteristics of the e-magazine based on ethnoscience include:

1. Incorporating Content Related to Ethnoscience, as illustrated in Figure 1.

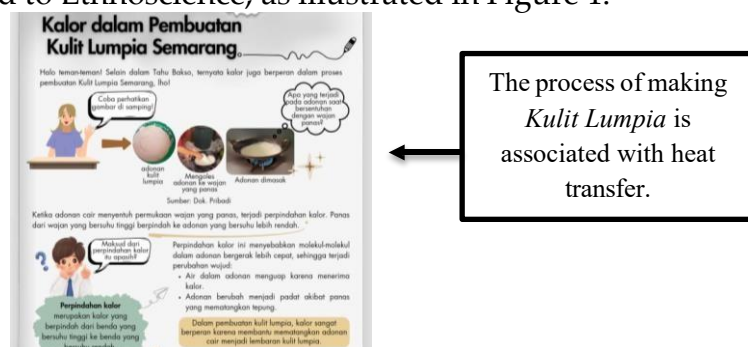


Figure 1. Ethnoscience Approach in the E-Magazine

As an ethnoscience-based medium, the e-magazine integrates local culture into science learning, thereby helping students understand scientific concepts through contextual, everyday experiences (Kantina *et al.*, 2022; Sudarmin, 2014).

2. Contains Aspects of Scientific literacy

This e-magazine based on ethnoscience is designed to develop students' scientific literacy skills. According to the OECD (2023), scientific literacy consists of four aspects: context, knowledge, competence, and scientific identity. The context aspect refers to

everyday situations that students may encounter in their surroundings (Nuzula & Sudibyo, 2022). In this e-magazine, context is presented through local phenomena, such as the process of making *Tahu Bakso* and *Kulit Lumpia* from Semarang. The knowledge aspect is conveyed through science content, specifically the topic of temperature and heat.

The science competence aspect is integrated through activities that encourage students to: (1) explain phenomena scientifically, (2) design and evaluate scientific investigations and critically interpret data and evidence, and (3) research, evaluate, and apply scientific information for decision-making and action (OECD, 2023). The e-magazine also promotes active participation and self reflection, enabling students to see themselves as individuals capable of scientific reasoning and action. The development of scientific identity is supported by demonstrating that science is relevant, useful, and can become part of students' self-concept and future aspirations (Sutrisna, 2021). An example of how the scientific competence aspect is implemented in the e-magazine is shown in Figure 2.

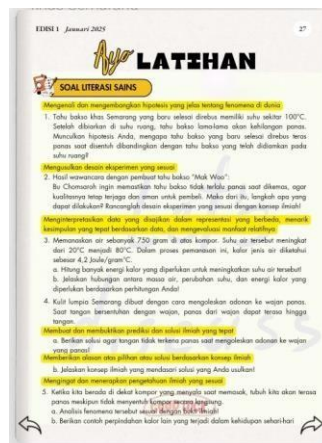


Figure 2. Science Competency Indicators in Practice Questions in the E-Magazine

3. Multiplatform

E-magazines are multiplatform because they are web-based (digital flipbooks) developed through the Heyzine platform, so they can be accessed through various devices such as laptops, tablets, and smartphones. The characteristic appearance of multiplatform e-magazines is shown in Figure 3.

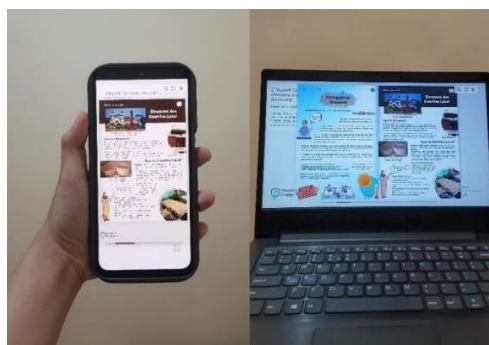


Figure 3. E-Magazine Display on Smartphone and Laptop

4. Efficient, Practical, and Flexible

E-magazine based on ethnosciences are developed in a digital format that allows for efficient use of resources, such as paper savings and no need for physical storage. These e-magazines are also easy to share online and can be accessed anytime and anywhere. This makes e-magazines flexible in supporting the learning process, both inside and outside the classroom. In line with the opinion of Kurniawan *et al.* (2023) the use of e-magazines is more flexible and allows the learning process to be conducted anytime and anywhere via mobile devices.

5. Contains Interactive Features

The e-magazine based on ethnoscience developed is equipped with various interactive features to enhance student engagement and motivation. These features include traditional music as background sound, such as the song “Gambang Semarang,” illustrative and educational videos, online quizzes integrated with practice questions and answers, science songs, and simple educational games like the wordwall “find the word.” The presentation of these features allows students to learn actively in a fun environment. This aligns with the view of Jundu *et al.* (2020) that educational videos can help students understand abstract concepts through presentations that emphasize real-world visuals. One of the interactive features in the e-magazine is shown in Figure 4.



Figure 4. Video Display in the E-Magazine

6. Has an Attractive and Colorful Visual Design

The page design is colorful, combining illustrations, infographics, and layouts that support understanding of the material. The use of contrasting colors makes it easier for students to distinguish between text and background, so that information can be conveyed more clearly and is easier to read. Arsyad (2013) states that an attractive visual appearance can increase students' interest and attention in learning. An example of an attractive and colorful page design in an e-magazine is shown in Figure 5.



Figure 5. Attractive and Colorful E-Magazine Page Design

7. Encouraging Independent Learning Among Students

E-magazine based on ethnosciences are designed to encourage student independence. This medium provides students with the opportunity to access and understand material independently without complete reliance on teachers. According to Nuraida *et al.* (2022), the availability of adequate learning media strengthens student engagement in the learning process in an active and independent manner, thereby enabling learning objectives to be achieved optimally.

The Feasibility of E-Magazine Based on Ethnosciences

The suitability of the e-magazine was assessed through validations by media experts, subject matter experts, and readability tests involving students. Details of the assessment for each aspect of media suitability are presented in Table 9.

Table 9. Validation Results for Each Aspect of Media Suitability by Media Experts

| No. | Aspect Assessed | Average Percentage | Criteria |
|-----------------------------|--|--------------------|---------------|
| A. Appearance | | | |
| 1. | The cover and content presentation are attractive | 100% | Very Suitable |
| 2. | The design of each page is attractive | 91,67% | Very Suitable |
| 3. | The presentation of illustrations, images, and videos supports concept understanding | 91,67% | Very Suitable |
| 4. | Titles and subtitles are well-balanced | 91,67% | Very Suitable |
| 5. | Images effectively capture students' attention | 100% | Very Suitable |
| 6. | Images are accompanied by references/sources | 100% | Very Suitable |
| 7. | Background color and text have good contrast | 91,67% | Very Suitable |
| 8. | The font used is easy to read and visually appealing | 91,67% | Very Suitable |
| 9. | The font size is appropriate and easy to read | 100% | Very Suitable |
| 10. | Margins on each page are balanced | 100% | Very Suitable |
| 11. | Text is clear and engaging | 100% | Very Suitable |
| B. Interactive Media | | | |

| No. | Aspect Assessed | Average Percentage | Criteria |
|----------------|--|--------------------|---------------|
| 12. | Videos can be played online without downloading | 91,67% | Very Suitable |
| 13. | Quizzes are easy to access and operate | 91,67% | Very Suitable |
| 14. | The media can be accessed without requiring additional applications (other than Heyzine) | 100% | Very Suitable |
| 15. | The presentation of material is interactive and actively involves students | 100% | Very Suitable |
| Average | | 96,11% | Very Suitable |

Based on the analysis presented in Table 9, the average media feasibility score was 96.11%, categorized as highly feasible. The assessment encompassed two main aspects appearance and interactive media. The appearance aspect included cover design, page layout, illustrations, and typography, all of which were designed to be visually appealing in order to stimulate students' reading interest and facilitate conceptual understanding (Ergen, 2009; Jupowicz-Ginalska, 2018; Nuraida *et al.*, 2022). Contextual illustrations and videos were effective in explaining the concepts of temperature and heat (Jundu *et al.*, 2020; Kurniawan *et al.*, 2018). Additionally, appropriate use of margins, the selection of the Futura font, and a well structured visual layout enhanced readability (Anggraini & Nathalia, 2014; Basiroen *et al.*, 2024; Sitepu, 2016). Every image was accompanied by a clear source citation, adhering to academic ethics (Wiradi, 2020), while feedback from validators also suggested improving background design for better visual comfort (Theresa & Iswanto, 2023).

The interactive media aspect included video features, quizzes, and educational games such as Wordwall, all of which were considered easy to access and effective in promoting student engagement (Hadi *et al.*, 2024; Harmelia *et al.*, 2022). The e-magazine can be accessed without requiring additional applications due to the flexible and efficient capabilities of the Heyzine platform (Fauzy *et al.*, 2024). These findings indicate that the e-magazine based on ethnoscience meets the standards of feasibility as a digital learning medium and is appropriate for use in both small scale and large scale readability tests, although some suggestions for refinement remain.

The validation of material aspects in this study covers three aspects, namely content/material coverage, presentation, and language use. The assessment of material experts on e-magazine based on ethnosciences with detailed assessments for each aspect of the feasibility of e-magazine based on ethnosciences is presented in Table 10.

Table 10. Validation Data for Each Aspect of Material Suitability by Material Experts

| No. | Aspects Assessed | Average Percentage | Criteria |
|-------------------------------------|--|--------------------|---------------|
| A. Content/Material Coverage | | | |
| 1. | Suitability of material in the e-magazine with Learning Outcomes and Learning Objectives | 100% | Very Suitable |
| 2. | Accuracy of facts and concepts | 91,67% | Very Suitable |
| 3. | Presenting concrete connections with the ethnoscience approach | 100% | Very Suitable |
| 4. | Ease of understanding the material in the e-magazine | 91,67% | Very Suitable |
| B. Presentation | | | |

| No. | Aspects Assessed | Average Percentage | Criteria |
|--------------------|---|--------------------|---------------|
| 5. | Clarity of material presentation in the e-magazine | 100% | Very Suitable |
| 6. | Efficient and interactive presentation of material in the e-magazine | 91,67% | Very Suitable |
| 7. | Examples, images, and videos in the e-magazine are appropriate for the material | 100% | Very Suitable |
| 8. | Presentation of the owner's identity, table of contents, and instructions for using the e-magazine to assist students | 91,67% | Very Suitable |
| C. Language | | | |
| 9. | The sentences used in the e-magazine are communicative so that they are easy for students to understand | 100% | Very Suitable |
| 10. | Sentences, terms, and symbols are clearly legible | 100% | Very Suitable |
| 11. | The use of language is effective and efficient (simple and clear in meaning) | 91,67% | Very Suitable |
| Average | | 96,21% | Very Suitable |

Based on Table 10, the validation of the material aspect obtained an average score of 96.21% with a very feasible category, covering content feasibility, presentation, and language use. The material was assessed as consistent with the learning outcomes of phase D and the learning objectives. Conceptual accuracy was rated at 91.67%, falling into the “very suitable” category, although the validator suggested adding scientific facts, such as the explanation that “in physics, there is no such thing as cold, there is only the absence of heat.” This indicates that the content of the e-magazine aligns with scientific principles and is not misleading. In line with the learning objectives of science education according to Samatowa (2011), which aim to help students understand concepts, principles, facts, and scientific phenomena to explain natural phenomena and solve problems in daily life.

The ethnoscience approach helps students understand scientific concepts through experiences that are closely connected to local culture, thereby strengthening their scientific literacy (Mardianti *et al.*, 2020) and serving as both a source and a medium for science learning aimed at preserving local potential and wisdom (Sudarmin, 2014). In addition, visualizing content through contextual images and videos makes the material more accessible and easier to comprehend (Munir, 2017; Septiani *et al.*, 2024). The presentation aspect also includes the author’s identity, table of contents, and usage instructions to facilitate user navigation (Tedjasendjaja & Lukman, 2014). The language used in the e-magazine is considered highly appropriate, featuring communicative sentences, clear terminology and symbols, and language that is easily understood by students (Daryanto, 2010; Nabila *et al.*, 2024).

Overall, the e-magazine is considered valid as a contextual, engaging, and scientific literacy enhancing educational medium. These findings indicate that the e-magazine is suitable for use in readability tests on both small and large scales, following revisions based on input from media and content experts. Therefore, it is deemed appropriate for use as a contextual and enjoyable science learning medium that effectively supports the development of students' scientific literacy.

The Effectiveness of E-magazine based on ethnosciences in Training Students' Scientific literacy Skills

The effectiveness of the e-magazine based on ethnoscience was analyzed based on the results of pretests and posttests of students during five learning sessions on temperature and heat. The material was presented contextually by linking science concepts to the process of making Semarang specialties, such as *Tahu Bakso* and *Kulit Lumpia*.

Before further analysis, a normality test was conducted to determine whether the data was normally distributed or not. The results of the normality test are presented in Table 11.

Table 11. Results of the Normality Test for Pretest and Posttest Data

| <i>Shapiro-Wilk</i> | | | | |
|---------------------|------------------|-----------|-------------|--------------------------|
| | <i>Statistic</i> | <i>df</i> | <i>Sig.</i> | <i>Criteria</i> |
| <i>Pretest</i> | 0,934 | 32 | 0,051 | Normally distributed |
| <i>Posttest</i> | 0,848 | 32 | 0,000 | Not normally distributed |

The results indicate that the pretest data is normally distributed ($\text{Sig.} > 0.05$), while the posttest data is not normally distributed ($\text{Sig.} < 0.05$), due to the tendency for high and uniform scores after the treatment, making it difficult to achieve a normal distribution. Therefore, a nonparametric test, the Wilcoxon test, was conducted. The results of the Wilcoxon test for the pretest and posttest data are presented in Table 12.

Table 12. Wilcoxon Test Results

| <i>Test Statistics^a</i> | |
|------------------------------------|---------------------------|
| | <i>Posttest - Pretest</i> |
| <i>Z</i> | -4.970 ^b |
| <i>Asymp. Sig. (2-tailed)</i> | 0.000 |

The Wilcoxon test results show a significance value of 0.000, which is less than 0.05, indicating that H_0 is rejected and H_1 is accepted. This means that there is a statistically significant difference between the pretest and posttest scores. Therefore, the use of e-magazine based on ethnosciences has a significant effect on improving students' scientific literacy skills.

Furthermore, the effectiveness was measured using the N-Gain test. The e-magazine based on ethnoscience was considered effective in training scientific literacy skills if the N-Gain score was ≥ 0.3 . The overall results of the N-Gain test are presented in Table 13.

Table 13. N-Gain Test Results

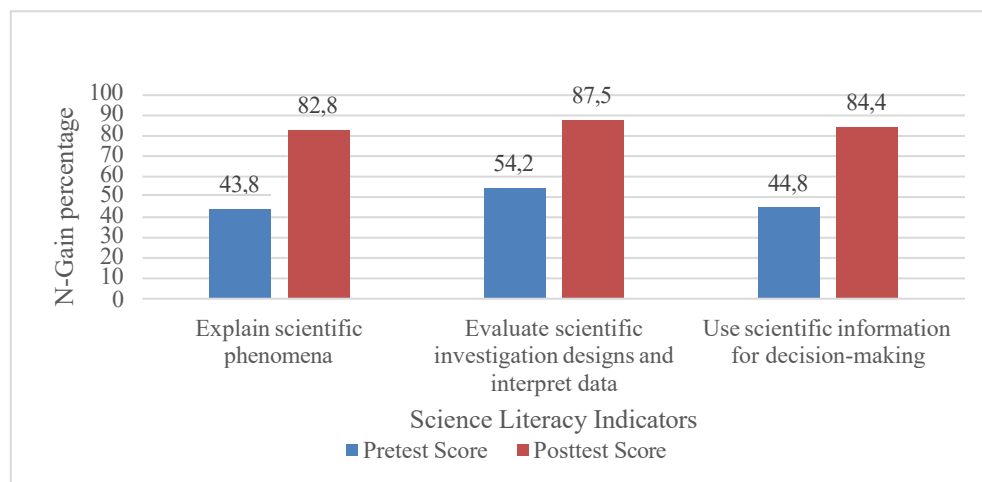
| <i>Pretest Average</i> | <i>Posttest Average</i> | <i>N-Gain Score</i> | <i>Category</i> |
|------------------------|-------------------------|---------------------|-----------------|
| 47,2 | 84,7 | 0,73 | High |

The analysis shows that the average N-Gain score of 0.73 falls into the high category. However, based on the effectiveness criteria in Table 5, the percentage increase of 73% is categorized as moderately effective. The N-Gain analysis for each scientific literacy indicator is shown in Table 14.

Table 14. N-Gain Analysis for Each Scientific Literacy Indicator

| Indicator | N-Gain | Category |
|--|--------|----------|
| Explaining phenomena scientifically | 0,69 | Moderate |
| Designing and evaluating scientific investigation plans and critically interpreting data | 0,73 | High |
| Researching, evaluating, and using scientific information for decision-making and action | 0,73 | High |

The N-Gain analysis per indicator shows that two indicators fall into the high category, while one is categorized as moderate. The percentage comparison of pretest and posttest scores for each scientific literacy indicator is illustrated in Figure 6.

**Figure 6.** Percentage Graph of Pretest and Posttest Scores for Each Scientific literacy Indicator

Based on Figure 6, all scientific literacy indicators showed a significant increase in scores from the pretest to the posttest. Overall, the average posttest score reached 84.7%, which is categorized as high. This indicates that the e-magazine effectively enhances students' abilities to explain scientific phenomena, think critically, and make evidence-based decisions (Abidin *et al.*, 2018; OECD, 2023).

This improvement is closely related to the ethnoscience approach applied. The e-magazine presents content through local phenomena such as boiling *Tahu Bakso* and heating *Kulit Lumpia*, supported by illustrations, videos, and quizzes. This makes learning more contextual and meaningful, allowing students to connect scientific concepts with real life experiences (Hamida *et al.*, 2022; Shofia *et al.*, 2024).

The increase in posttest scores also confirms the effectiveness of the e-magazine in helping students understand scientific concepts contextually. Students can relate the heat conduction process in a metal spoon to the properties of metals as conductors of heat. Furthermore, they are able to propose solutions using the concept of insulators, such as recommending non-conductive materials when spreading *Kulit Lumpia* on a hot pan. They can also evaluate scientific claims, for instance, understanding the relationship between the mass of water and the heat required to increase its temperature, demonstrating their ability to use scientific information critically and logically.

Next, to determine students' responses to the use of e-magazine based on ethnosciences in learning about temperature and heat, a response questionnaire was distributed. The results of the analysis of students' responses are presented in Table 15.

Table 15. Results of Student Response Analysis

| No. | Statement | Average Percentage | Category |
|---|---|--------------------|-----------|
| A. Material | | | |
| 1. | The material presented in the e-magazine based on ethnoscience is relevant to the concepts of temperature and heat | 86% | Very Good |
| 2. | The e-magazine based on ethnoscience facilitates a clear, comprehensive, and detailed understanding of the concepts of temperature and heat | 88% | Very Good |
| 3. | The examples of phenomena in the preparation of traditional Semarang food presented are easy to understand | 87% | Very Good |
| B. Presentation | | | |
| 4. | The presentation of material in the e-magazine based on ethnoscience is engaging and not boring | 87% | Very Good |
| 5. | The images, illustrations, and layout in the e-magazine based on ethnoscience facilitate understanding of temperature and heat concepts | 85% | Very Good |
| 6. | The language used in the e-magazine based on ethnoscience is easy to understand | 88% | Very Good |
| C. Use of Interactive Media | | | |
| 7. | E-magazine based on ethnosciences provide interesting interactive features, such as videos and quizzes | 84% | Very Good |
| 8. | Ease of using interactive features in e-magazine based on ethnosciences | 87% | Very Good |
| D. Benefits of E-magazine based on ethnosciences | | | |
| 9. | E-magazine based on ethnosciences support understanding of temperature and heat concepts and their relevance to daily life | 87% | Very Good |
| 10. | E-magazine based on ethnosciences simplify explanations of temperature and heat concepts using simple language | 88% | Very Good |
| 11. | After reading the e-magazine based on ethnoscience, students can provide examples of events related to temperature and heat | 88% | Very Good |
| 12. | The e-magazine based on ethnoscience motivates students to learn about scientific concepts in their surroundings | 84% | Very Good |
| Average | | 87% | Very Good |

Based on the analysis in Table 15, it can be concluded that students' responses to the use of the e-magazine based on ethnoscience were very positive, with an average score of 87%, categorized as very good. Students perceived the e-magazine as helpful in understanding temperature and heat concepts, engaging in its presentation, and equipped with interactive features that enhanced learning engagement. Moreover, the ethnoscience approach was considered relevant and motivational, fostering students' interest in exploring science within their local context (Afrida *et al.*, 2025). Learning through e-magazine based on ethnosciences enables students to construct knowledge through real-life experiences and cultural relevance (Mardianti *et al.*, 2020; Sudarmin, 2014).

Conclusion

Based on the results of the research entitled "Development of an E-Magazine Based on Ethnoscience of Semarang's Traditional Food in the Topic of Temperature and Heat to Train Students' Scientific Literacy Skills", it can be concluded that the developed e-magazine possesses the following characteristics: an attractive and colorful visual design, accessibility across various devices, efficiency, practicality, flexibility, and interactive features. The e-magazine also incorporates an ethnoscience approach, integrates aspects of scientific literacy, and promotes independent learning. The e-magazine based on the ethnoscience of Semarang's unique foods has been declared suitable for use as a science learning medium. The use of the e-magazine based on the ethnoscience of Semarang's unique foods in science learning has proven to be quite effective in training students' scientific literacy skills.

Based on the results of the study, it is recommended that the content of articles in e-magazines be developed to be more varied and informative so that students obtain additional references relevant to the material. In addition, the context of ethnoscience can be expanded so that it can be applied to other topics in science learning. This e-magazine can also be used as a reference for the development of e-magazine based on the ethnoscience on other materials or chapters.

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