



# Development of Socio-Scientific Issues-Based E-Magazine to Improve Junior High School Students' Argumentation Skills

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Article Info	Abstract
<p><b>Keywords:</b> <i>Argumentation Skill; E-Magazine; Junior High School; Socio-Scientific Issues; Student</i></p>	<p><b>Background:</b> This study aims to develop a socio-scientific issue-based e-magazine to improve students' argumentation skills in science learning at the Indonesian School Kuala Lumpur (SIKL). The study is motivated by the low level of students' argumentation skills, as reflected in their lack of participation in classroom discussions and the predominance of memorization-oriented learning.</p>
<p><b>Received:</b> 03/02/2026</p> <p><b>Revised:</b> 19/04/2026</p> <p><b>Accepted:</b> 12/05/2026</p>	<p><b>Methods:</b> This study adopted the ADDIE development model, which consists of the analysis, design, develop, implement, and evaluate stages. It involved 36 seventh-grade students at the Indonesian School in Kuala Lumpur. The validity of the e-magazine was assessed by experts, and its practicality was evaluated based on the observation of students' learning activities.</p> <p><b>Results:</b> The findings reveal that the developed e-magazine demonstrated highly valid criteria, with a score of 88.66% based on experts' validation and highly practical criteria according to observational results, with a score of 85.54%. This indicates that the media is easy to use and feasible for classroom implementation. Furthermore, the effectiveness of the e-magazine was reflected in students' argumentation skills, with an average post-test score of 84.89% (very good category), as well as positive student responses, with an average percentage of 82.36%.</p> <p><b>Conclusion:</b> Based on these results, the socio-scientific issues-based e-magazine is highly valid, highly practical, and effective for use in the learning process. The integration of contextual socio-scientific issues and interactive multimedia features contributes to increased student engagement and supports the development of structured, evidence-based argumentation skills. Therefore, the e-magazine can be effectively implemented in classroom activities to enhance both students' participation and their argumentation abilities.</p>

## INTRODUCTION

Argumentation skills are recognized as a crucial competency for students in the 21st-century. This ability enables students to achieve a deeper understanding through critical analysis, the construction of logical arguments, and informed decision-making (Sitanggang et al., 2024). In addition, argumentation skills, particularly in socio-scientific issues contexts, can significantly enhance students' scientific literacy by engaging them in analyzing real-world problems, considering multiple perspectives, and making evidence-based decisions (Türk & Çam, 2025). Furthermore, argumentation skills play an essential role in helping students formulate their understanding based on their own reasoning, while also strengthening students' conceptual comprehension by linking science concepts to real-life contexts and everyday scientific phenomena (Hasanah et al., 2022). The indicators of students' argumentation skills consist of several interrelated components: claim, data, warrant, backing, and rebuttal (Olii et al., 2025). These indicators serve as benchmarks for assessing the development of students' argumentation skills, which can be facilitated through systematically designed learning media aligned with instructional materials and learning objectives.

Students' argumentation skills in complex socio-scientific issues remain relatively low. Preliminary findings from student analysis indicate that many students are only able to provide brief responses without supporting evidence or scientific reasoning, reflecting low levels of argumentation skills. Many students struggle to construct logical, evidence-based arguments, which hinders their participation in meaningful and constructive discussions. Previous studies by Riwayani et al. (2019) and Rahman et al. (2018) indicate that students' scientific argumentation is generally low in quality. This issue is influenced by several factors. Science learning often emphasizes memorization rather than providing meaningful learning experiences, limiting students' opportunities to actively express their ideas both orally and in writing (Hasanah et al., 2022). In addition, science education tends to focus predominantly on cognitive achievement, resulting in students' limited ability to integrate scientific concepts comprehensively. Argumentation activities are also rarely incorporated into classroom practices, as science instruction is often dominated by teacher-centered approaches that emphasize content delivery rather than discussion, reasoning, and evidence-based explanation (Carpenter et al., 2020). This condition limits students' opportunities to construct, evaluate, and justify scientific arguments during the learning process (Puteri et al., 2025). Furthermore, students' low self-confidence in responding to questions or solving problems further contributes to their limited argumentation skill (Wahyuni et al., 2023). Developing argumentation skills is therefore essential for fostering critical thinking and preparing students to face the challenges of the 21st century (Barid et al., 2025; Darmaji et al., 2022; Masruri et al., 2026).

Furthermore, students' low argumentation skills are partly attributed to the limited use of relevant and engaging instructional media. Studies have shown that instructional media play a crucial role in facilitating students' active engagement and supporting the development of higher-order thinking skills, including argumentation (Kim et al., 2020). Traditional learning methods, which are still commonly employed, are less effective in encouraging students to take an active role in learning activities. Teacher-centered approaches tend to limit opportunities for discussion, reasoning, and evidence-based argument construction, which are essential components of scientific argumentation (Miller, 2025). In this context, e-magazines have been identified as an innovative medium for fostering argumentative skills, as they present learning materials through attractive layout, images, videos, and interactive features (Ramli et al., 2023). Previous research by Navarez (2018) at Northeastern University involving 100 participants reported that e-magazine-based learning achieved an average score of 7.07, indicating its effectiveness compared to

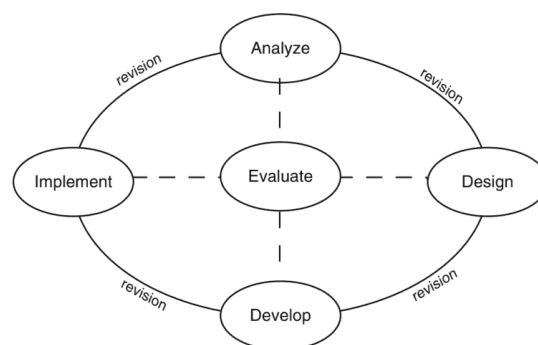
conventional media such as whiteboards in the learning process (Sari et al., 2021). Furthermore, integrating technology-based teaching materials is essential in enhancing students' motivation and meaningful learning experiences in the 21<sup>st</sup> century (Gunawan et al., 2022).

Despite its potential, the use of e-magazines needs to be integrated with a comprehensive instructional approach, such as socio-scientific Issues, to effectively enhance students' argumentation skills. Socio-scientific issues-based learning connects science education with real-world social contexts through scientifically grounded societal issues (Rifa'i & Subiantoro, 2022). This approach emphasizes the analysis of facts, phenomena, and events related to social issues with a scientific foundation. The open-ended nature of socio-scientific issues encourage students to develop critical thinking through discussions involving multiple perspective, making it highly effective for scientific discourse (Kusumawati et al., 2022).

In junior high school science learning, the topic of matter and its changes offers strong potential for integration with socio-scientific issues, such as environmental pollution, plastic use, and energy transformation in everyday life. By integrating socio-scientific Issues into the e-magazine, students are expected not only to understand scientific concept of matter and its changes, but also to apply them in analyzing real-world problems. The topic of matter and its changes includes three main subtopic: the state of matter and particle models, which explain macroscopic properties of matter through microscopic particle behavior such as atoms, molecules, and ions (Hapsari et al., 2024); physical and chemical changes, which differ in reversibility and observable characteristics such as color, temperature, gas formation, and energy release (Zumarah et al., 2024); and density, which represents a substance's characteristic property (Inabuy et al., 2021). Based on the description above, this study proposes the development of an e-magazine based on socio-scientific issues as an innovative solution to improve the argumentation skills of junior high school students. Strengthening these skills is essential for preparing students to face future challenges and enhancing the quality of Indonesian education in a global context (Lusiana et al., 2021). Therefore, this research aims to develop a socio-scientific issues-based e-magazine to improve students' argumentation skills at the Indonesian School Kuala Lumpur on the topic of matter and its changes.

## METHODS

The ADDIE (Analyze, Design, Develop, Implement, Evaluate) development model was implemented in developing a socio-scientific issues-based e-magazine aimed at improving students' argumentation skills. According to McGriff (2000), the ADDIE model was selected due to its systematic and effective framework for designing educational products (Destyara et al., 2025). The stages of the ADDIE model are illustrated in Figure 1.



**Figure 1.** Stages of ADDIE development model (Branch, 2009)

The first stage, analysis, involved identifying conditions and challenges in the science learning process. This stage was conducted through data collection at the school by interviews and observation. The data were obtained from science teacher and seventh-grade students to identify students' initial argumentation skills and learning needs. The second stage, design, focused on developing the e-magazine framework by creating a storyboard using Canva. The design also integrated argumentation components, namely claim, data, warrant, backing, and rebuttal, into the learning content and activities presented in the e-magazine. The third stage, development, involved producing the e-magazine based on the planned design, followed by expert validation to ensure its feasibility for classroom use. The validation process involved experts in science education and learning media, focusing on content, presentation, and language aspects. This e-magazine was not only developed as a digital reading medium but was also innovatively designed by integrating the socio-scientific issues approach.

The implementation stage involved testing the e-magazine in learning activities to evaluate its practicality based on observations of learning implementation and student responses. Students' argumentation skills were analyzed based on post-test scores. The post-test consisted of 15 essay questions representing five indicators of argumentation skills: claim, data, warrant, backing, and rebuttal. Each item was designed based on socio-scientific issues, requiring students to construct written arguments. Students' responses were assessed using an analytical scoring rubric, where scores ranged from 0 to 4 based on the completeness and quality of the argument components. The total scores were then used to determine the level of students' argumentation skills. The evaluation stage was conducted to assess the effectiveness of the e-magazine in improving students' argumentation skills, based on post-test results and supporting data obtained during the implementation.

### Research Subject

The subjects involved in the product validation were three experts, consisting of two lecturers and one teacher. The participants of this study were 36 seventh-grade students from class VII B in the odd semester at the Indonesian School of Kuala Lumpur. The selection of participants was based on the research needs, specifically their relevance to the objectives of the study. The validity of the e-magazine was determined based on expert validation results. The obtained scores were calculated using the following formula:

$$V = \frac{\text{total score achieved}}{\text{maximum score}} \times 100\%$$

Description:

V = Percentage of e-magazine validity

The resulting percentage was interpreted to determine the validity level of the media based on predetermined criteria. The classification of validity levels is presented in Table 1.

**Table 1.** Validity Criteria of The E-Magazine

Percentage (%)	Validity Criteria
86 – 100	Highly Valid
71 – 85	Valid
51 – 70	Moderately Valid
< 50	Less Valid

The e-magazine was considered valid if it achieved a percentage of  $V > 70\%$  (Hutabri, 2022).

### 1. Practicality of e-magazine

The practicality of the e-magazine was measured based on observations of the implementation of learning activities using the e-magazine. The obtained scores were analyzed using the following formula:

$$P = \frac{\text{total score achieved}}{\text{maximum score}} \times 100\%$$

Description:

P = Percentage of e-magazine practicality

The resulting percentage was interpreted based on predetermined criteria. The classification of practicality levels is presented in Table 2.

**Table 2.** Practicality Criteria of The E-Magazine

Percentage (%)	Practicality Criteria
85 – 100	Highly practical
70 – 84	Practical
55 – 69	Less practical
<55	Not practical

The e-magazine was considered practical if it achieved a percentage of  $P > 70\%$  (Benda et al., 2022).

### 2. Effectiveness of e-magazine

The effectiveness of the e-magazine was measured based on students' post-test results and their responses to the questionnaire. The post-test scores were analyzed to determine the students' argumentation skills. The obtained scores were calculated using the formula:

$$SA = \frac{\text{total score obtained}}{\text{maximum score}} \times 100\%$$

Description:

SA = argumentation skill score

The resulting percentage was interpreted based on predetermined criteria. The classification is presented in Table 3.

**Table 3.** Criteria for Students' Argumentation Skills

Percentage (%)	Interpretation
81.26 – 100	Very Good
62.51 – 81.25	Good
43.76 – 62.50	Poor
25 – 43.75	Very Poor

Students' argumentation skills were categorized as good if they achieved a score of  $SA > 62.50\%$  (JK & Yuliani, 2021). While the questionnaire responses were used to evaluate students' perceptions of the learning process. Students' responses were analyzed using the following formula:

$$SR = \frac{\text{number of students selecting a response}}{\text{total number of students}} \times 100\%$$

Description:

SR = Percentage of students' response

The resulting percentage was interpreted based on predetermined criteria to determine the level of students' responses. The classification is presented in Table 4.

**Table 4.** Criteria for Students' Responses

Percentage (%)	Category
> 84	Very Positive
71 – 85	Positive
51 – 70	Less Positive
< 50	Not Positive

The e-magazine was considered effective in terms of student responses if the percentage of responses reached SR > 70% (Farida et al., 2022).

## RESULT AND DISCUSSION

### Analysis

Based on interviews and observations conducted at the Indonesian School in Kuala Lumpur, the learning process is carried out through face-to-face sessions twice a week using the Merdeka Curriculum and allowing the use of mobile phones. However, e-magazines have not yet been utilized as learning media. This is likely due to teachers' limited familiarity with digital learning media, the lack of availability of appropriate instructional materials, and the predominance of conventional teaching practices. Students in class VII B demonstrate diverse characteristics and levels of participation; some are active, while others are less engaged and still experience difficulties in expressing their scientific opinions verbally. The predominance of lecture-based methods also contributes to student boredom and reduces learning motivation. Therefore, innovative and interactive media, such as socio-scientific issues-based e-magazines, are needed to enhance student engagement and argumentation skills.

### Design

The design stage represents the initial phase in developing a socio-scientific issues (SSI)-based e-magazine on the topic of matter and its changes. Prior to developing the e-magazine, instructional modules aligned with the Merdeka Curriculum were prepared. The development process involved two main steps: designing the layout and content of the e-magazine using Canva, and utilizing the Heyzine platform to integrate interactive features. This approach was intended to produce engaging learning media that support active student participation.

### Develop

The advantage of this medium lies in its integration of socio-scientific issues (SSI) as a means of assessing students' argumentation skills on the topic of matter and its changes. The sections of the developed e-magazine are presented in Figure 2.

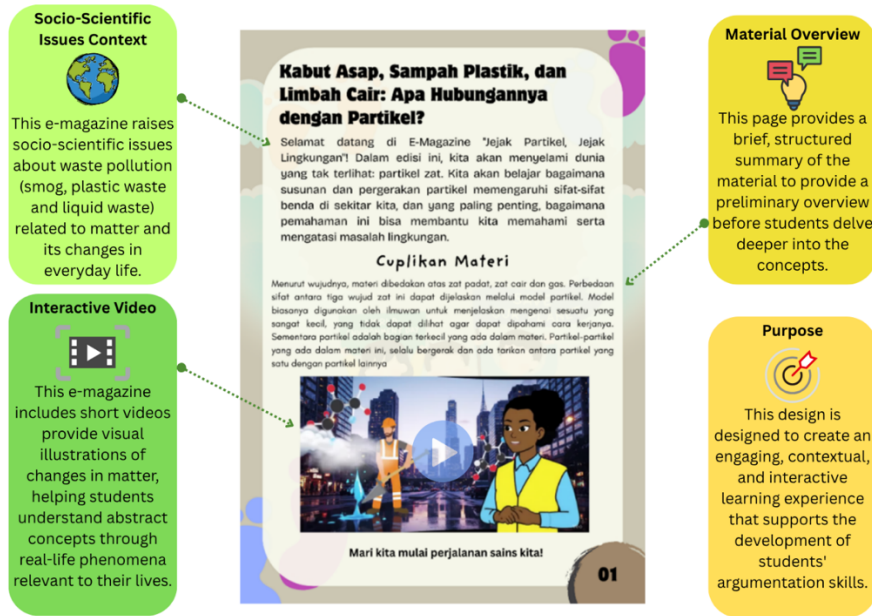


Figure 1. Sections of the E-Magazine

The socio-scientific issues-based e-magazine is designed by integrating key indicators of students' argumentation skills, namely claim, data, warrant, backing, and rebuttal into each learning activity. Each activity is not only intended to enhance students' understanding of the material but also to develop their ability to construct scientific arguments. Students are guided to formulate initial claims related to the issues discussed, provide supporting data or evidence, explain the relationship between the data and their claims (warrant), strengthen their arguments using relevant scientific concepts or theories (backing), and respond to or refute opposing arguments logically (rebuttal). By integrating these indicators, the socio-scientific issues-based e-magazine is expected to systematically and sustainably improve students' scientific argumentation skills. An example of an e-magazine section that incorporates these argumentation indicators is presented in Table 1.

Table 5. Sections of the E-Magazine Based on Argumentation Skill Indicators

Appearance	Description
	<p>This page presents narrative-based stimuli derived from socio-scientific issues to support students in formulating <b>claims</b>, including articles or news related to real-world problems (environmental pollution). These narratives are designed to activate students' prior knowledge and provide contextual grounding. Guiding questions are included to prompt students to identify key issues, formulate initial claims, and express their opinions based on the information presented.</p>

## Appearance

**Indikator Data**

### Mengamati Wujud Zat!



Apakah bentuknya berubah? Apakah bisa mengalir atau memampatkannya? Catat hasilnya.

Apakah bentuk air mengikuti wadahnya?  
Apakah air bisa mengalir?  
Catat hasilnya





Apakah udara mengisi seluruh ruang di balon? Seberapa cepat bau pengharum ruangan menyebar? Catat hasilnya.

**Tabel Data Pengamatan:**

Benda/Zat	Pengamatan (Apa yang dilihat/dirasakan)	Kesimpulan Awal
Coin		
Air		
Udara		

**05**

## Description

This page provides **data** to support students' claims through contextualized narrative content, including short videos related to the concept of matter. The videos are accompanied by structured guiding questions and data tables that require students to observe, identify relevant evidence, and organize information systematically. This process supports students in distinguishing between opinions and evidence, thereby strengthening the data component of their arguments.

**Indikator Pembeneran**

### Menguak Misteri Kerapatan: Partikel dan Gravitasi!

Kalian sudah mengukur dan menghitung kerapatan. Sekarang, mari kita pahami mengapa nilai kerapatan tersebut menentukan apakah benda mengapung atau tenggelam, dengan melihat apa yang terjadi pada partikel di dalamnya!




**Penjelasan: Kerapatan Relatif dan Gaya Apung**  
Kerapatan adalah ukuran seberapa banyak massa suatu zat yang terkandung dalam volume tertentu. Dengan kata lain, seberapa rapat partikel-partikel penyusun zat tersebut dalam ruang tertentu.

**Cari contoh benda apasaja yang mengapung dalam air**


**Cari contoh benda apasaja yang tenggelam dalam air**

**06**

This page presents **warrant** components through explanatory narratives supported by visual illustrations, such as diagrams showing differences in particle arrangement across states of matter. These explanations are complemented by concise conceptual descriptions and guiding questions that encourage students to explain why the evidence supports their claims. This section aims to help students construct logical connections between data and claims by explicitly articulating scientific reasoning.

**Indikator Dukungan**

### Sains di Sekitar Kita: Ini Solusinya!




**"Penyebaran Bau dari TPA: Bukti Pergerakan Partikel Gas."**

Jelaskan kenapa bau dari TPA bisa sampai ke pemukiman warga? buktikan dengan menghubungkan pergerakan partikelnya!!!

**TULISKAN JAWABANMU DI SINI**

**10**

This page presents **backing** components through extended narrative contexts, such as a short video on plastic recycling processes and their environmental impact. The narrative is enriched with additional scientific explanations and probing questions that require students to relate the observed phenomena to underlying scientific principles (changes in the form and properties of matter). This component reinforces students' arguments by providing deeper theoretical justification and strengthening the credibility of their reasoning.

Appearance	Description
	<p>This page presents <b>rebuttal</b> components through reflective narrative-based discussion prompts, particularly focusing on the limitations of particle models in explaining certain phenomena. Students are encouraged to critically evaluate alternative viewpoints, identify possible weaknesses in their own arguments, and construct counter-arguments. This section is designed to develop higher-order thinking by engaging students in evaluating competing explanations and refining their argumentation.</p>

The product was initially designed and subsequently developed, followed by expert validation to assess the suitability of each aspect. The validation process involved three expert validators, consisting of two lecturers in science education and one practicing science teacher. The aspects evaluated in this study included content validity, presentation feasibility, language clarity, and the integration of socio-scientific issues and argumentation components (claim, data, warrant, backing, and rebuttal). The results of the validation of the socio-scientific issues-based e-magazine, developed to enhance students' argumentation skills, are presented in Table 2.

**Table 6.** Validation Results of the E-Magazine

Aspect	Average (%)	Criteria
Content Suitability a. Alignment of content with argumentation skill indicators b. Alignment of content with socio-scientific issues c. Clarity of concepts related to matter and its changes	88,89	Highly Valid
Language Suitability a. Clarity and comprehensibility of language b. Appropriateness of text–image integration c. Accuracy of terminology and sentence structure	87,50	Highly Valid
Graphic Suitability a. Clarity of font type and size b. Consistency and organization of layout c. Attractiveness of design d. Relevance of images to the content	89,58	Highly Valid
<b>Average (%)</b>	<b>88,66</b>	<b>Highly Valid</b>

The validation results indicate that the E-Magazine achieved high validity across three main aspects, suggesting that it is suitable for use in learning and has a solid foundation prior to practicality testing. Content suitability was evaluated based on its alignment with argumentation skill indicators, its integration with socio-scientific issues, and the clarity of concepts related to matter and its changes. These criteria ensure that the content is accurate, relevant, and adequate (Setiani et al., 2022).

In terms of language suitability, the findings show that the E-Magazine employs clear and comprehensible language, supported by appropriate text–image integration and accurate terminology. The linguistic aspect plays a crucial role in facilitating students' understanding and enhancing learning motivation, particularly when aligned with their cognitive development level (Melati et al., 2025). Nevertheless, minor revisions are required, as some scientific terms and

sentence structures remain relatively complex for junior high school students with diverse literacy levels at the Indonesian School in Kuala Lumpur.

Regarding graphic suitability, the assessment covered font clarity, layout organization, visual attractiveness, and image relevance. An engaging visual design can enhance students' attention and motivation by presenting learning materials in a more modern and contextualized manner (Aulia & Mintohari, 2023). Despite the high validity rating, validators suggested improvements in several design elements to enhance communicativeness and support learning focus. Thus, the slightly lower scores reflect opportunities for refinement rather than fundamental limitations of the developed E-Magazine.

### Implement

The next stage involved the implementation of the validated product. The Socio-Scientific Issues-based E-Magazine was applied to 36 seventh-grade students in class VIIB at the Indonesian School in Kuala Lumpur. During the learning process, three observers conducted direct observations to evaluate the practicality of the E-Magazine. However, during the implementation phase, several challenges were identified. First, students experienced difficulties in expressing their opinions, particularly in articulating scientific arguments. To address this issue, teachers provided guidance and scaffolding to support students in developing confidence and improving their ability to construct arguments. Second, some students encountered difficulties in using the e-magazine as a learning medium. This challenge was addressed by providing clear instructions and demonstrations on how to effectively use the e-magazine during the learning process. The results of the e-magazine's practicality are presented in Table 3.

**Table 7.** The Practicality Result of E-Magazine

No	Details of Learning Activities	Average (%)	Criteria
1	Identifying claims based on the presented issues to answer the guiding questions.	86,10	Highly Practical
2	Recording data obtained from observations in the short video.	88,87	Highly Practical
3	Establishing warrants by linking the claims with the observed data.	83,32	Practical
4	Providing backing by explaining how the phenomenon or technology supports the warrants.	86,10	Highly Practical
5	Formulating rebuttals by identifying the challenges and limitations of scientific explanations.	83,32	Practical
<b>Average (%)</b>		<b>85,54</b>	<b>Highly Practical</b>

The results of the analysis of the practicality of using e-magazine media based on socio-scientific issues show that the learning implementation indicates a high level of practicality, thus entering the very practical category. The high level of practicality of the media indicates that the learning media plays a role in deepening students' understanding of the material more easily (Aulia & Mintohari, 2023). The learning activities were systematically designed to develop students' argumentation skills, beginning with the identification of claims based on issues presented in the E-Magazine. At this stage, students demonstrated the ability to understand contextual problems and formulate initial claims appropriately, reflecting a high level of practicality.

In the subsequent activity, students recorded observational data from a short video embedded in the E-Magazine, which served as evidence to support their claims. This stage was also categorized as highly practical, indicating that the use of video-based media effectively facilitated students in observing phenomena and interpreting visual information (Masito et al., 2022).

Furthermore, students constructed warrants by logically connecting claims and supporting data. Although this stage was still categorized as practical, the slightly lower score suggests that some students experienced difficulties in consistently and critically linking evidence to their claims, which aligns with previous findings (Ramli et al., 2023).

The next stage involved providing backing by explaining how the presented phenomena or technologies support the established warrants. In addition, the e-magazine integrates various reading sources, such as short scientific articles, news excerpts, and contextual informational texts, which serve as references for students to strengthen their arguments. At this stage, students were able to strengthen their arguments using relevant scientific concepts and theories, resulting in a highly practical classification. This indicates that students were capable of developing more structured and scientifically grounded arguments.

The learning activity concludes with summarizing rebuttals, which involves identifying challenges, limitations, or possible counterarguments based on scientific perspectives. This stage was also considered practical, as students began to demonstrate the ability to critique arguments (Hendratmoko et al., 2024). However, this stage received the lowest average score among all stages, indicating that students still faced challenges in articulating rebuttals. This limitation may be attributed to time constraints and the complexity of tasks requiring deeper analysis and teacher guidance. Therefore, future implementations should allocate more instructional time for this stage and incorporate structured scaffolding strategies, such as guided questioning or rebuttal framework, to better support students in developing their argumentation skills.

### Evaluate

Following the implementation of the socio-scientific issues-based e-magazine, an evaluation stage was conducted to assess the effectiveness of the product in improving students' argumentation skills and to examine students' responses to the learning process. The improvement in students' argumentation skills was measured using post-test results, while students' responses were collected through a response questionnaire. Students' argumentation skills were analyzed based on post-test scores consisting of 15 items representing five indicators: claim, data, warrant, backing, and rebuttal. The results of students' argumentation skills for each indicator are presented in Table 4.

**Table 8.** Students Argumentation Skills by Indicator

Indicator	Mean Score (%)	Category
Claim	89.07	Very Good
Data	86.85	Very Good
Warrant	83.15	Very Good
Backing	87.59	Very Good
Rebuttal	77.41	Good

Based on Table 4, students' argumentation skills demonstrated strong performance across most indicators. The claim indicator achieved the highest mean score (89.07%), categorized as very good. Similarly, the data, warrant, and backing indicators also fell within the very good category, indicating that students were generally able to construct arguments supported by evidence and reasoning. However, the rebuttal indicator obtained a relatively lower score (77.41%), categorized as good, suggesting that students still require further support in developing counter-arguments and evaluating alternative perspectives. Overall, these results indicate that students have mastered most components of argumentation, although improvement is still needed in more complex aspects such as rebuttal. The distribution of students' argumentation scores is presented in Table 5.

**Table 9.** Post-test Results of Students' Argumentation Skills

Component	Score (%)	Category
Lowest Score	62.67	Poor
Highest Score	97.33	Very Good

Based on Table 5, students' argumentation skills varied across a relatively wide range. The lowest score obtained was 62.67% (poor category), while the highest score reached 97.33% (very good category). The average score of students' argumentation skills was 80.00%, which falls into the very good category. These findings indicate that, in general, students demonstrated a high level of argumentation skills after the implementation of the e-magazine.

The effectiveness of the learning process was also evaluated based on students' responses collected through a questionnaire consisting of 10 statements. The questionnaire aimed to capture students' perceptions after participating in learning activities using the socio-scientific issues-based e-magazine. The results are presented in Table 6.

**Table 10.** Students' Responses to the E-Magazine

Aspect	Percentage (%)	Category
Media Display and Usability	84.03	Very Positive
Socio-Scientific Issues Content	80.69	Positive
<b>Average</b>	<b>82.36</b>	<b>Positive</b>

Based on Table 6, the overall student response to the use of the e-magazine was positive, with an average percentage of 82.36%. The aspect of media display and usability obtained the highest score (84.03%), categorized as very positive, indicating that students found the e-magazine attractive and easy to use. Meanwhile, the socio-scientific issues aspect achieved a percentage of 80.69% (positive category), suggesting that although students responded well to the contextual content, further improvement may be needed to optimize its integration. Overall, these results indicate that the e-magazine was well received by students and effectively supported the learning process.

## CONCLUSION

The socio-scientific issues-based e-magazine was found to be highly valid, with an average validity score of 88.19%, indicating that the developed media meets the required standards and is suitable for use in the learning process. This validity result was established through expert validation involving two science education lecturers and one practicing teacher, ensuring that the e-magazine is both theoretically sound and practically applicable in classroom settings. Furthermore, the e-magazine was also categorized as highly practical, as evidenced by observational results across three meetings, yielding a practicality score of 85.54%. This finding suggests not only that the media is easy to use, but also that it can be effectively implemented in real classroom contexts, supporting both teachers in facilitating learning and students in actively engaging with the material. In terms of effectiveness, the implementation of the e-magazine contributed to the improvement of students' argumentation skills, as indicated by the post-test results with an average score of 84.89%, categorized as very good. Analysis based on argumentation indicators showed that students performed very well in claim, data, warrant, and backing components, while the rebuttal component, although categorized as good, still requires further improvement. These findings indicate that the e-magazine effectively supports students in constructing structured, evidence-based arguments. Additionally, students' responses toward the use of the e-magazine were positive, with an average response percentage of 82.36%, indicating that the media was well received and supported student engagement in learning. Therefore, it can

be concluded that the socio-scientific issues-based e-magazine is valid, practical, and effective in improving students' argumentation skills. For future research, it is recommended to provide more intensive guidance during the initial stages of e-magazine implementation, particularly to support the development of higher-level argumentation components such as rebuttal.

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