

**Validity of a Socio Scientific Issues Based Interactive E-Module
Using the Argument Driven Inquiry Model**

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Abstract

This research is motivated by the importance of developing learning media capable of facilitating scientific argumentation skills through contextual issues. The objective of the study is to develop and evaluate the validity and practicality of an interactive e-module based on Socio-Scientific Issues (SSI) using the Argument Driven Inquiry (ADI) model to support the improvement of students' scientific argumentation skills. This study employs the Research and Development (R&D) method with the 4D development model (Define, Design, Develop, and Disseminate), specifically focusing on the validation and testing phases. The validity of the e-module was assessed by four validators across 25 indicators, while the pretest–posttest instruments were validated by two experts using eight assessment items. Practicality was measured through student response questionnaires in a small-scale trial with 13 participants and a large-scale trial with 20 participants. The results indicate that the e-module achieved a validity score of 93.4%, falling into the highly valid category, while the assessment instrument reached 95% validity, also categorized as “highly valid”. The practicality of the e-module was also found to be very high, with percentages of 97.69% in the small-scale trial and in the large-scale trial. These findings demonstrate that the SSI-based e-module with the ADI model is not only theoretically feasible but also practical for use as a learning medium that supports investigation, scientific argumentation, and problem-solving based on socio-scientific issues. In conclusion, this e-module has the potential for broader implementation and further testing to evaluate its effectiveness in improving scientific argumentation skills.

Keywords: Argument-Driven Inquiry (ADI), interactive e-module, scientific argumentation skills, Socio-Scientific Issues (SSI), validity

INTRODUCTION

Education in the 21st-century era demands that students master higher-order thinking skills (HOTS), such as critical thinking, communication, collaboration, and creativity. These skills are essential for enabling students to address increasingly complex and dynamic global challenges (Situmorang, 2024). One of the most crucial competencies is argumentation skills. Argumentation is not merely limited to expressing opinions; rather, it demands logical, systematic, and data-driven reasoning. Through argumentation, students are trained to evaluate claims, draw conclusions, and respond based on relevant evidence (Novanda et al., 2024). In science education, scientific argumentation plays a vital role in deepening conceptual understanding while simultaneously training critical and reflective thinking skills (Nur'aini & Sinaga, 2025).

One of the effective learning models for training argumentation skills is Argument-Driven Inquiry (ADI). This model positions students as active subjects in scientific investigation through several stages: identifying the problem, collecting data, constructing arguments, engaging in argumentation sessions, writing investigation reports, conducting double-blind peer reviews, and revising reports. This process enables students to build evidence-based knowledge and develop scientific reasoning (Nur'aini & Sinaga, 2025). In addition to ADI, the Socio-Scientific Issues (SSI) approach is also relevant as it presents real-world contextual issues, such as healthy dietary patterns or public health. Consequently, students do not only understand science concepts but also learn to analyze social problems from a scientific perspective, consider alternative solutions, and draw data-based conclusions (Lestari et al., 2023).

Results from the preliminary study indicate that the scientific argumentation skills of junior high school students remain low. Based on an initial questionnaire administered to 32 students, 68.7% experienced difficulty understanding the digestive system and nutrition material, and 59.4% preferred technology-based interactive learning. Furthermore, over 90% expressed an interest in learning through digital media featuring animations or videos. Regarding learning methods, 53.2% of students favored discussion- or debate-based learning, while 78.1% aspired to be more confident in expressing their opinions. These data underscore the need for science learning that is interactive, contextual, and discussion-based.

In addition to student data, results from questionnaires distributed to science teachers further reinforce the urgency of developing interactive learning media. Most science teachers stated that the material on the digestive system and nutrition requires interactive media to improve student understanding. Furthermore, teachers observed that students tend to be more engaged when using digital media compared to textbooks alone, with the majority expressing strongly agree (75%). These findings indicate that from both student and teacher perspectives, the use of interactive digital media is highly necessary to enhance engagement and learning motivation.

Furthermore, teachers emphasized that the digestive system topic can be integrated with real-world problems in society (Socio-Scientific Issues), and the Argument-Driven Inquiry (ADI) model can assist students in developing scientific argumentation skills. In addition, the teaching of digestive system material is often hindered by the limited availability of appropriate interactive media; students frequently struggle to grasp digestive concepts because they lack access to visual processes or simulations. These findings underscore the necessity for learning media that is not only interactive and engaging but also contextual and evidence-based.

Furthermore, teachers provided input regarding the ideal characteristics of an interactive e-module. All respondents agreed that the e-module needs to be flexible and usable in both online and offline settings, noting that the school's ICT infrastructure (laptops, projectors, and internet) is sufficient to support its implementation. The teachers also emphasized that the e-module should incorporate images, animations, or simulations of digestive processes, supplemented by practice exercises and discussions based on real-world problems. Moreover, it must enable students to develop scientific arguments based on data or phenomena. Finally, the interactive e-module should be user-friendly for both teachers and students. Collectively, these findings reinforce the necessity of developing an SSI-based interactive e-module using the ADI model, capable of enhancing both conceptual understanding and the scientific argumentation skills of junior high school students.

In addition to the questionnaire data, brief interviews with science teachers highlighted practical constraints and real-world experiences in teaching the digestive system and nutrition. Several teachers noted limitations in learning media, the use of scientific terminology that students find difficult to comprehend, challenges in delivering material contextually, and difficulties in providing a clear visualization of digestive processes particularly chemical changes within the body. Teachers' experiences in implementing argumentation-based learning models varied; while some reported that students became more active and enthusiastic in expressing their thoughts, others experienced a lack of student interest or had never implemented such models before. Furthermore, teachers utilized diverse media ranging from torsos, posters, and 3D media to simple props, while some still lacked adequate media resources.

The digestive system material itself is a complex topic that frequently poses difficulties for students. The digestive process occurs through abstract stages involving multiple organs with interrelated functions and is laden with biological terms that are difficult to grasp. This complexity often leads to misconceptions, such as in distinguishing between mechanical and chemical digestion or in understanding the functions of accessory organs (Gul et al., 2024). Furthermore, conventional learning that relies solely on lectures or textbooks is often inadequate, particularly in online learning environments where teacher-student interaction is not optimal. These conditions result in many students failing to fully master the material; in fact, a recent study indicates that 45% of students possess a low level of conceptual understanding regarding the digestive system (Kumalasari & Anggraito, 2023). Therefore, more interactive and effective learning media are required to assist students in achieving a deep understanding of the concepts.

Topics such as the digestive system and nutrition are directly related to students' lives, for instance, through issues of nutrition, obesity, and junk food. This context provides an authentic opportunity for students to practice argumentation and make decisions based on scientific evidence (Morris et al., 2024). Furthermore, the topic of the digestive system is highly relevant to socio-scientific contexts (SSI), such as nutrition issues, obesity, junk food consumption, and public health problems related to diet and lifestyle. These contexts provide authentic opportunities for students to construct evidence-based scientific arguments regarding food choices and healthy lifestyles. This is in line with studies suggesting that the use of the SSI approach in science education can enhance scientific literacy, decision-making skills, and evidence-based argumentation (Hogstrom et al., 2024).

In general, the structure of a scientific argument consists of several key components: claim (the statement or conclusion being proposed), evidence (the data or

findings that support the claim), and reasoning or justification (the logical explanation that connects the evidence to the claim). Morris et al. (2024) emphasize that the quality of scientific argumentation is influenced by three primary factors: content knowledge, scaffolding (structured guidance in constructing arguments), and the teacher's instructional style. Given the necessity of developing these scientific argumentation skills, the Socio-Scientific Issues (SSI) approach is considered highly relevant for classroom implementation. The SSI context presents real-world, controversial issues such as environmental, health, and technological problems thereby encouraging students to construct evidence-based scientific arguments while simultaneously considering moral, social, and ethical dimensions (Syarlisjswan et al., 2024).

Interactive e-modules serve as a solution to overcome these limitations. This medium is flexible, accessible anytime and anywhere, and integrates text, images, videos, animations, and interactive quizzes, making learning more engaging than printed books. With these characteristics, interactive e-modules support independent learning while simultaneously facilitating the development of students' scientific literacy, critical thinking, and creativity.

Various previous studies support the urgency of developing SSI- and ADI-based interactive e-modules. Dewi et al. (2023) demonstrated that SSI-based learning is effective in enhancing scientific argumentation skills, with a high improvement category (N-gain 0.82–0.87). Similarly, Utami et al. (2023) found that an SSI-based e-module on global warming material was not only valid but also capable of improving students' critical thinking skills (N-gain 0.78) and sustainability awareness (N-gain 0.45), while receiving highly positive responses. A systematic review by Herlina & Abidin (2024) also confirms that interactive e-modules incorporating various approaches including SSI, Inquiry, and STEM are proven effective in enhancing scientific literacy, critical thinking skills, communication, and student learning independence.

Based on this analysis, this research is conducted to develop and evaluate the validity of an interactive e-module based on Socio-Scientific Issues (SSI) with the Argument-Driven Inquiry (ADI) model for the topic of food and the digestive system. This study aims to produce a valid and feasible learning tool designed to enhance junior high school student's scientific argumentation skills while supporting the attainment of 21st-century skills, which require students to think critically, reflectively, and contextually.

METHOD

This study was a Research and Development (R&D) project aimed at producing an interactive e-module based on Socio-Scientific Issues (SSI) with the Argument-Driven Inquiry (ADI) model. The product was developed for the topic of the Digestive System and Nutrition, with the goal of enhancing the scientific argumentation skills of junior high school students.

The development model employed was the 4D model (Define, Design, Develop, and Disseminate) (Thiagajaran in Sugiyono, 2019). This model was selected because it is well-suited for producing instructional products with proven validity, practicality, and effectiveness. The stages of the 4D model in this research are described as follows. First, define: Determining learning needs, student characteristics, and the competencies to be achieved through the e-module. Second, design. Designing the e-module, including the SSI-based learning flow and ADI steps, as well as preparing the data collection instruments. Third, develop. Creating the initial version of the e-module, conducting

expert validation, making revisions, and performing limited trials to obtain a feasible module for use. Fourth, disseminate. Conducting field trials in selected schools, collecting data on the module's effectiveness, and preparing the module for wider implementation.

The 4D model provides a systematic framework for researchers to develop, validate, and implement the e-module in stages, ensuring the quality of the product and its impact on students' scientific argumentation skills. The research procedure follows the 4D development model (Define, Design, Develop, Disseminate), which aims to produce an Interactive E-Module Based on Socio-Scientific Issues (SSI) using the Argument-Driven Inquiry (ADI) approach for the topic of the Digestive System and Nutrition. The research procedures are detailed as follows:

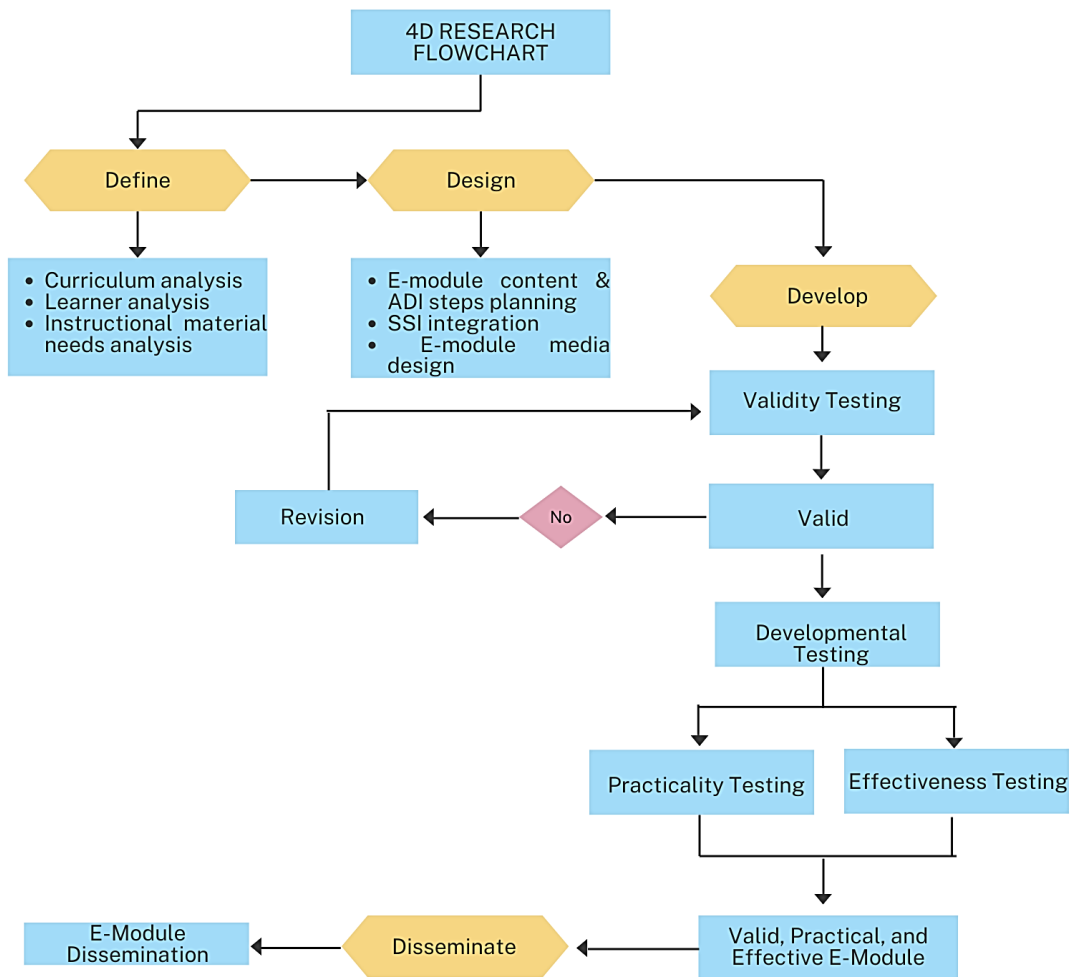


Figure 1. Stages of Interactive E-Module Development Using the 4D Model

Data Analysis Method

The collected data were analyzed to assess the validity, practicality, and effectiveness of the SSI-ADI e-module. The analysis was conducted quantitatively using systematic procedures to ensure the scientific accountability of the research results. The validity analysis was performed using expert validation sheets, which evaluated aspects of content, language, presentation, visual design, and e-module interactivity. Each score

from the validators was summed and averaged. The average results were then categorized to determine the extent to which the e-module is academically and technically feasible before being tested on students.

Based on the validators' assessment results, the e-module validation scores were analyzed descriptively using a percentage formula in accordance with the established criteria (Riduwan, 2013). According to Riduwan (2013), a module is considered feasible or valid for use if the percentage interpretation is $\geq 71\%$.

Criterion Score = Highest score per aspect x number of aspects x number of validators

$$\text{Validity Percentage (\%)} = \frac{\text{Total Score Obtained}}{\text{Criterion Score}} \times 100\%$$

Table 1. Validity Scale Criteria

Rating Scale	Description
1	Bad
2	Below Average
3	Fair
4	Good
5	Very Good

Table 2. Interpretation Criteria for Science Module Feasibility Assessment Scores

Score (%)	Interpretation Criteria
25 – 40	Invalid
41 – 55	Less Valid
56 – 70	Fairly Valid
71 – 85	Valid
86 – 100	Very Valid

FINDINGS AND DISCUSSION

Findings

The product developed in this study is an Interactive E-Module based on Socio-Scientific Issues (SSI) integrated with the Argument-Driven Inquiry (ADI) model to enhance students' scientific argumentation skills. The development process followed the 4D model stages (Define, Design, Develop, Disseminate) to produce a final product that is feasible for classroom use.

This e-module is designed with an engaging visual appearance and a user-friendly interface, containing various components that support scientific argumentation activities. The introductory section features an interactive cover displaying the title, author identity, and visual illustrations reflecting the Socio-Scientific Issues context. Furthermore, the module is designed using a soft-colored layout, supporting icons, and adaptive digital navigation, making it easier for students to explore the material.

In the content section, the e-module provides material presentation based on socio-scientific issues, which are linked to real-world phenomena to stimulate students' critical thinking skills. Each topic is equipped with concise explanations, illustrations, and relevant case studies. The module also incorporates the ADI learning steps, such as

question formulation, claim construction, evidence collection, reasoning development, as well as discussion and reflection sessions.

Furthermore, the e-module provides various interactive features, such as video links, learning resources, case study-based exercises, and scientific argumentation activities. Students are guided to construct claims, analyze evidence, and develop arguments through the Claim, Evidence, Reasoning (CER) table. To strengthen the documentation of the development results, several examples of the module interface are presented in figures, including: the module cover, sample material pages, scientific argumentation activities, and interactive features. These visual presentations aim to provide a clear illustration of the form and structure of the developed e-module.

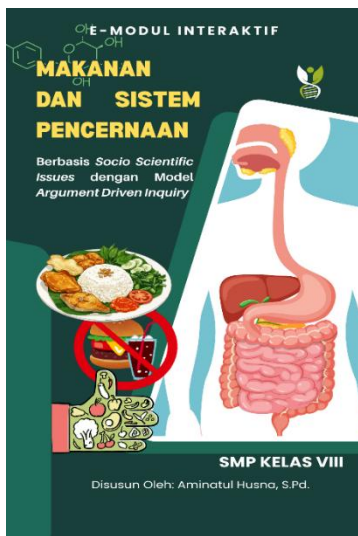


Figure 2. E-Module Cover Page

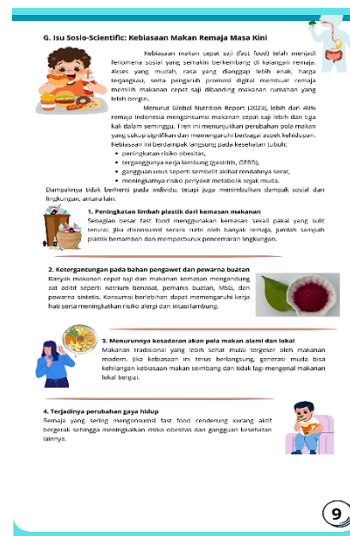


Figure 3. Presentation of SSI Context



Figure 4. SSI Interface

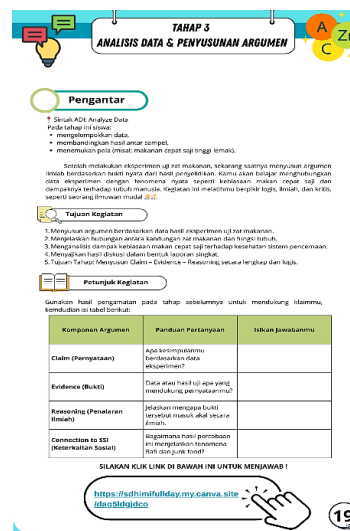


Figure 5. ADI-CER Interface

E-Module Validity Findings

To determine the validity level of the interactive e-module based on Socio-Scientific Issues using the Argument-Driven Inquiry (ADI) model, an evaluation was conducted by expert validators. The overall validity assessment results of the e-module are presented in tabular form to provide a general overview of the product's validity level, as shown in Table 3.

Table 3. E-Module Validity Results

Validator	Validity Score (%)	Category
Validator 1	93.6	Very Valid
Validator 2	95.2	Very Valid
Validator 3	92.0	Very Valid
Validator 4	92.8	Very Valid
Average	93.4	Very Valid

Based on Table 3, it can be seen that the validity scores of the e-module assessed by the four validators are very high. The individual validity scores range from 92.0% to 95.2%, all of which fall into the "Very Valid" category. The overall average validity score of the e-module is 93.4%, indicating that the developed e-module has met very good validity criteria according to expert judgments. These results demonstrate that the content, presentation, and overall feasibility of the e-module for instructional use meet high quality standards.

E-Module Validity by Aspect

In addition to the overall validity assessment, the validity of the interactive e-module was also analyzed based on each assessment aspect. This analysis aims to determine the level of e-module validity for each component evaluated by the validators. The validity results of the e-module according to each assessment aspect are presented in Table 4.

Table 4. E-Module Validity Based on Assessment Aspects

Aspect/Indicator	Maximum Score	Obtained Score	Percentage (%)	Category
Content Quality	100	97	97%	Very Valid
Presentation	80	72	90%	Very Valid
Language	60	57	95%	Very Valid
Graphics	60	53	88.33%	Very Valid
Alignment of the E-Module with the ADI Model	60	56	93.33%	Very Valid
Integration of the SSI Approach	60	58	96.67%	Very Valid
Integration of CER in the E-Module	80	74	92.5%	Very Valid

Based on Table 4, all assessment aspects of the interactive e-module achieved validity percentages above 86%, thus falling into the “very valid” category. The content quality aspect obtained the highest validity percentage at 97%, followed by the integration of the *Socio-Scientific Issues* approach at 96.67% and the language aspect at 95%.

The other aspects, including presentation, graphics, alignment of the e-module with the *Argument-Driven Inquiry* model, and the integration of *Claim, Evidence, and Reasoning* (CER) in the e-module, also demonstrated high validity percentages ranging from 88.33% to 93.33%. These results indicate that the developed interactive e-module has comprehensively met the validity criteria and is suitable for use as a science learning medium based on the ADI model with the SSI approach.

Validity Results of Pretest and Posttest Instruments

The test instruments were validated by two validators with a total of 8 indicator items using a 1–5 Likert scale. The total assessment score obtained was 76, while the ideal maximum score was 80. Based on the assessment conducted by two validators, the research instrument obtained total scores of 73 and 74 out of an ideal maximum score of 80. Accordingly, the validity percentages from the first and second validators were 90% and 93%, respectively. The average validity percentage of the instrument was 91.5%, which falls into the very valid category.

These results indicate that the instrument has met the eligibility criteria in terms of content, language clarity, and alignment with learning objectives. Therefore, the instrument is considered appropriate and ready to be used for collecting students’ data. A detailed summary of the validation results for each instrument aspect assessed by both validators is presented in Table 5.

Table 5. Instrument Validation Results by Validators

No	Instrument Aspect/Item	Validator		Average	Percentage (%)	Category
		I	II			
1	Alignment of indicators with learning objectives	5	5	5.0	100%	Very Valid
2	Relevance of the material to the topic	5	5	5.0	100%	Very Valid
3	Appropriateness of the <i>Socio-Scientific Issues</i> context	4	4	4.0	80%	Valid
4	Level of difficulty	4	4	4.0	80%	Valid
5	Clarity of language	5	5	5.0	100%	Very Valid
6	Completeness of <i>Claim, Evidence, and Reasoning</i>	4	5	4.5	90%	Very Valid
7	Relevance to the <i>Argument-Driven Inquiry</i> model	5	5	5.0	100%	Very Valid
8	Integration of the <i>Socio-Scientific Issues</i> context with science concepts	4	4	4.0	80%	Valid
Average				4.56	91.5%	Very Valid

Practicality Results Based on Student Responses (Small-Scale Trial)

The practicality test was conducted with 13 students using a 16-item questionnaire on a 1–5 Likert scale. The total positive response score obtained was 1,016 out of an ideal maximum score of 1.040.

Table 6. Practicality Calculation Results (Small-Scale Trial) SMP Muhammadiyah 11 Wuluhan

Component	Value
Number of Students	13
Number of Questionnaire Items	16
Total Positive Response Score	1016
Ideal Maximum Score	1040
Practicality Percentage	97.69%

Based on the practicality interpretation criteria (86–100% = Very Practical), this value falls into the “Very Practical” category. This means the e-module is considered very easy to use, helps in understanding the material, and provides a positive learning experience for students during the small-scale trial.

Practicality Results Based on Student Responses (Large-Scale Trial)

The subsequent practicality test was conducted with 20 students using the same questionnaire consisting of 16 items. The total positive response score obtained was 1.437 out of an ideal maximum score of 1.600.

Table 7. Practicality Calculation Results (Large-Scale Trial) SMP Muhammadiyah 6 Wuluhan

Component	Value
Number of Students	20
Number of Questionnaire Items	16
Total Positive Response Score	1303
Ideal Maximum Score	1600
Practicality Percentage	81.43%

Based on the practicality interpretation criteria, the percentage of 81.43% falls into the “Practical” category. This indicates that the e-module is not only theoretically feasible but also effective and easy to use for a larger number of students.

Discussion

The research results demonstrate that the interactive e-module based on Socio-Scientific Issues (SSI) developed using the Argument-Driven Inquiry (ADI) model possesses a very high level of validity and practicality. This indicates that the developed learning product meets the quality standards of instructional media in terms of content feasibility, presentation, language, and graphics. These findings reinforce the idea that combining a social-scientific issue-based approach with an argumentative learning model is an effective strategy for enhancing the quality of science education.

Firstly, the e-module's validity results achieved a percentage of 93.4%, falling into the "Very Valid" category. This percentage indicates that the experts provided a highly positive assessment regarding the content structure, conceptual accuracy, alignment of the material with learning objectives, and the quality of the e-module's visual display. This high validity reflects the quality of the e-module content, which was structured based on learning indicators, pedagogical principles, and student needs. Furthermore, the integration of SSI and ADI elements was deemed relevant to the characteristics of the digestive system material, which requires a connection between biological concepts and daily life phenomena. This finding is consistent with a study by Lestari et al. (2023) which indicates that SSI-based modules are effective in enhancing scientific thinking skills by linking learning to real-world issues that are closely related to students' experiences.

The validity of the interactive e-module was analyzed not only overall but also based on each assessment aspect to obtain a detailed picture of the quality of its components. The analysis results indicate that all aspects achieved validity percentages above 86% and were classified as "Very Valid", confirming that the e-module meets the feasibility criteria in terms of content, language, presentation, and alignment with the learning model and instructional approach employed.

The content aspect obtained the highest validity percentage (97%), followed by the integration of *Socio-Scientific Issues* (96.67%) and the language aspect (95%), indicating that the material is aligned with learning objectives, contextual, and easily understood by students. The presentation aspect (90%), graphical design (88.33%), conformity with the *Argument Driven Inquiry* model (93.33%), and the integration of *Claim, Evidence, and Reasoning* (92.5%) were also classified as very valid, indicating that the e-module is systematically designed and effectively facilitates inquiry processes and the development of students' scientific argumentation skills.

Secondly, the validity of the pretest and posttest instruments reached 95%, falling into the "Very Valid" category. This indicates that the instruments used in this study accurately represent the indicators of scientific argumentation skills and conceptual understanding. Instrument validity is a crucial aspect of development research, as the quality of the instrument determines the accuracy of the data obtained. In line with this, Riduwan (2013) emphasizes that a valid instrument is an absolute requirement for ensuring reliable measurement results. Consequently, the instruments in this study are justifiable as feasible measurement tools in the e-module validation process.

Furthermore, the practicality test results indicate that the developed e-module has a high level of practicality. The small-scale trial conducted at SMP Muhammadiyah 11 Wuluhan obtained a practicality percentage of 97.69%, which falls into the "very practical" category, while the large-scale trial carried out at SMP Muhammadiyah 6 Wuluhan achieved a percentage of 81.43%, categorized as practical. These results indicate that the e-module is easy to use, engaging, and helpful for students in the learning process. The high level of practicality is influenced by the ease of navigation, clarity of visual presentation, interactive features, and the integration of argumentation activities based on the CER (Claim, Evidence, and Reasoning) framework, which support active student engagement. This finding is consistent with the study by Utami et al. (2023), which states that interactive e-modules are able to enhance students' motivation and engagement by providing a more visual, flexible, and independent learning experience.

The difference in percentages between the small-scale and large-scale trials indicates a variation in preferences and more heterogeneous learning styles within the

larger group. Nevertheless, this decrease is not significant, and the score remains within the highest category. This demonstrates that the e-module consistently provides a positive learning experience even when used by a larger number of students. In other words, the e-module design meets the principles of universal usability, meaning it can be used effectively by diverse users without any significant obstacles.

Based on the validation results from material experts, media experts, and learning experts, the developed e-module based on Socio-Scientific Issues (SSI) using the Argument-Driven Inquiry (ADI) model is categorized as “highly valid”. This is evidenced by the validity scores of each component falling within the high range, across the aspects of content suitability, construction, visual design, and usability in science learning.

This finding aligns with research by Rhahmadanny et al. (2024), which states that learning tools integrating ADI must satisfy both conceptual and procedural validity to effectively guide students in constructing claims, evaluating evidence, and developing scientific reasoning. In the context of this study, the e-module structure, which incorporates ADI stages ranging from investigation and argumentation sessions to reflection is a key factor behind the high validation scores.

Furthermore, these validation results are supported by Junaedy et al. (2025), who reported that well designed e-modules can strengthen students’ understanding of scientific concepts, as evidenced by a total percentage of 91.12%, indicating that the developed e-module is valid and feasible for use. Additionally, research by Utami et al. (2022) emphasizes that well validated ADI based learning tools are capable of strengthening students’ scientific argumentation, particularly in linking evidence with scientific concepts. This reinforces the results of the current study, confirming that the e-module is construct valid and feasible for improving the scientific argumentation skills of junior high school students.

Overall, the findings of this research reinforce that the integration of the SSI approach with the ADI model is capable of providing a rich and meaningful learning context. The SSI approach encourages students to analyze socio-scientific issues, consider evidence, evaluate arguments, and make data-driven decisions. Meanwhile, the ADI model provides a clear argumentative learning structure through stages of investigation, argument construction, argumentative discussion, and reflection. The combination of these two approaches has proven effective in facilitating the development of scientific argumentation skills, as also reported by Dewi et al. (2023) and (Novanda et al., 2024).

Theoretically, the high levels of validity and practicality indicate that the e-module is not only content-appropriate but also relevant to the demands of 21st-century learning. Interactive digital learning media play a crucial role in encouraging independent learning, increasing motivation, and strengthening constructivist-based learning experiences. Practically, the e-module can serve as an alternative learning medium that can be integrated into both online and offline learning environments. Furthermore, this e-module has the potential to become an adaptive learning tool catering to various student learning styles.

In conclusion, the results of this study confirm that the interactive e-module based on Socio-Scientific Issues with the Argument-Driven Inquiry model is feasible for use as a learning medium to enhance the quality of science education. The high validity and practicality indicate that this e-module not only possesses theoretical strength but is also highly applicable in real classroom implementation. In the next stage, further research

can test the effectiveness of the e-module on improving scientific argumentation skills, conceptual understanding, or critical thinking skills to strengthen empirical evidence regarding the impact of using this e-module.

CONCLUSION

Based on the research results and discussion, it can be concluded that the e-module developed in this study has met the criteria as a valid and practical learning medium for use in the learning process. The e-module validity reached 93.4%, while the test instrument validity reached 95%, both of which are in the “Very Valid” category. This indicates that the content, structure, language, and design of the e-module are in accordance with the principles of learning media development and are able to represent the established learning outcomes. Furthermore, the practicality test results demonstrate that the e-module is highly user-friendly, as evidenced by the practicality percentages of 97.69% in the small-scale trial and 81,43% in the large-scale trial, both of which are categorized as “Practical”. These findings confirm that the e-module is not only theoretically feasible but also effective in terms of ease of use, attractiveness, and its benefits in helping students understand the learning material. The e-module provides a more interactive and flexible learning experience, thereby supporting the achievement of the intended learning objectives.

With the fulfillment of the validity and practicality criteria, it can be concluded that the developed e-module is in accordance with student needs and is ready to be implemented in learning on a broader scale. This research provides a tangible contribution to the development of digital learning media that is relevant to the demands of contemporary educational technology. Based on the research results, the developed e-module has proven to be highly valid and practical, making it feasible for implementation in the classroom. Therefore, it is suggested that teachers utilize this e-module as a learning resource to support both independent and digital-based learning processes. The use of the e-module should be integrated with instructional activities such as discussions, exercises, and formative evaluations to ensure its benefits are optimized for students. Furthermore, future research is expected to conduct effectiveness trials involving a larger number of participants or different educational levels to obtain a broader perspective on the impact of e-module usage on improving learning outcomes.

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