



## Feasibility of Steam-Based IPAS Learning Module in Developing Critical Thinking Skills of Grade V Elementary School Students

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**ABSTRACT:** STEAM-based learning modules are a phenomenon as a medium for developing critical thinking skills in learning Science of Nature and Social Sciences (IPAS) in elementary schools (SD). The purpose of this study was to describe the feasibility of developing STEAM-based IPAS learning modules as a medium for developing critical thinking skills. The type of research is Research and Development (R&D). Data were collected through expert validation questionnaires and tests. The results showed that the validation scores for all experts were greater than 0.80, meaning that the IPAS learning module was valid for data collection; Student response questionnaire > 80%, meaning that the readability of the IPAS learning module has good criteria; Increased average learning outcomes of 33.41 and a decrease in standard deviation of 3.646; The results of hypothesis testing obtained data calculated significance value (0.000) < 0.05 or absolute t count (23). The conclusion of the research is that the STEAM-based IPAS learning module can be interpreted as feasible to be used as learning media in developing critical thinking skills, because it has fulfilled the validity aspects, practicality aspects, and effectiveness aspects.

**KEYWORDS:** Critical thinking skills, media, STEAM

### INTRODUCTION

Education at the primary school level has an important role in developing students' thinking skills and life skills. Along with the rapid development of science and technology, learners are not only required to master basic knowledge but also need to have good critical thinking, creative, and problem-solving skills. These skills are very important as a foundation for facing increasingly complex challenges in the 21st century (Ngatminiati, 2024).

Critical thinking skills are the ability to analyze arguments through aspects of finding basic similarities and differences in the material or learning topics studied (Erlistiani, et al., 2020). Larasati and Syamsurizal (2022) Critical thinking skills are the ability to correctly conclude a problem, review and thoroughly examine the decisions taken. Meanwhile, Septiany, et al., (2024) explained that: critical thinking is thinking that uses reason to solve a problem by first understanding the problem, expressing opinions or arguments clearly and being able to draw conclusions from existing problems. Based on the description above, critical thinking skills are the ability to analyze to pay attention to similarities and differences which are then synthesized to formulate conclusions.

Individuals who have critical thinking skills, there are aspects and indicators. Ennis (Baharizki, S. (2021) explains that aspects and indicators of individuals having critical thinking skills, namely: explaining simply, the indicator analyzes a reality; building basic skills, the indicator makes observations of a problem and provides arguments for the problem; giving conclusions, the indicator makes induction or concludes a problem and reviews it; explaining further, the indicator builds arguments and provides further clarification; and setting strategies, the indicator looks for the most appropriate solution to do in problem solving.

The benefit of students having critical thinking skills in the 21st century is the ability to analyze for problems that arise. Halpern (2019) explains that the benefit of critical thinking skills is to help learners develop analytical as well as creative thinking skills. This skill allows them to solve problems with a logical and systematic approach. In addition, critical thinking also trains learners to consider the impact of every action they take with wisdom. Meanwhile, Brookfield (2019) revealed that the development of critical thinking skills has a significant positive impact in improving collaboration and group discussions in the learning environment. Learners who are trained to think critically tend to be more able to actively participate in discussions, by listening to other perspectives openly and constructing their own arguments in a more structured and confident manner.

Some of the big pictures of critical thinking skills possessed by elementary school students are difficult to realize. Preliminary studies that have been conducted on grade V elementary school teachers in Musuk Subdistrict, Boyolali Regency, in IPAS learning, there are 70% of teachers who say that students' critical thinking skills on the material studied are still low as evidenced by the



learning outcomes of students still only slightly above the Minimum Completeness Criteria that have been determined. In addition, the results of direct observations that have been carried out in class V IPAS learning at SDN 1 Ringinlarik, Musuk District, Boyolali Regency, the results show that the low critical thinking skills of students are very visible, namely when the teacher asks several learning questions, most students do not dare to express their opinions. This is in accordance with the opinion of Santrock (2018), which states that students often feel anxious or lack confidence in expressing opinions in class, especially when they are afraid of making mistakes or getting negative responses from teachers and peers.

Learning methods, especially in IPAS subjects in grade V of elementary schools today, often lie in approaches that are still conventional and focused on one discipline, without a clear connection with other disciplines or real situations that are relevant to the lives of students (Suryani, Setyawati, & Roshayanti, 2023). Methods that focus too much on theory and memorization cause IPAS learning to be less able to stimulate students' critical and creative thinking skills. In this context, the application of interdisciplinary and problem-based learning is needed to overcome these problems. In learning activities, students are expected to be able to fully develop their learning capacity and potential so that students can get better learning outcomes.

Building and developing critical thinking skills, one of the learning models that can be used is Science, Technology, Engineering, Art, and Mathematics (STEAM). Dewi (2019) explains that STEAM-based learning is also effective in increasing students' learning motivation because it involves hands-on activities and creative exploration. In addition, STEAM helps learners develop technological literacy skills and 21st century skills that are needed in today's digital era. Lee and team (2021) in, arts integration in STEAM learning provides a creative dimension that enriches the science and technology learning process. This approach allows learners to utilize their artistic skills in understanding and applying scientific concepts, thus creating more innovative and engaging learning. Based on the above description, it can be concluded that STEAM-based learning (Science, Technology, Engineering, Arts, and Mathematics) is an educational approach that integrates natural science, technology, engineering, arts, and mathematics in a unified learning process.

The benefits of the STEAM approach in teaching have an impact on several predetermined goals, such as: increasing concept understanding, developing critical and creative thinking skills. Kim and Park (2022) explain that STEAM-based learning has a significant impact on increasing students' motivation and engagement in the learning process. This is due to the relevance of the subject matter that students feel is closer to their daily lives, so they are more interested in participating in learning. Meanwhile, Robinson and Martinez (2023) mentioned that the application of STEAM learning in elementary schools has its own challenges and benefits. this approach helps learners in understanding abstract concepts, because STEAM utilizes a hands-on approach that facilitates the connection between scientific concepts and their application in art and engineering. The effectiveness of STEAM learning in improving students' creative thinking skills. The results of his research show that the STEAM approach allows learners to think more broadly and freely in finding creative solutions to the problems given.

STEAM as an approach to learning has stages in learning. Bequette & Bequette (2012) explain the stages in learning, namely: 1) Identification of Problems or Challenges, STEAM learning begins by introducing learners to certain problems or challenges that are relevant to everyday life; 2) Exploration and Research, learners explore and gather information related to the topic or challenge at hand; 3) Solution or Idea Planning, learners are invited to plan a solution; 4) Prototype or Product Development, learners put their solutions into practice by developing prototypes or products that can represent their ideas; 5) Testing and Evaluation, learners conduct testing to see if the solution works; 6) Presentation and Reflection, learners present their work to teachers and peers; and 7) Implementation and Impact (Optional), learners' products or solutions can be implemented in real life.

The STEAM approach in learning requires media to match the developmental level of students. The STEAM approach used for elementary school students needs to use learning media. This is because learning media adapts to the learning style and concrete operational stages of elementary students. Module is interpreted as a set of teaching materials that are presented systematically, so that users can learn with or without a facilitator or teacher. A module must be used as teaching material as a substitute for the function of educators. If the educator has the function of explaining something in a language that is easily accepted by students according to their level of knowledge and age (Prastowo, 2015). Meanwhile, Westomi et al, (2018) explained that the learning module is a learning resource that encourages the independence of self-learning students, meaning that the awareness and activeness of students in learning is a priority for the teacher. The teacher makes himself not the only source of knowledge that must be accepted by students, but the teacher appears as a facilitator of student learning. Based on the description above, learning modules are learning resources that direct students to be able to learn independently and make the teacher a facilitator.



The development of learning modules needs to pay attention to the characteristics so that students can learn independently. Nursafitri et al., (2020) explained that the characteristics of learning modules include: self instructional, self contained, stand alone, adaptive, and user friendly. This can be explained as follows: 1) Self Instructional, through the module a person or learner is able to teach themselves, does not depend on other parties; 2) self contained, all learning material from one unit of competency or sub-competency studied is contained in one module as a whole; 3) stand alone, the module developed does not depend on other media or does not have to be used together with other learning media; 4) adaptive, said to be adaptive if the module can adjust the development of science and technology, and is flexible to use; 5) user friendly, every instruction and information exposure that appears is helpful and friendly to the user, including the ease with which the user can respond, access according to their wishes.

Based on the description above, the researcher determined the research title, namely: Feasibility of STEAM-Based IPAS Learning Module in Developing Critical Thinking Skills of Grade V Elementary School Students. Feasibility is the development stage of the learning module. The purpose of this study is to describe the feasibility of developing STEAM-based IPAS learning modules as a medium for developing critical thinking skills.

## RESEARCH METHOD

This research is a Research and Development (R&D) research. Data collection through expert validation questionnaires and qualitative tests. Sugiyono (2022: 297) explains that Research and Development research is a research method used to produce certain products and test the effectiveness of these products. The research subjects in this study were fifth grade students and elementary school teachers in Musuk Boyolali sub-district. The data collection technique used expert validation questionnaires and tests. validation test using Aiken's formula, namely:

$$V = \frac{S}{[n*(c-1)]} \text{ where } S = \sum n_i(r - \ell_o)$$

(Aiken, 1980:955)

Description:

- V = Aiken's validity index
- $n_i$  = number of raters who chose criterion i
- c = number of categories/criteria
- r = ith criterion
- $\ell_o$  = lowest category
- n = total number of raters

Analyze the questionnaire using the percentage formula, which is formulated:

$$\text{Percentage} = \frac{\text{Number of Subject Answers}}{\text{Number of Subjects}} \times 100\%$$

(Arikunto, 2019)

The percentage value is greater than 80, so it is interpreted that STEAM-based learning media can be categorized as feasible to be continued to the broad trial stage. Meanwhile, the analysis of test results using the Paired t-test test, which is formulated:

$$t = \frac{\bar{X}_1 - \bar{X}_2}{\sqrt{\frac{s_1^2}{n_1} + \frac{s_2^2}{n_2} - 2r \left( \frac{s_1}{\sqrt{n_1}} \right) \left( \frac{s_2}{\sqrt{n_2}} \right)}}$$

(Sugiyono, 2022)

Description

- $\bar{X}_1$  = Average of sample 1
- $\bar{X}_2$  = Average of sample 2
- $s_1$  = Standard deviation of sample 1
- $s_2$  = Standard deviation of sample 2
- $s_1^2$  = sample variance 1



$s_2^2$  = sample variance 2

r = correlation between two groups of data

This study aims to see the effect of learning module media on the development of critical thinking skills.

### RESULTS AND DISCUSSION

The results of media and material expert validation of the development of IPAS learning module media for grade V in Musuk Boyolali sub-district obtained the following data:

**Table 1. Results of Media Expert Validation and Learning Media Material**

No.	Aspect	V count
1	Self Instructional	0.90
2	Self Contained	0.90
3	Stand Alone (Berdiri Sendiri)	0.90
4	Adaptive	0.85
5	User friendly	0.85

The decision-making procedure is if V count > V table (0.80) then the learning module media is said to be valid for data collection in the field. Vice versa, if V count < V table (0.80) then the learning module media is not valid for data collection. Based on the table above, it is found that V count for each aspect is greater than V table (0.80). so it can be concluded that the learning module media can be said to be valid.

Questionnaires of students' responses from the results of the intermediate test, arranged in the table as follows:

**Table 2. Learners' Response Questionnaire to Learning Module Media**

No.	Aspect	Response
1	Self Instructional	95.46%
2	Self Contained	81.82%
3	Stand Alone (Berdiri Sendiri)	90.91%
4	Adaptive	81.82%
5	User friendly	86.36%

The procedure for determining the criteria is if the questionnaire response > 80%, then the learning module media has good criteria; 60 < questionnaire response ≤ 80% criteria is sufficient; and questionnaire response ≤ 60% criteria is less. The decision, all aspects have a response greater than 80%, so it is concluded that the learning module media has good criteria.

The test results before the action and after the action at the intermediate test stage are organized as follows:

**Table 3. Descriptive Statistics**

	N	Min	Max	Mean	Std. Deviation
Pretest learning outcomes	22	40	75	54.77	10.291
Posttest learning outcomes	22	80	100	88.18	6.645
Valid N (listwise)	22				

Based on the table above, the data shows that there is an increase in the average learning outcomes of 33.41 and a decrease in the standard deviation of 3.646 which can be interpreted as an increase in positive learning responses using the IPAS learning module.

The normality test results obtained the following data:



**Table 4. Normality Test Results**

	Shapiro-Wilk Statistic	df	Sig.
Pretest learning outcomes	0,939	22	0,188
Posttest learning outcomes	0,892	22	0,060

The decision-making procedure is if the calculated significance > 0.05 then the data comes from a normally distributed population. Conversely, if the significance count < 0.05 then the data does not come from a normally distributed population. The results of the data processing above can be concluded that the significance of the Pretest count (0.188) and the Posttest significance (0.060) is greater than 0.05. So it can be concluded that the data comes from a normally distributed population.

The hypothesis test results can be organized as follows:

**Table 5. Paired Samples Test**

Pair 1		Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference		T	df	Sig. (2- tailed)
					Lower	Upper			
Pair 1	Pretest learning outcomes - Posttest learning outcomes	-33.409	6.616	1.411	-36.343	-30.476	-23.684	21	.000

The basis for decision making is if the significance count <0.05 or t absolute count > t table (2.07961) then there is an influence of the use of IPAS learning module media on the development of critical thinking skills. Vice versa, if the significance count > 0.05 or absolute t count < t table (2.07961), then there is no effect of using IPAS learning module media on the development of critical thinking skills. Based on the table above, the calculated significance value (0.000) <0.05 or absolute t count (23.684) is greater than t table (2.07961), it is concluded that there is an effect of using IPAS learning module media on the development of critical thinking skills.

**DISCUSSION**

Based on the description above, the IPAS learning module media can be said to be feasible if it has met three aspects of the criteria. Husein I.M. & Rusimamto (2020) explain that three aspects of the media are said to be feasible, namely: fulfill the aspects of validity, practicality, and effectiveness. In the validity aspect, V count for each aspect is greater than V table (0.80), so it can be concluded that the learning module media can be said to be valid. This shows that the media can be used for data collection in the research field.

The practical aspect can be noted from the students' response questionnaire to the learning module media. all aspects have a response greater than 80%, so it is concluded that the learning module media has good criteria. This is also corroborated by the results of the increase in test scores by 33.41. This is in line with the concept of Nieveen which explains that the practicality of the product is determined from the opinion of educators who state that the product produced can be used and the product can be used easily by educators and students as expected (Riva'i, Ayuningtyas, & Dhany, 2020). Nuryadi & Khuzaini (2017) stated that practicality is measured based on the assessment results of teachers and students who use the product during the trial. Data on the practicality of learning media is obtained from the responses of students and teachers to learning media. The learning media developed is said to be practical if the responses of students and teachers show minimum criteria in the practical category.

effectiveness in this study is shown by the results of the Paired t-test hypothesis test with the data of the calculated significance value (0.000) <0.05 or absolute t count (23.684) greater than t table (2.07961), it is concluded that there is an effect of



using IPAS learning module media on the development of critical thinking skills. The effect of the IPAS learning module media shows that the media is effective in developing critical thinking skills. This is in accordance with the concept of Nieveen stating that the effectiveness of the product can be reviewed from the consistency between the design or objectives with the experience and learning outcomes achieved by students (Riva'i, Ayuningtyas, & Dhany, 2020).

## CONCLUSION

The STEAM-based IPAS learning module can be interpreted as feasible to be used as learning media in developing critical thinking skills, because it has fulfilled the validity aspects, practical aspects, and effectiveness aspects.

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