TA'DIB JOURNAL, 27 (1), 2024, (January-June)

ISSN: 1410-8208 (*Print*) 2580-2771 (*Online*)
Available online at https://ejournal.uinmybatusangkar.ac.id/ojs/index.php/takdib/index

Developing 'I Can Adapt' Science Module Using RIAS Learning for Enhanced Critical Thinking

Received: 23-08-2023; Revised: 08-06-2024; Accepted: 13-06-2024

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Abstract: In the context of Natural Science lessons, students often lack critical thinking skills. To address this challenge, the researchers developed the "I Can Adapt" scientific module for students at SMP Negeri 10 Magelang. This study evaluates the module's viability, efficacy, and practicality using a research and development (R&D) approach based on the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. The expert validation process confirmed the module's validity, with material experts rating it at 4.0 and teaching materials experts at 4.2. To assess efficacy, the researchers employed a one-group pretest-posttest design with paired sample t-test analysis. The results revealed a significant increase in critical thinking skills ($p < 0.05$), as indicated by a significance value of 0.00. The average N-Gain score of 0.83 falls within the high category. Furthermore, student questionnaires related to the RIAS-based science modules demonstrated a practicality level of 84.6%. Overall, the findings support the use of the "I Can Adapt" RIAS-based science module as an effective tool for enhancing critical thinking abilities.

Abstrak: *Dalam konteks pembelajaran IPA, siswa seringkali kurang memiliki kemampuan berpikir kritis. Untuk menjawab tantangan tersebut, peneliti mengembangkan modul ilmiah "Saya Bisa Beradaptasi" untuk siswa di SMP Negeri 10 Magelang. Penelitian ini mengevaluasi kelayakan, kemanjuran, dan kepraktisan modul dengan menggunakan pendekatan penelitian dan pengembangan (R&D) berdasarkan model ADDIE (Analysis, Design, Development, Implementation, and Evaluation). Proses validasi ahli memastikan keabsahan modul, ahli materi memberi nilai 4,0 dan ahli bahan ajar memberi nilai 4,2. Untuk menilai kemanjuran, para peneliti menggunakan desain one-group pretest-posttest dengan analisis uji-t sampel berpasangan. Hasil penelitian menunjukkan adanya peningkatan keterampilan berpikir kritis yang signifikan ($p < 0,05$), yang ditunjukkan dengan nilai signifikansi 0,00. Rata-rata skor N-Gain sebesar 0,83 termasuk dalam kategori tinggi. Selanjutnya angket siswa terkait modul sains berbasis RIAS menunjukkan tingkat kepraktisan sebesar 84,6%. Secara keseluruhan, temuan ini mendukung penggunaan modul sains berbasis RIAS "Saya Bisa Beradaptasi" sebagai alat yang efektif untuk meningkatkan kemampuan berpikir kritis.*

Keywords: Module; RIAS-Based Learning; Critical Thinking Skills.

INTRODUCTION

The characteristics of the Natural Sciences consist of four components: attitudes, processes, products, and applications. Students who have had direct exposure to the scientific method are more likely to be curious, as evidenced by their ability to think critically, creatively, and analytically (Rokhim & Prayitno, 2018). The purpose of critical thinking, according to (Facione, 2015), is to prove a point, understand what happened, and come up with a solution. Critical thinking is an essential skill for students to have since it helps motivate students to tackle issues of all complexity levels (Snyder & Snyder, 2018). Students' academic appreciation as lifelong learners can be increased by developing critical thinking abilities (Conklin & Wendy, 2012). Future advantages of the capacity for critical thinking include protection against competition from constantly developing technological advancements, environmental issues, and a knowledge-based economy that demands such abilities (Kemendikbud, 2013).

Based on (Rahmadhani et al., 2018), Indonesia belongs to the group of nations that have struggled to develop students' critical thinking skills. One issue affecting SMP Negeri 10 Magelang students is their lack of critical thinking abilities. According to the teacher's examination of the class VII midterm exam assessment (UTS) results and the five UTS description questions, which only used two of the indicator points for critical thinking, namely the four interpretation questions and the one evaluation question. Analysis of UTS findings in one class revealed that 49.6% of assessment ability and 62.3% of interpretation ability met the required standards.

Students still have difficulty understanding the concepts and examples of questions presented in textbooks. One of the issues is that students don't respond when the teacher explains the content, which makes them bored since in-class learning, students are sometimes expected to memorize facts or formulae rather than comprehend concepts. When engaging in group activities like discussions, practicums, and project creation, students are more enthused. According to a study by (Sianturi et al., 2018), students' critical thinking abilities were underdeveloped as a result of the low student response and the propensity to memorize information rather than comprehend a topic.

Fostering students' motivation to become used to exercising critical thinking is one alternate technique for enhancing students' critical thinking skills. Teachers require a tool that could assist students to strengthen their critical thinking skills. Teaching materials are instruments that may help students exercise critical thinking. Modules are teaching instruments that are methodically organized using language that young learners are able to comprehend and that are customized for their age and level of knowledge so they may study on their own with the teacher's assistance (Andi, 2012).

According to findings from observations at SMP Negeri 10 Magelang, there hasn't been much progress in the development of modules used in science learning activities, and there aren't any modules designed to develop critical thinking skills. As a result, teaching materials in the form of modules are required in order to promote independent learning among students and develop their critical thinking abilities. According to an earlier study by (Mulia Rasyidi, 2020), modules may facilitate students to learn independently by connecting what they already know with how to use it in real-world situations. This enhances students' critical thinking skills and learning outcomes.

Using educational resources in the form of modules can serve to strengthen learning activities and contribute to maximizing students' critical thinking skills. Applying the science learning paradigm that the teacher uses assists students to develop their critical thinking skills. The module development is combined with the RIAS learning model.

Based on (Warningsih, 2022), his research proves that the RIAS learning model is appropriate and effective for use as a science module that is able to improve students' critical thinking skills. RIAS learning in the module combines scientific concepts with the phenomena of problems that exist in everyday life through pictorial illustrations and brief explanations. Through the RIAS learning model students are able to interact with each other in learning activities, this is because in the RIAS learning model there are discussions that are able to involve students to play an active role in learning (Muhlisin et al., 2021). Active learning activities will increase learning activities, where with an increase in learning activities, the ability to think critically will further develop. In line with (Rasiman, 2013) that through an active learning process, posing challenging problems, and students drawing conclusions independently in the learning process are efforts to improve critical thinking skills.

It is expected that the development of the science module with the theme "I Can Adapt" based on the RIAS (Reading, Identification, Analysis, and Self-Reflection) learning model would be able to support students and teachers in understanding the learning concepts that have been built and be able to enhance students' critical thinking abilities.

METHOD

Research Design

The research methodology used in this study is research and development. R&D is a research process used to create particular products, which are then put to the test to see how effective they are. To produce specific product outcomes and evaluate the usefulness of these products for society, research that is a requirements analysis is used (Sugiyono, 2019). Analysis, Design, Development, Implementation, and Evaluation are the development phases covered by the ADDIE research paradigm used in this study's approach. This development approach was chosen because it corresponds to the goals of the study to be conducted. Figure 1 represents the stages of development in research.

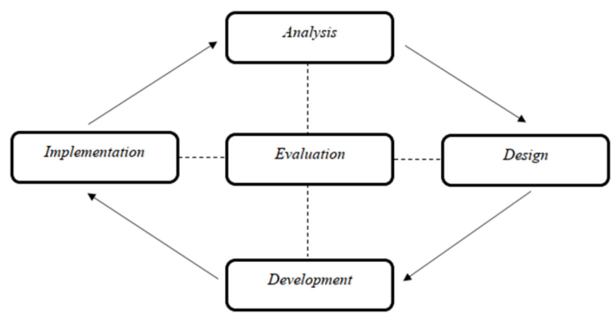

Figure 1. ADDIE development model

The design used in testing with a limited scale is using one group pretest-posttest to measure indicators of achievement of increasing students' critical thinking skills. The RIAS-based Science module is implemented in a structured way in learning Science through the designed RPP. The learning steps use the RIAS learning model syntax as shown in Table 1.

Table 1. RIAS Learning Model Phase

Learning Phase	Learning Activities
Phase 1: Introduction	a. The teacher instructs students to pray their pre-lesson prayers in accordance with their particular religions and beliefs. b. The teacher checks the student attendance. c. The teacher explains the learning goals to be met and the procedures to

		follow.
Phase 2: Main Learning	a.	Reading Students read topics or study materials that will be studied independently.
	b.	Identification Students identify important things related to phenomena or problems related to the material being studied in groups.
	c.	Analysis Students carry out problem analysis and make solutions to overcome these problems in groups.
	d.	Self-Reflection Students convey the results of the analysis to other students and do self-reflection regarding the advantages and disadvantages of the learning process and the material that has been studied.
Phase 3: Closing	a.	The teacher gives conclusions related to the learning that has been done.
	b.	The teacher provides confirmation regarding the learning process that has been carried out.
	c.	The teacher conveys follow-up instructions for further learning activities.
	d.	Students and teachers pray together according to their respective beliefs and religions to close the lesson.

Source: (Muhlisin et al., 2020)

Research Sample and Population

Class VII B students of SMP Negeri 10 Magelang served as the study's subjects. The sampling procedure was carried out employing the random sampling technique, which involves selecting samples at random from the population such that every member of the population has an equal chance of being chosen as a sample.

Research Instrument

Tests and questionnaires were utilized as research instruments. The questionnaire tool is an expert questionnaire that contains questions about the validity of research and instructional materials. As stated by (Facione, 2015), the test instrument is based on six indications of critical thinking, including interpretation, analysis, assessment, inference, explanation, and self-regulation. Examples of critical thinking skills questions contained in the module are presented in table 2.

Table 2. Examples of questions measuring critical thinking skills

No.	Learning Achievement	Indicator		Question
		Critical Thinking	RIAS Learning	
1.	Students are able to comprehend the concepts of temperature and heat as well as the mechanism for sustaining stable body temperatures.	Interpret the difference between temperature and heat.	Identify the difference between temperature and heat.	*Is temperature the same as heat? State your opinion!*
2.		Give reasons for any findings (explanations) you have on the occurrence of tire inflation (expansion).	Analyzing the concept of temperature and expansion on the phenomenon of tire inflation.	*When we pay attention, there is a threshold for the recommended tire pressure. It is not advisable for vehicle owners to inflate tires over the limit. Why is this necessary?*

The validity analysis of the test items was carried out by experts using a Likert scale with intervals of 1 to 5, which were then averaged using the validity formula. Testing the validity of these questions was carried out by two expert teachers who provided assessments as well as suggestions for improvement on the test questions before they were used for research. The results of the analysis of the validity of the question instrument are presented in table 3.

Table 3. Results of the Test Instrument Validity Analysis

Average		Final Result
Expert I	Expert II	
0,76	0,80	0,78
Percentage		78%
Category		Valid

The results of the validity of the test instrument for the pretest-posttest obtained a final average of 0.78 with a percentage of 78% in the "valid" category.

The reliability test of the questions was carried out using the Cronbach alpha method with the help of SPSS 26 on 15 class VIII students of junior high school and obtained an r value of 0.977. The instrument is declared to have perfect reliability if the value of r > 0.9. The calculation results obtained show that the value of r is greater than 0, so that the instrument is declared to have perfect reliability, so it is feasible to use in research. The results of the reliability test are shown in Figure 2.

Reliability Statistics

Cronbach's Alpha	N of Items
.977	10

Gambar 2. Reliability Test Results

Data Analysis

Validity, efficacy, and practicality analyses are among the data analytic methodologies used in this study. A Likert scale with intervals of 1 to 5 was used to evaluate the validity analysis of the module. The outcomes of the validation assessment were afterwards computed using the average value of each assessment aspect's component, and they were then applied to the validity category. The following is the reference for modifying the score.

Table 4. Validity Criteria

Interval	**Criteria**

X > 4,2	Strongly Valid
3,4 < X ≤ 4,2	Valid
2,6 < X ≤ 3,4	Quite Valid
1,8 < X ≤ 2,6	Less Valid
X ≤ 1,8	Not Valid

Source: (Widyoko & P, 2016)

Both the prerequisite test and the hypothesis test were utilized in the investigation of the module's efficiency, a normalcy test is used as the precursor test to see whether the data acquired satisfies the criteria for parametric statistical tests. The T-test and the N-Gain test are two examples of hypothesis testing. The T-test is used to compare post-test and pre-test findings in order to gather useful data from the two sets of data. T_{table} and T_{count} are produced during data processing using SPSS 26 with significance () = 0.05. H0 is rejected and Ha is accepted if the T_{table} value is greater than the T_{count} or sig value. By conducting a pretest and posttest before and after having students complete the RIAS-based science module, the N-Gain test is used to evaluate the level of the student's critical thinking skills. The N-Gain criteria are presented in table 5.

Table 5. Criteria of N-Gain

Gain Score	Interpretation
0,70 ≤ g ≥ 1,00	High
0,30 ≤ g ≥ 0,70	Average
0,00 ≤ g ≥ 0,30	Low
g = 0,00	No Improvement
-1,00 ≤ g ≥ 0,00	There is a decline

Source: (Sundayana, 2014)

The students' responses to a response questionnaire were used to determine how useful this module was. Percentage data are presented and analyzed using a Likert Scale with 1–5 rating levels. Students' comments, ideas, and recommendations will be used to improve the module and make it more useful for use in the following learning. The acquired score is subsequently calculated using the following procedure using the percentage value.

$$\textit{Persentase Kepraktisan} = \frac{\textit{Jumlah skor yang didapatkan}}{\textit{Skor maksimal}} \times 100\%$$

The practicality criteria for the module are shown in the Table 6.

Tabel 6. Criteria for the Level of Practicality of the Science Module

Interval (%)	Criteria
84% ≤ skor ≥ 100%	Strongly Practical
68% ≤ skor ≥ 84%	Practical
52% ≤ skor ≥ 68%	Quite Practical
36% ≤ skor ≥ 52%	Less Practical
20% ≤ skor ≥ 36%	Not Practical

RESULTS AND DISCUSSION

RIAS-Based Science Module Validity

The validity level of the resultant Science module is determined using the findings of the expert validation process. This validation's aim is to determine the module product's level of validity. Two professionals who teach science at SMP Negeri 10 Magelang conducted the validation. Experts in teaching materials and material factors validated the module. In Table 7, the results of expert module validation are presented.

Table 7. Module Validation Results by Experts

Aspect	Material	Teaching Material	Average
Presentation	4,0	4,0	4,0
Content	4,0	4,0	4,0
Language	4,1	4,7	4,4
Average	4,0	4,2	4,1

Category	Valid	Valid	Valid

The development of RIAS-based science learning modules is approved for use in educational activities, particularly those involving heat and temperature. This is based on the validation findings from material content experts and teaching materials received a score of 4.1 in the "valid" category.

A. Material Validation

The developed learning module receives an average score of 4.0 in the "valid" category based on the validator's evaluation of the content as a whole. The element with the highest average rating is the language element, which received a score of 4.1 out of a possible 5.0. The presentation and content areas both received a score of 4, though. The modules had been prepared methodically and effectively to ensure they could be utilized for learning, according to the validator's comments and recommendations. The suggestions made indicate that the material in the module has a solid foundation. There is a slight improvement in the preparation of the module, namely clarifying the image illustrations and their layout. Assessment of the substance of the material in the RIAS learning module by experts obtained a total of 4.0 with the "valid" category that deserves to be tested.

B. Teaching Material Validation

A team of educators conducted an expert assessment of the teaching aids, and the findings acquired a score of 4.2 out of a possible 5.0. The score is determined by averaging each aspect's score, which is then interpreted using the current validity standards. The language component, with an average score of 4.7 out of a possible maximum of 5.0, has the highest average. The average score for the presentation and content aspects is 4, while. The low average of these factors is a result of a number of errors that must be fixed in the module's preparation. The improvements made are tidying up the left margin on the cover and changing the color of the cover to be brighter. Repair of the module cover is presented in Figure 3.

(a) (b)

Figure 3. (a) Before improvement (b) After cover improvement

An improved module cover is expected to make the module more appealing and hence raise students' motivation to read and learn the module's material. Student motivation is a crucial component of the learning process, according to (Fitriani* et al., 2021). Study habits, learning activities, and assignment completion in the classroom may all be influenced by learning motivation. An expert evaluation of the Science Module Based on RIAS Learning, specifically assessing teaching resources, yielded an average rating of 4.2, falling within the ‘valid’ category during small-scale trials.

RIAS-Based Science Module Effectiveness

The developed RIAS-based science learning module was subsequently implemented with 30 seventh-grade B students at SMP Negeri 10 Magelang. The pretest and posttest test forms used for measuring students' critical thinking skills have undergone validity and reliability checks.

A. Prerequisite Test

Normality Test

The normality test is used to test the level of normality of the data distribution resulting from the pretest and posttest values. The normality test was carried out using the SPSS 26.0 application with the Kolmogorov-Smirnov sample test. The data analyzed in the normality test is using pretest and posttest data. The results of the normality test can be seen in table 8.

Table 8. Results of Normality Test Analysis

No.	Tested data	Nilai Sig.	Indication
1	Pretest	0,690	Normal Distributed
2	Posttest	0,152	Normal Distributed

The significance level in the Kolmogrov-Smirnov test is > 0.05, as shown by the results of the normality test using pretest and posttest data. From the results of the normality test calculations, it may be inferred that the data obtained are regularly distributed.

Homogeneity Test

The homogeneity test is applied to figure out if the data obtained from the pretest and posttest results are homogenous or not. The sig findings were calculated by applying the Levene statistics test to the homogeneity test results using the SPSS 26.0 tool. The sample pretest and posttest results are homogenous, according to the statistic 0.209 > 0.05. Table 9 provides an analysis of the outcomes of this homogeneity test.

Table 9. Homogeneity Test Analysis Results

No.	Data tested	Nilai Sig.	Indication
1	*Score of Pretest and Posttest* 7B	0,209	Homogeneous

B. Hypothesis Testing

T-test

By comparing the differences between the two means of two paired samples, the t-test is used to determine the success of the RIAS-based science learning module under the assumption that the data is normally distributed with the following hypothesis:

Ho : There is no difference in the results of students' critical thinking skills test before and after using the RIAS-based science learning module at SMP Negeri 10 Magelang.

Ha : There are differences in the test results of students' critical thinking skills before and after using the RIAS-based Science module at SMP Negeri 10 Magelang.

The RIAS-based Science module's pretest and posttest questions might be used to assess students' critical thinking skills before and after learning activities. Table 10 displays the outcomes of the T-test using the paired sample t-test in the SPSS 26.0 program.

Table 10. *Paired Sample T-Test Results*

No	Data Tested	Sig. (2-tailed)
1	Score of *Pretest and Posttest* 7B	0,00

The first hypothesis (H0) was rejected and the final hypothesis was accepted when the paired sample t-test resulted in a sig (2-tailed) score of 0.00, where the score was less than 0.05. This indicates there is a substantial difference between the pretest (the starting variable) and posttest (the end variable), indicating that there is a significant impact of each of these factors on the variation in the type of treatment received.

N-Gain Test

30 students took a pretest and a posttest using the N-Gain test to assess their improvement in critical thinking skills. The N-Gain test was conducted using the Microsoft Excel program, and the "high" category's average N-Gain score was 0.83. 27 students contributed to the "high" improvement category, whereas just 3 students contributed to the "moderate" improvement category. When interpreting the score acquired after utilizing the created RIAS-based scientific learning module, the

students' critical thinking skills shown a significant improvement. Figure 4 displays the outcomes of the N-Gain exam on students' critical thinking abilities from the pretest and posttest data.

Figure 4. *N-Gain Test Analysis Results*

Data	Nilai Minimal	Nilai Maksimal	*Mean*	Jumlah N	Nilai *N-Gain*	Keterangan
Pretest 7B	23	56	42,1	30	0,83	Tinggi
Posttest 7B	82	97	90,6			

The significance of critical thinking has increased from the pretest to the posttest, reflecting the average level of critical thinking across all students. In comparison to the average posttest score, which was 90.6, the average pretest score was 42.1. This demonstrates that the capacity to think critically is still at a low level before to receiving the module, but it improves after receiving instruction on how to utilize the module. The N-Gain calculation is also performed using the average findings, and a score of 0.83 is obtained, indicating that the produced module is successful in enhancing critical thinking skills.

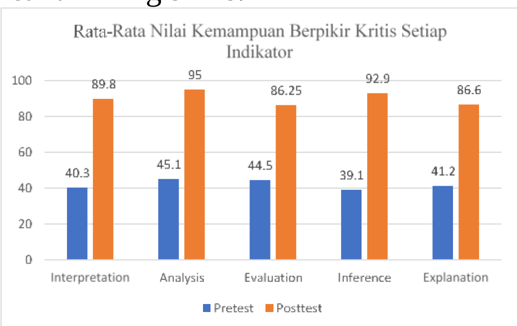

Figure 5. Average Critical Thinking Ability for Each Indicator

Each indication of critical thinking skills has its growth in the value of N-Gain calculated as well, allowing indicators that strongly influence the increase in critical thinking skills to be found. Based on the critical thinking skill indications displayed in Figure 6 and the pretest-posttest value data for class VII B, the N-Gain value is identified.

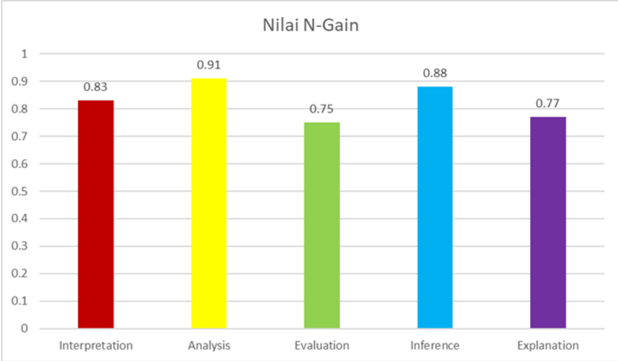

Figure 6. N-Gain Test Results Per Critical Thinking indicator

The interpretation indicator's N-Gain test score received a 0.83 in the high improvement category. Students are able to clearly understand and connect the two material concepts of temperature and heat in the subject matter, as well as recognize the distinctions between these two concepts. According to Sudjana (2013), interpretation is the capacity to link or join two disparate ideas as well as the capacity to recognize the primary topic from the non-subject.

The data-driven indicators N-Gain test results had a score of 0.91 and were classified into the high-scoring group. The indication with the greatest N-Gain rating among the others is the analysis indicator. Students are instructed to be able to put out what needs to be done in order to solve an issue or problem in this indication. This high rise in analytical indicators results from the indicators of critical thinking analysis being in line with the analysis stage, the third stage in the RIAS model. In the RIAS-based science module, each subject topic includes phases of analysis so that students may practice evaluating problems and coming up with solutions by debating with their groups. This has a significant influence on students in practicing analyzing and triggering an increase in students' analytical skills on a problem. According to (Novita et al., 2016) the ability to analyze is very important for students, where students who have high analytical skills will be able to achieve good learning outcomes, while students who have low analytical skills will hinder the achievement of learning outcomes.

The assessment indication with an N-gain score, the following measure of critical thinking abilities, receives a percentage of 75% in the strong improvement category. When compared to other indicators, the evaluation indicator, which measures critical thinking abilities, receives the lowest score. Students' reduced ability to provide logical justifications for their answers to the questions is the source of this weak assessment indication (evaluation). This is in alignment with the statement presented by (Wardani & Sholikhak, 2020), who states that students' lack of training in explaining their ideas, their inability to connect two or more physics concepts in a way that supports their arguments, and their lack of experience in predicting or coming up with original ideas are the main causes of the low evaluation indicators on critical thinking skills. they receive that could result from their ideas. Due to time constraints, students are unable to complete all of the practice questions that make up the final evaluation stage of their learning in the form of critical thinking indicators since there is not enough time.

The N-Gain test results on the inference indicator fulfilled the high-rise requirement with a score of 0.88. The results show a considerable improvement, which suggests that the students' ability to deduce a topic from the module is quite good. Students must be able to draw a logical conclusion from a topic or issue in order to pass this indication. They were able to draw the conclusion that it was connected to a phenomenon where students' railroads were stretched appropriately, but some students had not connected their replies to theory based on the data they had collected. Drawing inferences in this critical thinking indicator, according to (Kosasih, 2014), is done so that students can differentiate between what has been seen and what has occurred.

The explanation indication is the next to be evaluated, and it receives an N-Gain score of 0.77 in the high improvement category. Students are expected to be able to put out their final results and the justifications for the conclusions they reach for this indicator. Students are able to give explanations for the findings that have been drawn from the data collected on the occurrence of tire inflation. Only a few students were unable to provide explanations for the problem based on the concept of expansion. In accordance with the results of research by (Susilowati dkk, 2017)students' explanatory abilities relate to the ability to consider evidence, criteria, concepts, context, and present reasoning in the form of convincing arguments. This is in line with the opinion of (Kurniyasari et al., 2019) that the low explanation indicator is due to students' lack of courage in presenting their arguments regarding the problems given and their lack of confidence.

RIAS-Based Science Module Practicality

Following the application of the RIAS-based science learning module with 14 statements, the responses of 30 students were used to determine the practical evaluation of the learning module. The questionnaire is evaluated using a Likert scale with a range of one to five. The responses' recapitulation findings were then averaged and classed according to how practical they were, in percentage terms.

Table 11. Results of Student Responses to the Modules Developed

Assessment Aspect	Score	Total
Ease of Use	4,4	85%
	4,1	
	4,2	
	4,4	
	4,2	
	4,2	
Usage Time Efficiency	4,4	84%
	4,0	
Benefits	4,4	85%
	4,3	
	4,2	
	4,0	
	4,4	
	4,4	

Average	84,6%
Category	Strongly Practical

The students were handed a questionnaire form with 14 statement items covering three different aspects. The statements that receive the lowest score of 4.0 out of a possible score of 5.0 are those that discuss learning according to learning ability and reviewing information at home in terms of time efficiency and rewards. According to the Likert scale's interpretation, the practicality category of the produced module is "very practical" and receives an average score of 4.2 out of 5, or 84.6%. Based on student responses to the RIAS-based science module that had been tested, the practicality value was determined.

T In the practicality test of the module, three factors—ease of use, learning time efficiency, and module benefits—were averaged to determine this value. This RIAS-based module obtains an average score of 85% for the element of usability and is seen as being extremely useful. This demonstrates that the module is simple to use and that the look of the module may affect students' enthusiasm for studying. The module's content is presented simply yet clearly, and the font size and type are easy to read. Students may understand the procedures that must be done while learning by reading the module's clear usage instructions. In order to prevent confusion on the part of the teacher while implementing the module in class, the module is also accompanied by instructions for the instructor to utilize the module during learning. According to (Sudjana & Rivai, 2003), the purpose of teacher instructions is to give instructors the resources they need to carry out learning effectively. The produced modules are regarded as being extremely usable and linguistically simple to use. This is based on responses from students who claim that the language used in the program is understandable.

This module receives an average practicality test score of 84% in the extremely practical category, based on the efficiency aspect of learning time. This module emphasizes the students' capacity to talk in groups as well as their individual skills. Each step of the curriculum includes enrichment work that is done in groups. Students need to collaborate more closely with their group members and communicate with one another while working on the difficulties given in order to finish the questions within the specified time. In accordance with (Kementeri Pendidikan Nasional Republik Indonesia, 2008) that modules in learning aim to overcome the limitations of space, time, and sensory abilities of students and teachers so that learning can take place efficiently. The module includes steps that encourage students to learn independently, such as the reading and final evaluation phases. In accordance with (Nasution, 2003) statement, learning through the use of this module is carried out to provide possibilities for students to be able to study in accordance with their abilities, learning preferences, and individual learning paces.

In the aspect of benefits, RIAS-based modules are categorized as very practical according to the data on student responses with an average value of 85%. This proves that the module is able to assist students in understanding the concept of learning well and can encourage students to study independently and in accordance with their individual learning methods. The use of this module is also very beneficial for teachers who are able to streamline learning time because the developed module requires students to study independently so that teachers can easily monitor student learning activities and are able to provide individual guidance to students. This is in line with the statement of the (Kementeri Pendidikan Nasional Republik Indonesia, 2008) that the module must be able to be used as a teaching material as a substitute for or complementing the teacher's function.

Based on the observer's evaluation, the results of observations on student behavior during learning activities achieved a percentage score of 96%. This indicates that educational activities carried out by students adhere to the RIAS learning syntax as outlined in the Lesson Plan (RPP). According to (Ibrahim et al., 2003), teachers are required to provide instructions on what students should do, direct, master, and perform assessments when implementing learning that prompts student involvement. Consequently, this does not imply that the instructor does not engage in a variety of activities; rather, it just means that students must take an active role in their own education, with the teacher only providing support.

Effectively developed teaching materials play a pivotal role in enhancing high-level critical thinking skills. This heightened effectiveness stems from the deliberate application of the RIAS learning model within these materials. During the reading stage, students engage in honing skills related to remembering, classifying, and analyzing problems embedded in the teaching materials. By emphasizing reading as a foundational step, learning becomes structured around a student-centered approach, fostering independent understanding and idea development. Notably, pre-reading activities significantly impact students' readiness for active learning (Kırmızı, 2015). This observation aligns with the assertion by Restuningsih et al. (2017) that reading activities hold the potential to stimulate critical thinking skills. Reading, as a cognitive process, contributes to building a robust understanding of the material. Ultimately, this process serves as a cornerstone for higher-level thinking, including critical thinking.

In the identification stage, students engage in recognizing crucial aspects related to a given topic or phenomenon. During this phase, collaborative interactions, mutual support, and respectful engagement among students play a pivotal role in facilitating the learning process (Muhlisin et al., 2021). Notably, this aligns with the flexibility indicator, which encourages students to generate diverse ideas from varying perspectives. Subsequently, students delve into analyzing issues or phenomena directly linked to the subject matter under study (Irawatie et al., 2019). This analytical activity often occurs within group settings, allowing for social interaction and the exchange of ideas from multiple viewpoints. Consequently, diverse opinions emerge among group members, enriching the overall discourse (Napitupulu et al., 2020). Moreover, this stage emphasizes authenticity, i.e. an encouragement for students to create novel ideas distinct from those of their peers. By fostering such an environment, teachers can stimulate critical thinking skills and enrich their ideas.

The final stage within the RIAS learning model centers on self-reflection—an essential process characterized by elaboration indicators. These indicators encompass the development, expansion, and enrichment of ideas, coupled with the ability to meticulously detail problems and propose solutions (Mathew et al., 2017). During this phase, students actively present their analyses to their peers. Self-reflection serves as a deliberate practice, allowing individuals to observe their actions and decisions, ultimately contributing to character development and the cultivation of professional competencies. Moreover, this stage instills confidence in students, empowering them to take ownership of the ideas they explore and the outcomes they achieve during discussions.

CONCLUSION

The research findings underscore the suitability of science teaching materials based on the RIAS learning model, meticulously developed through the five stages of the ADDIE framework. Expert validation yielded favorable assessments, with material experts assigning a score of 4.0 and teaching material experts rating it at 4.2. Notably, the application of the RIAS learning model within the module significantly enhanced students' critical thinking abilities, as evidenced by an N-Gain score of 0.83—a classification denoting high effectiveness. Furthermore, practicality assessments conducted by students affirmed the module's suitability for learning contexts. However, the study identified certain areas for improvement. Enhancing clarity in module completion instructions is essential to facilitate students' comprehension of the content. Additionally, a strategic focus on critical thinking evaluation indicators would ensure more equitable mastery across students. Researchers are encouraged to optimize research time alignment with the learning implementation plan. Looking ahead, future research endeavors should explore similar learning modules tailored to develop other essential 21st-century skills, leveraging innovative teaching media customized to students' specific needs.

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