International Journal of Research and Review
[Indexed, Peer Reviewed Journal]
Volume 12; Issue: 1; January 2025
Website: www.ijrrjournal.com
Research Paper *E-ISSN: 2349-9788; P-ISSN: 2454-2237*

Development of IPAS Teaching Modules Using the SETS Approach (Science, Environment, Technology, and Society) to Enhance Cognitive Learning Outcomes of Fourth Grade Elementary School Students

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DOI: https://doi.org/10.52403/ijrr.20250109

ABSTRACT

Natural and Social Science (IPAS) learning at the elementary school level plays a vital role in shaping students' scientific understanding and environmental awareness. However, conventional teaching methods often fail to integrate science, technology, environment, and society contextually, resulting in less meaningful learning experiences. This study aims to develop a SETS (Science, Environmental, Technology, and Society)-based teaching module to enhance the cognitive learning outcomes of fourth-grade elementary students. The study employed the ADDIE development model with a quantitative pre-experimental approach, involving fourth-grade students from SD Negeri 1 Ngawen. The module was validated by content, media, and language experts, achieving high validity scores (92%-95%). The module's effectiveness was evidenced by an increase in pretest scores (65.8) to posttest scores (85.4). Furthermore, teacher and student responses demonstrated the module's practicality, appeal, and high engagement levels, at 100% and 92%, respectively. The findings indicate that the SETS-based module is effective and practical for use as an innovative teaching aid aligned with the Independent Curriculum, with the potential to foster critical thinking and environmental awareness

Keywords: SETS Approach, Teaching Modules, Cognitive Learning Outcomes, Independent Curriculum, IPAS

INTRODUCTION

The teaching of Integrated Science and Social Studies (IPAS) in elementary schools plays a vital role in fostering foundational knowledge and shaping students' attitudes towards their environment. However, IPAS learning often fails to integrate scientific concepts with real-life contexts, particularly in linking science, technology, environment, and society (Fernanda & Ahmadi, 2023). This gap poses a challenge, especially as Indonesia faces increasingly complex environmental issues, including plastic waste pollution, as highlighted by the Ministry of Environment and Forestry (2022).

Meaningful learning should connect to students' daily lives to enable them to understand and apply scientific concepts. According to Daryanto (2016), teaching modules are effective tools to facilitate learning, combining systematic content with interactive and engaging activities.

Similarly, Binadja (2016) emphasizes that the SETS (Science, Environmental, Technology, and Society) approach integrates science with societal and technological needs, promoting holistic and interdisciplinary understanding among students.

The introduction of the Independent Curriculum (Kurikulum Merdeka) offers a new direction for education in Indonesia, emphasizing autonomy for schools to design contextually relevant learning approaches (Manalu et al., 2022). The curriculum encourages the use of innovative teaching tools such as SETS-based modules, bridging the gap between theory and practice while fostering critical thinking, creativity, and environmental awareness (Suharini et al., 2020). Studies show that such approaches enhance students' ability to analyze real-world problems and contribute to environmental sustainability (Marlina, 2015; Kistiari & Ahmadi, 2021).

Despite its potential, the implementation of SETS-based learning in elementary education remains limited due to insufficient teacher training and lack of tailored teaching resources. Research indicates that teachers need structured support, including well-designed modules, to effectively integrate the SETS framework into classrooms (Habibi et al., 2023). In this context, the development of a SETS-based teaching module for fourth-grade IPAS students becomes critical to improving cognitive learning outcomes and fostering environmentally conscious behaviors.

This study aims to fill the existing gaps by creating and validating a practical, effective, and engaging SETS-based teaching module. By aligning with the goals of the Independent Curriculum, the research seeks to enhance not only students' learning outcomes but also their ability to address contemporary challenges responsibly.

MATERIALS & METHODS

This study involved fourth-grade students from SD Negeri 1 Ngawen as the research subjects, focusing on the development and implementation of a teaching module based on the SETS (Science, Environmental, Technology, and Society) approach as the primary instructional material. The research instruments included module validation sheets for subject matter, media, and language experts; cognitive tests in the form of pretests and posttests; and questionnaires to measure teachers' and students' responses to the teaching module.

The research design utilized the ADDIE development model (Analyze, Design, Develop, Implement, Evaluate) with a pre-experimental approach. The sampling technique employed was purposive sampling, aimed at selecting research subjects relevant to the implementation of the SETS-based module. This study measured two types of variables: the independent variable, which was the use of the SETS-based teaching module, and the dependent variables, which included students' cognitive learning outcomes assessed through pretests and posttests, as well as students' and teachers' responses to the module. Data were collected through expert validation of the module, pretest and posttest results to evaluate the module's effectiveness, and questionnaires to assess the module's practicality and appeal. Data analysis was conducted quantitatively. Module validation was evaluated based on expert feedback, while the module's effectiveness was analyzed using the N-Gain Score calculation to measure improvements in students' learning outcomes. Teachers' and students' responses were analyzed descriptively to assess the practicality and engagement of the SETS-based module.

Write here procedure/technique of your research study.

RESULT and DISCUSSION

This research focused on the development of a SETS-based Integrated Science and Social Studies (IPAS) module designed for fourth-grade students. The module was created to enhance students' understanding of the characteristics of living organisms

and their environments through a scientific, environmental, technological, and societal approach. The SETS methodology integrated interdisciplinary topics that align with the broader goals of environmental education.

The module includes several key components. The cover page provides the title, grade level, and authors' names, offering a general overview of the module's focus on the anatomy and functions of living organisms, the importance of environmental balance, and conservation efforts. The preface outlines the module's content, development objectives, and the expectations of the authors. It emphasizes the intention to serve as a supplementary teaching tool for teachers, enabling students to achieve the learning goal of understanding the interrelationship between living beings and their surroundings.

The table of contents organizes the module into three interconnected learning topics, facilitating a coherent structure for students and teachers. The module includes instructions for both teachers and students. For teachers, the instructions are designed to aid in the effective implementation of the module in the classroom. For students, these guidelines help them navigate the material and complete the exercises with ease.

The module also includes learning materials that are clearly aligned with the learning objectives. These materials provide students with the necessary information to understand the topics, while the lesson plan (RPP) gives teachers a structured approach to teaching the content. The pretest and posttest, included as part of the evaluation, measure students' initial knowledge and the progress made throughout the learning process. The posttest serves to assess how well students have grasped the material, while the evaluation questions help to measure the overall understanding of the content. Overall, the SETS-based IPAS module was developed with the goal of enhancing students' cognitive learning outcomes and fostering a deeper understanding of science, the environment, and societal issues. By integrating these aspects, the module offers a comprehensive learning experience that not only improves students' academic knowledge but also encourages them to think critically about the world around them.

Validity of the IPAS Teaching Module

The validity of the SETS-based science teaching module is evaluated through expert assessment which includes subject matter experts, language experts and learning design experts. This evaluation process is carried out to ensure that the IPAS teaching module meets the required educational standards. The aspects assessed by experts are summarized in Table 1.

Table 1 Aspects Assessed by Validators

Validator	Rated aspect
Media	Display of the IPAS Module assisted by the SETS Approach, materials, Visual Communication
Language	Straightforward, Communicative, Dialogical, interactive, use terms, symbols and icons
Material	Learning format, material content, language

The development of the SETS-based IPAS teaching module aimed at improving the cognitive learning outcomes of fourth-grade elementary school students was preceded by validation conducted by experts in relevant fields. Validation was carried out by providing the initial product along with the research instruments. The media expert instrument contained ... questions, the language expert instrument consisted of questions, and the subject matter expert instrument included 12 questions.

The results of the validation assessed by the experts are summarized in the table below.

Table 2. Material Expert Validation Results

No.	Rated aspect	Total Validator Score
1.	Suitability of the SETS approach to the science and science teaching module in accordance with CP & TP	4
2.	Suitability of the SETS approach science teaching module with learning objectives	4
3.	Suitability of the SETS approach science and science teaching module with the cognitive level of fourth grade elementary school students	4
4.	The ability of the SETS approach science and science teaching module measures the cognitive improvement of fourth grade elementary school students	4
5.	Suitability of the SETS approach science teaching module with learning objectives	4
6.	Suitability of the SETS approach science and science teaching module with the cognitive level of fourth grade elementary school students	4
7.	The ability of the SETS approach science and science teaching module measures the cognitive improvement of fourth grade elementary school students	3
8.	Suitability of the SETS approach science teaching module with learning objectives	4
9.	The relationship between the material used in the SETS approach science and science teaching module	4
10.	Standard language used	4
11.	Accuracy of the text content of learning materials	4
12.	Simplicity of sentence structure in the SETS approach science teaching module	4
	Amount	47
	Maximum Score	48
	Average	3,9
	Percentage%	98%
	Criteria	Very Valid

The assessment by the subject matter expert resulted in a total validation score of 47, or 98%, which falls under the "very valid" category. Overall, the evaluation results indicate that the SETS-based IPAS teaching module is considered highly valid, requiring only minor revisions.

The validation results assessed by the language expert are presented in Table 3

Table 3. Linguistic Expert validation results

No	Rated aspect	Total Validator Score
1.	Accuracy of sentence structure	3
2.	Sentence effectiveness	4
3.	standardness of terms	4
4.	Message readability	4
5.	Accuracy in the use of language rules	4
6.	Ability to push messages or information.	4
7.	Sequence and integration between learning activities	4
8.	Sequence and coherence between paragraphs.	3
9.	Consistency in use of terms.	3
10.	Consistent use of symbols or icons.	4
	Amount	37
	Maximum Score	40
	Average	3,7
	Percentage%	92,5%
	Criteria	Very Valid

The language expert's assessment resulted in a total validation score of 37, or 92.5%, categorized as "highly valid." Overall, the SETS-based IPAS teaching module is considered highly valid, with minor revisions required, including adjustments to standard grammar and effective sentence structures in accordance with Indonesian language rules (EYD).

The validation results assessed by the instructional design expert are presented in Table 4.

Table 4 Module Expert Validation Results

No.	Rated aspect	Skor Total Validator
1	SETS assisted IPAS Module cover design	4
2	Clarity of image illustrations	4
3	Accurate color proportions	3
4	Suitability of text and image layout	4
5	Consistency of the text of the SETS-assisted IPAS module	3
6	Consistency in the similarity of the background themes of the SETS-assisted IPAS module	4
7	Appropriate selection of font type & size	3
8	Convenience of using the SETS-assisted IPAS module	4
9	Safety of using the IPAS module assisted by SETS	4
10	Determination on the use of materials/paper	4
11	Clarity of the description of the material presented	4
12	Simple and attractive	4
13	communicative	4
14	Easy to understand language	4
	Amount	53
	Maximum Score	56
	Average	3,8
	Percentage%	94,6%
	Criteria	Very Valid

It can be concluded that the assessment results from the module validator yielded a total validation score of 3.8, or 94.6%, which falls under the "highly valid" category. Overall, the SETS-based teaching module designed to improve the cognitive learning outcomes of fourth-grade students is considered highly valid, with only minor revisions required.

A summary of the product evaluation results from the experts is presented in Table 6.

Table 5. Recapitulation of product assessment results

Validator	Mark	Criteria
Material	98%	Very Valid
Language	92,5%	Very Valid
Media	94,6%	Very Valid

Question Item Validation Results

The item validity was assessed using Microsoft Excel, involving various types of questions such as multiple-choice, complex multiple-choice, short answer, true/false, and matching. A total of 25 items were analyzed using the Corrected Item-Total Correlation method, where the score of each item was correlated with the total score. A validity formula was used to calculate the validity coefficient, with a coefficient ≥ 0.30 considered valid and < 0.30 deemed invalid (Azwar, 2014). Validity analysis was also performed using Pearson Correlation, with the results compared against the r-table value of 0.444. Items that did not meet the validity criteria were excluded from subsequent testing. The item validity results are presented in Table 7.

Table 6. Question Item Validation Results

Valid Question	Invalid Question
1,2,3,4,5,6,7,8,10,12, 13,14,15,16,17,19,20, 21,22,23	9,11,18,24,25
20 Valid Question	5 Invalid Question

The analysis results showed that items deemed invalid had values below the r-table value of 0.444. Conversely, items with values exceeding the r-table value of 0.444 were considered valid. Invalid items were excluded from further use.

Reliability of Question Items

Reliability refers to the consistency of an instrument in producing the same results when tested on the same group at different times (Arikunto, 2013). The reliability of the test items was analyzed using Microsoft Excel to assess internal consistency. The instrument is considered reliable if the reliability coefficient (r11) is greater than 0.6.

Table 7. Reliability Results of Question Items

Questions about PG, PGK, B/S	Description and Matching Questions
0,735	0,8575

Therefore, the test instrument used in this study is considered reliable.

Level of Difficulty

Table 8. Difficulty Level Results

Criteria	Index Value	Question Number
P 0,00 - 0,30	Difficult Problem	2,6,10
P 0,31 - 0,70	Medium Problem	1,5,7,8,12,13,14,15,16,17,18,19,20,24,25
P 0,71 - 1,00	Easy Question	3,9,11,21,22,23

The analysis of the 25 test items revealed three levels of difficulty: 3 items were categorized as "difficult," 15 items as "moderate," and 6 items as "easy."

Different Power

Table 8. Results of Differentiating Power of Questions

Differentiating Power	Question Number
0.00 - 0.20 Poor	18,20,22,23,24,25
0.21- 0.40 Sufficient	2,3,6,8,10,14,17,19,21
0.41- 0.70 Good	4,5,7,12,15,16
0.71-1.00 Very Good	1,9,11,13

Based on the item discrimination index, 4 items were rated as "very good," 6 items as "good," 9 items as "fair," and 6 items as "poor."

Effectiveness of the Science Teaching Module

The effectiveness of this study is demonstrated by the improvement in students' cognitive learning outcomes, analyzed using the average scores from the pretest and posttest, as well as the N-gain calculation. The research involved 26 fourth-grade students from Class IVa. Initially, students were administered a pretest to assess their baseline knowledge before the intervention. Following the pretest, students participated in a learning intervention using the SETS-based IPAS teaching module. Upon completing the intervention, a posttest, designed with a format similar to the pretest, was conducted to evaluate changes or improvements in students' cognitive learning outcomes.

The purpose of the posttest was to assess the impact of the SETS-based IPAS module on students' comprehension and mastery of the subject matter. The results of the pretest and posttest, as presented in Table 11, highlight significant improvements in cognitive

achievement following the intervention. The pretest results prior to the implementation of the SETS-based IPAS teaching module indicated that only 7 out of 26 students (27%) met the minimum mastery criteria, while the remaining 19 students (73%) did not. The average pretest score was 63%. Following the intervention, which involved learning through the SETS-based IPAS teaching module, students were administered a posttest. The posttest results showed a significant improvement, with 24 out of 26 students (92%) achieving mastery, while only 2 students (8%) did not. The average posttest score increased to 82%.

The pretest data had a significance value (Sig) of 0.431, and the posttest data had a Sig value of 0.598. Since both values are greater than 0.05, the data distributions for the pretest and posttest were confirmed to be normal. This normal distribution enabled the calculation of the normalized N-Gain score. The improvement in students' cognitive learning outcomes through the use of the SETS-based IPAS teaching module was measured by comparing the average pretest and posttest scores. The N-Gain calculation served as a basis for evaluating the effectiveness of the intervention in enhancing the learning outcomes of fourth-grade students at SDN 1 Ngawen, Blora Regency.

Tabel 9. Hasil Pretest Posttest,N-Gain

Student	pretest	posttest	N gain	criteria
1	46	70	0,44	Currently
2	64	80	0,44	Currently
3	55	82	0,60	Currently
4	65	84	0,54	Currently
5	68	84	0,50	Currently
6	66	83	0,50	Currently
7	72	88	0,57	Currently
8	66	75	0,26	Low
9	69	86	0,55	Currently
10	60	85	0,63	Currently
11	55	70	0,33	Currently
12	50	78	0,56	Currently
13	62	88	0,68	Currently
14	56	78	0,50	Currently
15	66	98	0,94	Tall
16	50	68	0,36	Currently
17	80	90	0,50	Currently
18	78	92	0,64	Currently
19	45	65	0,36	Currently
20	74	88	0,54	Currently
21	68	82	0,44	Currently
22	72	90	0,64	Currently
23	80	96	0,80	Tall
24	50	72	0,44	Currently
25	70	94	0,80	Tall
26	58	71	0,31	Currently
Average	63,27	82,19	0,55	Currently

The N-Gain calculation revealed that learning with the SETS-based IPAS teaching module resulted in an average pretest score of 63.27 and an average posttest score of 82.19, yielding an N-Gain of 0.55, categorized as moderate. These results indicate that using the SETS-based IPAS teaching module is effective in improving students' cognitive learning outcomes.

Practicality of the Science Teaching Module

Practicality data were collected through student and teacher response questionnaires, which were analyzed to determine whether the SETS-based IPAS teaching module met the required criteria. The questionnaires aimed to evaluate whether the module developed for fourth-grade elementary students was engaging, practical, and easy to use.

P = f N x 100%

Keterangan:

P = angka presentase

f = skor yang diperoleh

N= skor keseluruhan

Teacher Response Results

Table 10. Teacher Response Questionnaire Results

No	Indicator	Teacher Response
		Total
1	The images presented in the SETS approach science and science teaching module attract students' learning interest.	4
2	The use of text displayed in the SETS approach science and science teaching module is easy for students to read	4
3	The presentation of material and questions in the SETS approach science and science teaching module makes it easier for teachers to convey material about understanding the characteristics of living things and the environment.	4
4	Students can understand the content of the story by using language that is easy to understand.	4
5	The questions given in the SETS approach science and science teaching module provide a new experience for teachers.	4
	Amount	20
	Average	4
	Maximum Score	20
	Presentation	100%
	Category	Very interesting

The summary of the fourth-grade teacher questionnaire at SDN 1 Ngawen, Blora Regency, shows that the use of the IPAS teaching module resulted in an average score of 4, or 100%, on the teacher response questionnaire. Therefore, the SETS-based module was categorized as highly engaging based on the teacher's feedback.

Student Response Results

Table 11. Results of Student Response Questionnaire

Name	Total
1.	80
2.	78
3.	80
4.	71
5.	73
6.	71
7.	75
8.	72
9.	80
10.	73
11.	80
12.	75
13.	72
14.	66
15.	74
16.	67

17.	68
18.	74
19.	76
20.	80
21.	76
22.	77
23.	77
24.	78
25.	69
26.	67
Amount	1929
Average	74,19
Maximum Score	2080
Presentation	92,7%

The learning implemented with the SETS-based IPAS teaching module resulted in an average student response questionnaire score of 74.19, equivalent to 92.7%. Based on this, the IPAS teaching module was categorized as highly engaging according to the students' feedback. The development of the SETS-based IPAS teaching module aimed at enhancing the cognitive learning outcomes of fourth-grade students was carried out by evaluating the module's content, instructional quality, and technical aspects. The module, designed to improve students' understanding of the characteristics of living organisms and their environment, followed a structured format, which includes a title, introduction, table of contents, learning objectives, lesson plans (RPP), material for each topic, pre-test and post-test exercises, and evaluations.

According to Maryam (2012), a good module should meet criteria for content quality and clear objectives to enhance students' cognitive abilities. This SETS-based module aligns with the constructivist theory of learning, as outlined by Purwanti et al. (2021), which emphasizes that intellectual development occurs through direct experiences in a supportive learning environment, allowing students to build their knowledge through problem-solving. The instructional quality of the module was designed to engage students and stimulate their motivation for learning, as suggested by Rusilowati and Sarwi (2024), who emphasize the importance of modules in improving cognitive learning outcomes. The module presented the material in an engaging format, incorporating evaluation questions, and offered a balance of individual and group activities, aligning with Rusilowati and Yulianti's (2018) statement that problem-based learning is key to improving learning effectiveness.

In terms of technical quality, the SETS-based IPAS module was designed with an A4 paper size, clear and balanced color compositions, and images that effectively complemented the content. According to Sugiarto (2018), technical quality must include appropriate paper size, image quality, font style, and color balance. The module's technical aspects, including its use of visuals, font sizes, and clear organization, contributed to making the content more accessible and engaging for students. The validation of the module was conducted by three experts: a subject matter expert, a language expert, and a module expert. The results of their assessments confirmed the module's validity, with a high percentage of agreement on its content, instructional design, and visual communication. The content validity was rated highly by the experts, with 94.6% and 98% validation scores, categorizing the module as highly valid. In terms of practicality, both teacher and student feedback revealed that the module was highly engaging and easy to use.

Teachers reported that the module facilitated teaching, while students found it engaging and effective in enhancing their understanding of the material. The

effectiveness of the module was demonstrated by the significant improvement in students' cognitive learning outcomes, as reflected in the pre-test and post-test results, with an N-Gain score of 0.55, indicating moderate improvement. Based on these findings, it can be concluded that the SETS-based IPAS teaching module is an effective tool for improving cognitive learning outcomes and is a valuable resource for enhancing the learning experience in elementary education.

CONCLUSION

Based on the results of the study, the SETS-based IPAS teaching module has been shown to be effective in improving the cognitive learning outcomes of fourth-grade students. This is evidenced by the significant improvement in posttest scores compared to pretest scores, with the N-Gain calculation indicating a moderate level of improvement. Additionally, the module was validated for content, media, and language, with expert evaluations confirming its high validity. The reliability of the module was also confirmed, with high consistency indicated by the reliability score. Furthermore, the teacher and student response questionnaires demonstrated that the module was engaging, practical, and easy to use, receiving very high ratings from both groups. In conclusion, the SETS-based IPAS teaching module not only enhances students' cognitive development but also provides an engaging and practical learning experience, making it a suitable tool for elementary education.

Declaration by Authors

Acknowledgement: None
Source of Funding: None
Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Tania Puji Lestari, Erni Suharini, Farid Ahmadi. Development of IPAS teaching modules using the sets approach (science, environment, technology, and society) to enhance cognitive learning outcomes of fourth grade elementary school students. *International Journal of Research and Review*. 2025; 12(1): 55-65. DOI: *https://doi.org/10.52403/ijrr.20250109*

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